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SUSTAINABLE REMEDIATION FORUM UK

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A Review of the Legal and Regulatory Basis for Sustainable Remediation in the European Union and the United Kingdom

CL:AIRE

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EXECUTIVE SUMMARY

This report is intended as an easy to-use resource to facilitate the identification of references in legislation, regulation and guidance issued both by the European Union and legislative or environmental regulatory bodies in the United Kingdom (UK) that specifically require, promote, or support the application of sustainable remediation principles to the assessment and management of risks associated with soil and groundwater contamination.

The report has the primary aim of presenting the relevant sections of such documentation in an easily accessible manner, so that they can be readily brought to bear in developing the argument for a sustainable remedial approach.

As such, the numerous regulatory references which have been identified by this review have been categorised according to their relevance to scenarios associated with either remedial triggers, or within specific aspects of a remediation project as follows:

- **Scenario 1:** Having a site determined as "contaminated land" by local or regulatory authority
- **Scenario 2:** Receiving an enforcement notice from an authority requiring remedial action.
- **Scenario 3:** Seeking planning permission/discharging planning conditions
- **Scenario 4:** Identifying sustainability as a key project objective
- **Scenario 5:** Determining, applying, and modifying compliance and assessment points
- **Scenario 6:** Deriving remedial target concentrations
- **Scenario 7:** Evaluating risk
- **Scenario 8:** Conducting a remedial options appraisal - considerations of sustainability
- **Scenario 9:** Incorporating cost-benefit assessment in remedial options appraisal
- **Scenario 10:** Considering sustainable alternatives when remedial objectives cannot be met
- **Scenario 11:** Engaging with stakeholders
- **Scenario 12:** Implementing sustainable remedial and waste management practices
- **Scenario 13:** Deviating from the waste hierarchy where justified on sustainability grounds
- **Scenario 14:** Implementing a monitoring and verification programme

To find references relevant to a particular aspect of a remediation project, report users can proceed directly to the report reference tables by following the hyperlinks in the list above.

Where a relevant reference is identified, hyperlinks to the online source of the original document are provided in reference tables. Report users should always refer back to the original source document to ensure that the reference is applicable to the project context and that the reference is current.

Background information on the definitions and principles associated with sustainable remediation (Chapter 3) as well as a brief summary of the regulatory and technical context of contaminated land management in the UK (Chapter 4 and Chapter 5) are provided. Possible future directions for the role of sustainable remediation in international (EU) regulatory frameworks as well as those in the UK are explored in Chapter 9.

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1. INTRODUCTION

This report presents a review of documents issued by European Union (EU) legislative bodies as well as legislative and environmental regulatory bodies in the United Kingdom (UK) to identify references that specifically require, promote, or support the application of sustainable remediation principles.

The purpose of this document is to present the findings of this review in such a way as to provide an easily-accessible source of material for promoting or supporting the argument for sustainability at various stages of the contaminated land management life cycle.

1.1 Background to Project

Whilst the principles of sustainable remediation are becoming increasingly adopted in the UK contaminated land regulatory regime, a disparity may exist between what is presented in the law and guidance applicable to sustainable remediation, how contaminated site owners and their professional advisors apply sustainable remediation principles in projects, and its adoption or acceptance by regulators. A means of addressing this disparity is through site operators and their consultants more clearly referencing their decisions and reporting related to sustainable remediation to relevant text set out in regulatory documents.

This report is intended to serve as a resource for contaminated land owners, consultants and regulatory authorities to provide an easy-to-find selection of regulatory text that supports the application of sustainable approaches to soil and/or groundwater remediation. Consequently it will allow suitable sections of regulatory text to be readily brought to bear in developing and/or supporting an argument for a sustainable remediation approach.

1.2 Objectives

The objectives of this report are as follows:

- To identify pertinent sections of text within EU and UK legislation, regulations and guidance documents that specifically require, promote or support the application of sustainable remediation principles; and,
- To review the literature in question and communicate it in a manner that enables the relevant areas of text to be readily brought to bear in developing the argument for a sustainable remedial approach, both in formal reporting and in direct engagement with the regulator and other stakeholders.

2. HOW TO USE THIS REPORT

This report is intended as an easy to-use resource to identify references in legislation, regulation and guidance that promote sustainable remediation. The methodology used for this review is provided in Appendix B.

It is important to note that this report is not intended as a guide to carrying out sustainable remediation. Rather it provides a compiled list of regulatory references that could be used in reporting, plans, and/or communications with regulators to promote or justify a sustainable approach to remediation. Where guidance is sought on carrying out sustainability assessments of remedial options, reference should be made to appropriate documentation. A good starting point for such is SuRF-UK's[1] *A Framework for Assessing the Sustainability of Soil and Groundwater Remediation* (2010) and NICOLE's[2] *Road Map for Sustainable Remediation (2010)*. In the case of the SuRF-UK framework, this document is supported by all the UK environment agencies[3].

2.1 Regulatory and Technical Context

Background information on the definitions and principles associated with sustainable remediation are provided in Chapter 3. A brief summary of the regulatory and technical context of contaminated land management in the UK is provided in Chapters 4 and 5. Chapter 5 includes a summary of the remediation project life cycle as per the EA's *Model Procedures for the Management of Land Contamination* (CLR 11) (2004). The remediation project life cycle forms the framework upon which the majority of sustainable remediation references in this report are linked. This report refers to the 'contaminated land regime'. This term is used to refer to both the *Contaminated Land* regime under Part 2A/III, and the *land contamination* regime under Town & Country Planning / Environmental Permitting/voluntary contaminated land activity. Where specific points about a particular regulation are made, the respective regime is identified.

2.2 Locating References that Promote Sustainable Remediation

To find references relevant to a particular aspect of a remediation project, report users can proceed directly to the report reference tables by following the hyperlinks in the list below. These reference tables, contained in Chapter 6, Chapter 7, and Chapter 8 of this report, list applicable regulatory references according to their relevance to particular scenarios associated with either remedial triggers, or with specific aspects of the remediation project life cycle.

The main scenarios for which regulatory text relevant to sustainable approaches to remediation have been identified are as follows:

- **Scenario 1:** Having a site determined as "contaminated land" by local or regulatory authority
- **Scenario 2:** Receiving an enforcement notice from an authority requiring remedial action.
- **Scenario 3:** Seeking planning permission/discharging planning conditions

[1] SuRF-UK is the United Kingdom's Sustainable Remediation Forum – an initiative set up to progress the UK understanding of sustainable remediation.

[2] NICOLE is a network for Industrial Contaminated Land in Europe set up to stimulate, disseminate and exchange knowledge about all aspects of industrially contaminated land.

[3] All four environment agencies in the UK, DEFRA and the Homes and Communities Agency signed the Foreword to the SuRF-UK framework report commending its use.

- **Scenario 4:** Identifying sustainability as a key project objective
- **Scenario 5:** Determining, applying, and modifying compliance and assessment points
- **Scenario 6:** Deriving remedial target concentrations
- **Scenario 7:** Evaluating risk
- **Scenario 8:** Conducting a remedial options appraisal - considerations of sustainability
- **Scenario 9:** Incorporating cost-benefit assessment in remedial options appraisal
- **Scenario 10:** Considering sustainable alternatives when remedial objectives cannot be met
- **Scenario 11:** Engaging with stakeholders
- **Scenario 12:** Implementing sustainable remedial and waste management practices
- **Scenario 13:** Deviating from the waste hierarchy where justified on sustainability grounds
- **Scenario 14:** Implementing a monitoring and verification programme

The flow chart (Figure 1) presented on the following page provides a graphical interpretation of how regulatory references relevant to sustainable remediation are categorised in this report.

Where a relevant reference is identified, hyperlinks to the online source of the original document are provided in the reference tables**. Report users should always refer back to the original source document to ensure the reference is applicable to the project context and that the reference is current.** It is important to note that EU and UK regulatory systems are dynamic, and that whilst documents referenced in this report were up-to-date at time of preparation [July 2014], document revisions, replacements, and amendments may occur in the future.

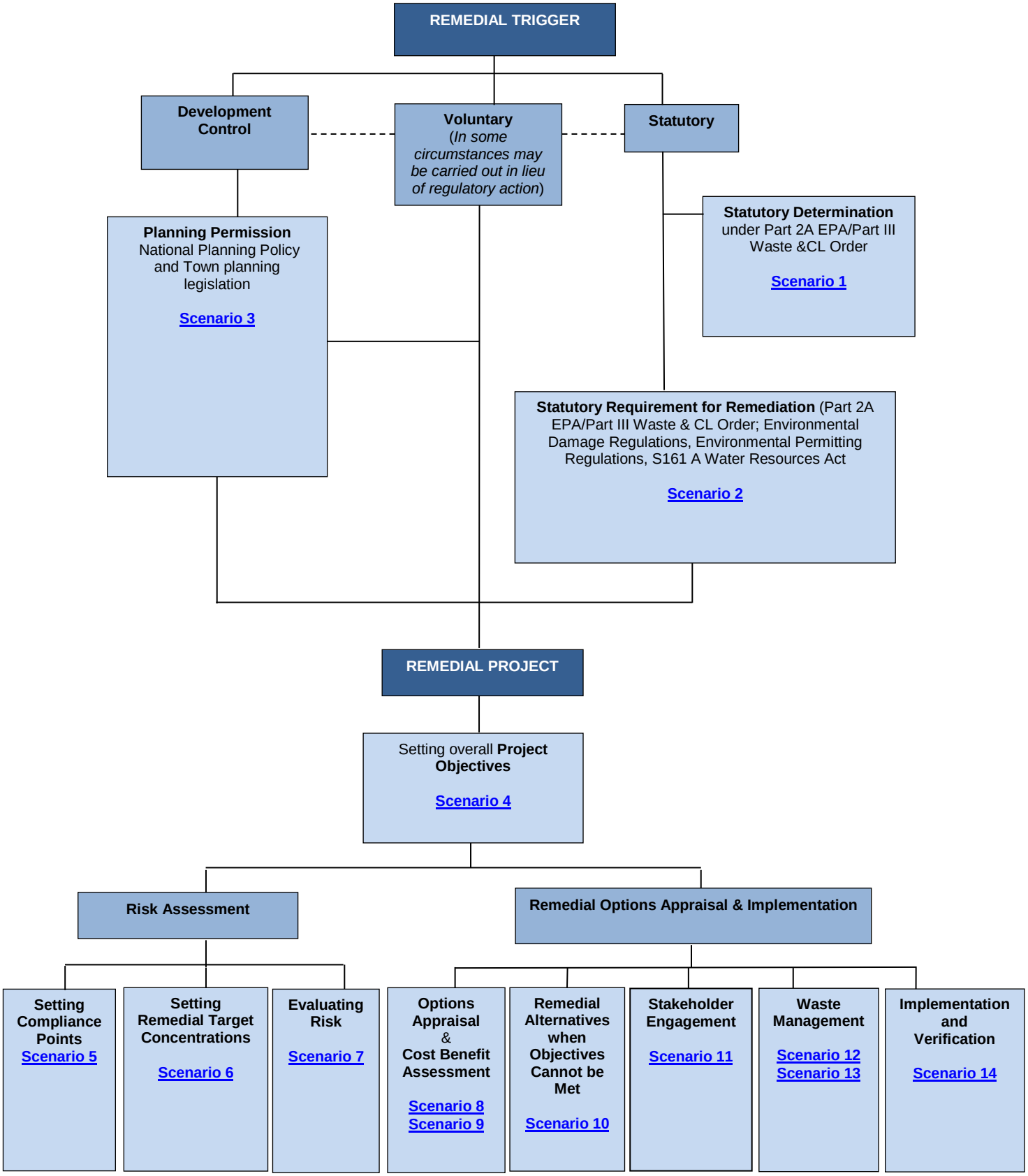

Figure 1: Flowchart showing scenarios in the UK contaminated land regime in which regulatory references relevant to sustainable remediation are found. Scenarios are hyperlinked to the relevant report section.

3. PRINCIPLES, DEFINITIONS, AND ASSUMPTIONS

3.1 Sustainability and Remediation

Sustainable remediation involves the balanced consideration of environmental, social and economic factors in soil and groundwater risk assessment and risk-management decisions. It is based on applying the principles of sustainable development to remediation practices.

In this report, the principle of sustainable development is based on the definition contained in the United Nations World Commission on Environment and Development (WCED) report: *Our Common Future: Report of the World Commission on Environment & Development* (the Bruntland report) (1987). The report defines sustainable development as:

> *"development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs".*

In practice, sustainable development relates to development which applies a balanced consideration of environmental, social and economic factors. This report adopts the definition of sustainable remediation developed by SuRF-UK in the document *A Framework for Assessing the Sustainability of Soil and Groundwater Remediation* (2010):

> *"The practice of demonstrating, in terms of environmental, economic and social indicators, that the benefit of undertaking remediation is greater than its impact, and that the optimum remediation solution is selected through the use of a balanced decision-making process."*

"Remediation", for the purposes of this report, is defined within the terms of the UK contaminated land regulatory framework, principally Part 2A of the *Environmental Protection Act* (1990), as applicable to England, Wales and Scotland, and Part III of the *Waste and Contaminated Land Order (1997)* (Northern Ireland). The three-phase remediation project life-cycle, as presented in the *Model Procedures for the Management of Land Contamination* (EA 2004) (CLR 11), is also the technical framework to which regulatory references to sustainability and sustainable remediation identified by this report are linked.

In this regard, remediation is considered to comprise the following:

a) *the doing of anything for the purpose of assessing the condition of—*

   i. *the contaminated land in question;*

   ii. *any controlled waters*[4] *affected by that land; or*

   iii. *any land adjoining or adjacent to that land;*

b) *the doing of any works, the carrying out of any operations or the taking of any steps in relation to any such land or waters for the purpose—*

   i. *of preventing or minimising, or remedying or mitigating the effects of, any significant harm, or any pollution of controlled waters, by reason of which the contaminated land is such land; or*

[4] The term "*controlled waters*" is applicable to jurisdictions in England and Wales. In Scotland the term "*water environment*" is applied, and in Northern Ireland the terms "*waterways or underground strata*" are applied.

ii. *of restoring the land or waters to their former state; or*

iii. *the making of subsequent inspections from time to time for the purpose of keeping under review the condition of the land or waters.* (S78A of the *Environment Protection Act* (1990))

CLR11 (2004), the overarching technical guidance document for the management of land contamination in the UK, divides the remediation process into three phases, which are examined in greater detail in Chapter 5:

1. Risk assessment;
2. Options Appraisal; and
3. Implementation of remediation.

This report considers principles of sustainability applicable to all three phases of the remediation project life cycle listed above and the review of regulatory documents has been conducted accordingly.

3.2 Geographical Extent

This report relates to the UK context within the broader EU regime. It is recognised that EU directives are to be implemented by all member states, however it should be noted that there may be inconsistencies in the timing and extent of implementation between member states.

4. LEGISLATIVE AND REGULATORY CONTEXT

The following section provides a brief summary of key documents relevant to the contaminated land regime in the United Kingdom (UK). A summary list of the key documents is provided as an Excel spreadsheet in Appendix A, attached. Appendix A also provides a general indication as to the extent to which the documents promote principles of sustainability and sustainable remediation.

Documents reviewed include EU Directives, UK domestic policy and legislation, and technical guidance documents issued by regulatory authorities. The review focuses on:

1. The legislative hierarchy
2. Document objectives;
3. Key points; and,
4. Relevance to the UK contaminated land regime.

4.1 European

The European Union (EU), which currently comprises 28 member states including the UK, was founded on two treaties: *The Treaty on the Functioning of the European Union (Treaty of Rome*, 1957), and *The Treaty on European Union (Maastricht Treaty*, 1993). These treaties sought to establish an economic and political union across European countries by unifying fiscal and labour markets and establishing institutions such as the European Parliament and the European Court of Justice that facilitate legislative, administrative and judicial functions at a pan-European level.

The legislative arm of the EU comprises the European Parliament and the Council of the EU. These institutions have powers under Article 288 of the Treaty of Rome to adopt legal acts such as "*regulations, directives, decisions, recommendations and opinions*". These legal acts differ in the extent to which they are binding on member states, as well as in relation to the timing of their implementation.

EU Directives are fully binding on member states and typically require signatory countries to create or amend domestic laws to implement the Directives within a specified timeframe. As an EU Member State, the UK government is therefore required to implement Directives applicable to the UK within its domestic legislative and regulatory framework.

There are a number of environment-focused Directives that have a significant bearing on contaminated land management and remediation practices in the UK and the other 27 EU member states. The following section briefly summarises six key EU Directives and their relevance to the UK contaminated land regime.

4.1.1 The Water Framework Directive (2000)

Directive 2000/60/EC Establishing a Framework for Community Action in the Field of Water Policy (The Water Framework Directive) was adopted by the EU in 2000 and introduced an integrated approach to the protection, improvement and sustainable use of Europe's surface waters and groundwater. The purpose of the Directive, as set out in Article 1, is to establish a framework which:

a) *"prevents further deterioration and protects and enhances the status of aquatic ecosystems and, with regard to their water needs, terrestrial ecosystems and wetlands directly depending on the aquatic ecosystems;*

b) *promotes sustainable water use based on a long-term protection of available water resources;*

c) *aims at enhanced protection and improvement of the aquatic environment, inter alia, through specific measures for the progressive reduction of discharges, emissions and losses of priority substances and the cessation or phasing-out of discharges, emissions and losses of the priority hazardous substances;*

d) *ensures the progressive reduction of pollution of groundwater and prevents its further pollution, and,*

e) *contributes to mitigating the effects of floods and droughts."*

More specifically, Article 4 sets out the environmental objectives of the Directive, which include the achievement of "good" status (based on ecological, quantitative, and chemical criteria) for surface water and groundwater bodies by 2015. Article 4 also sets out the environmental objective of "reducing pollution from priority substances and ceasing or phasing out emissions, discharges and losses of priority hazardous substances."

In order to meet these objectives, the Directive establishes a framework for:

- Developing river basin district management plans by designated local authorities (Art. 13);
- Characterising and monitoring of surface water and groundwater bodies in river basin districts (Art. 8);
- Implementing measures to protect the ecological and chemical status of surface water and groundwater bodies, such as controls on emission (Art. 10), abstraction (Art. 11), and establishing a list of priority and priority hazardous substances, the use of which is to be reduced or phased out, respectively. Importantly in the context of contaminated land management, Article 4 1. b) of the Directive requires Member States to implement measures to prevent or limit the input of pollutants into groundwater and to prevent the deterioration of the status of all bodies of groundwater.

Since its transposition into UK law, the Water Framework Directive has become a key part of the regulatory framework for surface water and groundwater, and related aspects of the contaminated land regime in the UK. The development of domestic policy and legislation relating to remediation where potentially impacted water bodies are a relevant factor is therefore driven by the need to comply with the Water Framework Directive.

The definition of hazardous substances, priority substances, and priority hazardous substances, as established in the Water Framework Directive is also relevant to risk assessments and in setting remediation targets. The requirements to prevent or limit inputs of pollutants to groundwater may also be relevant to where *in situ* remedial techniques or the reinjection of treated groundwater is proposed, albeit the Water Framework Directive Article 11(3)j provides certain exemptions from the general prohibition, including one that applies to remediation activities. Priority substances are discussed further in Section 4.1.5, below.

4.1.2 The Groundwater Directive (2006)

Directive 2006/118/EC on the Protection of Groundwater Against Pollution and Deterioration (The Groundwater Directive) builds on aspects of the Water Framework Directive that relate to the protection of groundwater resources. The Directive establishes specific measures to prevent and control groundwater pollution.

These measures include the establishment of criteria for assessing groundwater chemical status and for identifying significant and sustained upward trends in groundwater pollutant levels. In the event that such trends are identified, the Directive requires the implementation of a programme of measures to reverse the trends.

The Directive also complements the provisions in the Water Framework Directive to prevent or limit inputs of pollutants into groundwater. Some key features of the Directive relevant to contaminated land management include:

- Article 3, which requires member states to determine groundwater quality standards and threshold values for pollutants for assessing "good" groundwater chemical status;
- Article 6 S1, which requires member states to prevent the inputs of hazardous substances and to limit the input of non-hazardous pollutants to groundwater. Article 6 also allows for Member states themselves to classify pollutants as either hazardous substances or non-hazardous pollutants[5]; and,
- Article 6 S3, which sets out conditions under which Member states may be exempt from the prevent/limit requirements of Article 6 S1.

The Groundwater Directive and Water Framework Directive are also supported by a body of guidance known as Common Implementation Strategy Guidance Notes. *CIS Guidance Note 17: Guidance on preventing or limiting direct and indirect inputs in the context of the Groundwater directive 2006/118/EC (CIS Guidance Note No. 17)* is one of the most relevant Guidance notes to contaminated land management. This Guidance note clarifies technical details relating to prevent/limit requirements of the Groundwater Directive, and provides guidance for the assessment of inputs to groundwater. Key concepts relevant to contaminated land management raised by CIS Guidance Note No. 17 include:

- The development of conceptual hydrogeological models;
- Defining compliance points to determine whether inputs are acceptable;
- Establishing an appropriate monitoring network for the assessment of inputs; and,
- Examples of scenarios in which prevent/limit exemptions may apply.

The Groundwater Directive, like the Water Framework Directive is relevant to the contaminated land regime in that it forms part of the overarching policy framework for groundwater-related aspects of the contaminated land management in the UK. The establishment of groundwater quality standards and the classification of substances as hazardous substances and non-hazardous pollutants are relevant to: risk assessment; to the setting of remediation targets; and to

[5] In the UK classification of hazardous substances / non-hazardous pollutants is done by the Joint Agencies Groundwater Directive Advisory Group: http://www.wfduk.org/stakeholders/jagdag-work-area-0

remedial implementation where in situ remedial techniques or the reinjection of treated groundwater is proposed.

4.1.3 The Environmental Liability Directive

Directive 2004/35/CE on Environmental Liability with regard to the Prevention and Remedying of Environmental Damage (The Environmental Liability Directive) aims to establish a framework of environmental liability based on the 'polluter-pays' principle to prevent and remedy environmental damage. The Directive establishes that liability for harm to the environment caused by polluting or contaminating facilities falls on the operator of such facilities.

Article 5 of the Directive requires facility operators to take preventive action where "*environmental damage has not yet occurred but there is an imminent threat of such damage occurring*". In the event that environmental damage has already occurred, Article 6 S1 of the Directive requires the operator to take:

a) *"all practicable steps to immediately control, contain, remove or otherwise manage the relevant contaminants and/or any other damage factors in order to limit or to prevent further environmental damage and adverse effects on human health or further impairment of services and*

b) *the necessary remedial measures, in accordance with Article 7"*

Article 7 requires operators to identify potential remedial actions and makes the regulatory authority responsible for deciding which remedial option to implement. In general, costs for remedial works are to be borne by the operator.

Annex 2 of the Directive sets out in general terms remedial options that could be implemented if action is triggered by Article 6 S1 (b). These include the following:

a) *'Primary' remediation is any remedial measure which returns the damaged natural resources and/or impaired services to, or towards, baseline condition;*

b) *'Complementary' remediation is any remedial measure taken in relation to natural resources and/or services to compensate for the fact that primary remediation does not result in fully restoring the damaged natural resources and/or services;*

c) *'Compensatory' remediation is any action taken to compensate for interim losses of natural resources and/or services that occur from the date of damage occurring until primary remediation has achieved its full effect;*

Annex II also provides criteria for assessing remedial options. These include such factors as effect on public health and safety, social factors, environmental benefits, cost, and likelihood of future damage.

The Environmental Liability Directive is relevant to the contaminated land regime in the UK in that by its implementation within domestic law, the Directive provides a statutory trigger for remedial action. The Directive is also important as it:

- Clarifies that operators are liable for remediation costs, and that such costs are a factor in assessing remediation plans;
- Sets out criteria for assessing remedial options;

- Establishes principles, such as baseline measurements, that are used in assessing risk and in appraising remedial options.

4.1.4 The Industrial Emissions Directive

Directive 2010/75/EU on Industrial Emissions (Integrated Pollution Prevention and Control) (Industrial Emissions Directive) aims to minimise pollution from certain industrial installations throughout the European Union via the permitting of certain potentially polluting industrial activities (Annex 1 Activities).

Annex 1 activities comprise industrial operations which can result in emissions to air, water or soil. The list also includes activities related to the disposal and/or treatment of hazardous and non-hazardous waste and therefore has relevance to some remedial activities in the UK.

The purpose of the Directive is to ensure a high level of protection of the environment taken as a whole, and it is based on the following principles: (1) an integrated approach, (2) use of best available techniques (BAT), (3) flexibility, (4) inspections and (5) public participation.

The integrated approach requires permit applicants and issuers to take into account the whole environmental performance of an activity, including emissions to air, water and land, generation of waste, use of raw materials, energy efficiency, noise, prevention of accidents, and restoration of the site upon closure.

In the event that activity involves the use, production or release of hazardous substances, the Directive requires operators to prepare a soil and groundwater baseline report before commencing operations or before a permit is updated (Art. 22 S2). Importantly, in the context of the contaminated land regime, Article 22 also provides a regulatory trigger for remedial action when site operations come to an end (referred to as 'permanent cessation'). Upon cessation of activities, Article 22 S3 requires the operator to *"assess the state of soil and groundwater contamination by relevant hazardous substances"*, and *"where the installation has caused significant pollution of soil or groundwater by relevant hazardous substances compared to the state established in the baseline report…the operator shall take the necessary measures to address that pollution so as to return the site to that state."*

4.1.5 The Priority Substances Directive

Directive 2013/39/EU amending Directives 2000/60/EC and 2008/105/EC as regards Priority Substances in the Field of Water Policy (Priority Substances Directive) builds on the Water Framework Directive's strategy for addressing surface water pollution through the identification of priority substances, i.e. substances that pose a significant risk to the aquatic environment and whose discharge to surface water aquatic environments (i.e., excluding groundwater) is to be reduced or phased out.

The Priority Substances Directive presents a consolidated list of 45 priority substances and their associated Environmental Quality Standard (EQS) value in aquatic environments. Of the 45 priority substances, 19 are identified as priority hazardous substances whose emissions to water are to be phased out or ceased completely.

The relevance of the Priority Substances Directive to the UK contaminated land regime is largely in the applicability of EQS values to risk assessment, the setting of remedial targets, and acceptability of permitted discharges to surface water from water treatment systems.

4.1.6 The Waste Framework Directive

Directive 2008/98/EC on Waste and repealing Certain Directives (Waste Framework Directive) seeks to "*protect the environment and human health by preventing or reducing the adverse impacts of the generation and management of waste and by reducing overall impacts of resource use and improving the efficiency of such use*" (Art. 1). The Directive sets out a series of requirements for the management and treatment of waste, including permitting requirements for waste transport and treatment; promoting the Waste Hierarchy (see below); requiring waste producers to bear the cost of waste management and disposal; and efforts to protect human health and the environment.

The Directive requires Member States to apply the Waste Hierarchy as "*a priority order in waste prevention and management legislation and policy*" (Art. 4). The waste hierarchy comprises, in order of priority:

a) prevention;
b) preparing for re-use;
c) recycling;
d) other recovery, e.g. energy recovery; and
e) disposal.

The adoption of the hierarchy in the UK has significance to the selection and implementation of remedial options for contaminated sites, in that remedial action that results in the production of waste, such as excavated soil or contaminated groundwater, should conform to the waste hierarchy. Article 17 of the Directive also requires Member States to implement measures to ensure the traceability of hazardous waste movements from production to final destination. This requirement therefore also has a bearing on remedial implementation in the UK contaminated land regime.

4.2 United Kingdom

Contaminated land management in the UK operates under a regulatory and technical framework which seeks to:

1. Identify contaminated sites;
2. Establish conditions under which remedial action can be triggered for a particular site or operation (e.g. by statute or by development control);
3. Establish liability for costs for remediating contaminated sites; and
4. Specify regulatory and technical requirements for carrying out remediation (e.g. permitting and waste management requirements, and technical guidance).

National regulatory bodies who oversee contaminated land management are the Environment Agency (England), Natural Resources Wales (NRW), the Scottish Environment Protection Agency (SEPA), and the Environment Agency (Northern Ireland). These bodies are also responsible for the permitting of certain remedial and all waste management activities. Local Councils also have a major role in addressing contaminated land issues via development control under various planning acts and through their statutory duty to identify and determine Contaminated Land within their district boundaries. Local authorities typically consult with relevant national regulatory bodies for

more complex contaminated land issues, and for specific technical issues (e.g., controlled waters issues).

The following sections briefly review the UK contaminated land regulatory and technical framework.

4.2.1 Development Control

Legislation and policy associated with town planning and development control is the legal framework under which the bulk of soil and groundwater remediation is performed. An EA report in 2009 identified that 87% of remedial works carried out in England between 2000 and 2007 were triggered by site redevelopments that were subject to development control (*Reporting the Evidence: Dealing with Contaminated Land in England and Wales,* EA 2009).

National planning policies such as the *National Planning Policy Framework* (2012) (England), *Planning Policy Wales* (2014), the *National Planning Framework for Scotland v2* (2009) and *A Strategic Planning Policy Statement for Northern Ireland* (SPPS) (Draft) (2014) set out in general terms government policy on planning. They typically include policy statements in relation to contaminated land and the redevelopment of brownfield sites. Voluntary remediation is also promoted in certain circumstances to enhance site or neighbourhood amenity and value.

All of the national planning policy statements listed above list sustainable development as a key goal for planning policy. In Scotland, the national planning policy direction with regard to contaminated land is also supported by *Planning Advice Note PAN 33 (Scotland) Development of Contaminated Land*.

The *Town and Country Planning Act (England and Wales)* (1990 as amended), the *Town and Country Planning (Scotland) Act* (1997 as amended), and the *Planning (Northern Ireland) Order* (1991) are key acts under which town planning in the respective parts of the UK is regulated. These acts identify County and District councils as the main authorities for the preparation of local planning documents or development plans. The content of these plans is directed by national planning policy (see above) and local level involvement, and the plans form the basis against which planning decisions are made by local authorities.

National planning legislation also identifies local Councils as the main authorities for assessing development proposals. National policy documents and local development plans generally assert that the effects of pollution of land on human health and environment are material considerations in planning decisions. National policy and development plans also impose the need to consider prior land uses and potential hazards that may arise from such uses in determining a planning application (e.g. *PAN 33* (Scotland), S120-122 of the *National Planning Policy Framework* (England), and S13.5 – S13.7 *Planning Policy Wales*). In the UK, the "suitable-for-use" approach is advocated, in which the determination of a site's contamination status depends on its existing or proposed future use.

Planning legislation also allows Councils to grant planning permission subject to planning conditions, where they see fit (e.g. S70 of the *Town and Country Planning Act* 1990). Where site contamination is a relevant factor in determining an application, national planning policies and local development plans promote the use of conditions requiring the assessment of site contamination, and/or carrying out remedial works in the event that a site is assessed as not currently being fit for its proposed use.

4.2.2 Contaminated Land Legislation

Part 2A of the *Environmental Protection Act* (1990) (applicable to England, Wales and Scotland) and Part III of the *Waste and Contaminated Land (Northern Ireland) Order* (1997 as amended) provide a statutory means of dealing with unacceptable risks posed by land contamination to human health and the environment, and empowers regulatory authorities to find and deal with such land.

The Acts and their associated statutory guidance clarify the duties of regulatory authorities, establish liability and cost recovery mechanisms for contaminated land, and define key terms and concepts that form the basis for the assessment and remediation of contaminated sites in the UK. Such key concepts include:

- A definition of "contaminated land" that relates to site conditions where:
  - significant harm is being caused or there is a significant possibility of such harm being caused; or
  - significant pollution of controlled waters (England and Wales)/the water environment (Scotland)/ pollution of waterways or underground strata (Northern Ireland) is being caused or there is a significant possibility of such pollution being caused.
- A definition for "remediation" (see S 1.4)
- The concept of a "contaminant/pollutant linkage", which requires the presence of a contaminant source to be linked to a receptor via a plausible pathway, in order for there to be a viable risk from contamination. This concept forms the basis of the UK approach to risk assessment and remediation in relation to contaminated sites.
- The "suitable for use" approach, in which the determination of a site's contamination status should be based only on the current or likely future use of the site.
- Administrative and enforcement mechanisms, such as remediation notices, that allow regulatory authorities to require suitable persons to carry out remediation of contaminated sites or to recover costs from such persons in the event that remediation is carried out by the authority itself.

The Acts also require local authorities to identify sites within their geographical boundaries that are contaminated or potentially contaminated via risk assessments. In the event that sites are determined to be contaminated, the regulatory authority may serve a remediation notice on a suitable person. Statutory guidance to the *Environment Protection Act* indicates that enforcing authorities should seek to use Part 2A only where no appropriate alternative solution exists. It is no surprise therefore that in the majority of circumstances land contamination is dealt with through the planning system, as evidenced by the findings of the 2009 EA report mentioned earlier in section 4.2.1 (*Reporting the Evidence: Dealing with Contaminated Land in England and Wales, EA 2009*)

4.2.3 Environmental Liability

A number of UK regulations can trigger a requirement for remediation through a determination of liability for new or imminent threat of environmental damage or harm. The principal UK acts in this regard are those which transpose the EU Environmental Liabilities Directive (see S 4.1.3 above), namely:

- *The Environmental Damage (Prevention and Remediation) Regulations (2009) (England)*;

- *The Environmental Damage (Prevention and Remediation) Regulations (2009) (Wales)*;
- *The Environmental Liability (Scotland) Regulations (2009*); and
- *The Environmental Liability (Prevention and Remediation) Regulations (Northern Ireland) (2009*)

As per the provisions of the Environmental Liabilities Directive, these Regulations establish that operators of potentially polluting activities, as listed in the Regulations, are liable for any environmental damage caused by such activities. Environmental damage in these acts is defined in terms of changes to a body of surface water or groundwater that result in a lowering of its status with respect to the requirements of the Water Framework Directive and Groundwater Directive, or, with regard to environmental damage to land, "contamination of land by substances, preparations, organisms or micro-organisms that results in a significant risk of adverse effects on human health".

In the event that environmental damage is imminent, operators must take all reasonable steps to prevent the damage, whilst in the event that environmental damage has already occurred, Article 6 S1 of the Directive requires the operator to carry out remedial action to address the damage.

As per the Environmental Liabilities Directive, the Regulations also clarify the form of remediation can be required in the event of environmental damage (e.g. primary, complementary, compensatory), and also prescribe a list of criteria to be used for assessing and selecting a suitable remedial option.

It is important to note that the UK environmental liability regulations are not retrospective. Environmental damage that occurred prior to their implementation (i.e. prior to 2009) will therefore fall under the Part 2A Environmental Protection Act and Part III Waste and Contaminated Land (Northern Ireland) 1997 regime. Environmental damage taking place post-2009 falls under the requirements of the environmental liability regime. In practice, this arrangement should result in no action being taken under the Part 2A/Part III regime for incidents that take place post-2009.

Other potential statutory triggers for remediation where pollution to groundwater has occurred include:

- S161A of the *Water Resources Act (1991)*
- S32 of *The Water Environment (Controlled Activities) (Scotland) Regulations 2011*

These legislation empower authorities to require operators of controlled or permitted activities to carry out remedial action in the event that they have caused or are likely to cause significant adverse impacts on the water environment/controlled waters; or where an unauthorised direct or indirect discharge into groundwater of any hazardous substance or any other pollutant has occurred. However, it is worth noting that the enforcement action for breaches of these regulations would be via the Environmental Permitting regime (see below) rather than through a specific regulatory notice under either of the above Act or Regulation.

4.2.4 Environmental Permitting

Key UK regulations for the permitting of potentially contaminating activities transpose the main provisions of the Industrial Emissions Directive. These include the following:

- Environmental Permitting Regulations (England & Wales) 2010 (as amended by the Environmental Permitting (England and Wales) (Amendment) Regulations 2013)
- The Pollution Prevention and Control (Scotland) Regulations 2012
- The Pollution Prevention and Control (Industrial Emissions) Regulations (Northern Ireland) 2013

Core guidance for the Environmental permitting regime in England and Wales is also offered by DEFRA's (2013) *Core Guidance For the Environmental Permitting (England and Wales) Regulations 2010*.

These regulations have a considerable relevance to the UK contaminated land regime. Firstly, they can trigger remedial action in the event of site operations ceasing, or where the regulator considers that steps are necessary to avoid a pollution risk. In implementing Article 22 of the Industrial Emissions Directive, which requires that an operator return the active site to baseline conditions upon ceasing operations, UK regulations require that, upon applying to surrender a permit or where a permit has been revoked, the regulatory authority must be satisfied that "*necessary measures*" have been taken by the operator to, for example:

> "*return the site of the regulated facility to a satisfactory state, having regard to the state of the site before the facility was put into operation*." (Schedule 5 Part 1 S14 b) *Environmental Permitting Regulations (England & Wales) 2010*).

It is worth noting that the environmental permitting regime could potentially be interpreted as requiring an "absolute" (e.g. baseline), approach to remediation[6], in contrast to the "risk-based" approach adopted within the contaminated land regulatory framework. This distinction may have significant bearing on the sustainability of remedial approaches required under the environmental permitting regime.

Remediation can also be triggered by the regulations in circumstances where the regulator considers that actions by the operator are necessary "*to avoid a pollution risk resulting from the operation of the regulated facility" (*e.g. Regulation 23*, Environmental Permitting Regulations (England & Wales)* 2010). The regulator is also empowered to carry out remediation itself if it "*considers that the operation of a regulated facility under an environmental permit involves a risk of serious pollution* (Regulation 57, *Environmental Permitting Regulations (England & Wales)* 2010). Costs in such circumstances are recoverable from the operator.

The environmental permitting regulations are also relevant to the contaminated land regime in that a number of remedial activities require permits under the regulations due to their potential to generate waste, result in discharges to groundwater, or mobilise contamination. Permits are issued either for a specific site or activity, or for mobile plant, and guidance is offered by regulatory authorities such as the EA and SEPA with regard to the type of permit that is required, or whether any exemptions apply, e.g. in England & Wales for treatment of soil volumes of less than 1000m^3 (See also: *Remediation Position Statements*, EA 2010, *Land remediation and waste management guidelines*, SEPA 2009). For standard rules permits and other exemptions associated with contaminated land management see https://www.gov.uk/government/publications/standard-rules-

[6] See also: *EA Regulatory Guidance Note, RGN 9: Surrender, 2013*; and *SEPA PPC Technical Guidance Note 2 (Site Reports), 2013*

sr2008-number-27 and https://www.gov.uk/government/collections/standard-rules-environmental-permitting.

4.2.5 Waste Regulations

UK regulations for waste management have a particular bearing on remedial options appraisal and remedial implementation. The following regulations transpose the main provisions of the Waste Framework Directive:

- The Waste Regulations 2011 (England and Wales)
- The Waste Regulations (Northern Ireland) 2011 (as amended)
- The Waste Management Licensing (Scotland) Regulations 2011
- The Waste (Scotland) Regulations 2012

These regulations require that operators of waste generating activities give consideration to the waste hierarchy in developing waste management strategies. The regulations are therefore applicable to remedial activities carried out on contaminated sites due to their capacity to generate waste soil and/or groundwater.

Consideration must also be given to the use of waste transporters and waste treatment facilities which may be involved in remedial activities. Waste regulations in the UK require that operators of such activities must be suitably licensed in accordance with the regulatory framework.

UK environmental permitting regulations (See S4.2.4) also have relevance to the contaminated land regime in their transposition of aspects of *EU Directive 1999/31/EC on the landfill of waste* (Landfill Directive, 1999) that relate to the classification of waste soils for landfilling purposes. The classification of excavated soils will have a particular bearing in appraising remedial options due to the cost implications associated with the off-site disposal of soils.

4.2.6 UK Technical Guidance

Technical guidance documents have been released by UK environmental agencies to complement the regulatory framework for contaminated land management. These documents offer guidance, in technical terms, on how to achieve compliance with contaminated land legislation and regulations, which are often framed in a non-technical legal language. These guidance documents also offer clarity regarding the regulatory position of lead authorities in relation to technical matters within the regulatory framework. Such matters include guidance on determining whether a site is Contaminated Land; guidance on selecting remedial options; and regulator position statements on the permitting of remedial activities. Guidance is typically targeted toward local authorities, industry, site owners and operators, property developers and their contaminated land advisors. A list of key guidance documents prepared by UK regulatory authorities is presented in Appendix A (attached), and summarised below.

The *Model Procedures for the Management of Land Contamination* (EA 2004) (CLR 11) is the principal overarching technical guidance document for contaminated land management in the UK. It is referenced by regulatory authorities in England, Wales, Scotland and Northern Ireland and is the standard adopted technical procedure for the assessment and remediation of contaminated and potentially contaminated land.

CLR11 provides "*the technical framework for structured decision-making about land contamination*" and promotes a *risk-based* approach to dealing with land contamination. This approach breaks up the remediation project life-cycle into three parts:

1. Risk assessment;
2. Options Appraisal; and
3. Implementation of remediation.

CLR11 also clarifies the concept of a source-pathway-receptor 'pollutant' linkage and the notion that remediation involves breaking one or more part of the linkage. The remediation project life cycle and pollutant linkages are discussed in greater detail in Chapter 5, below.

In England and Wales, CLR11 is supported by the *Guiding Principles of Land Contamination* (GPLC1-GPLC3) (EA 2010), which offers guidance for all three phases of the remediation project life cycle using the approach presented in CLR11. Guidance for the overall remediation project life cycle in Scotland is also offered by *Planning Advice Note PAN 33 (Scotland) Development of Contaminated Land*, which frames contaminated land management in the context of the planning system.

Other relevant UK guidance documents include the following:

- Statutory guidance to the Part 2A EPA regime (*Environmental Protection Act 1990: Part 2A. Contaminated Land Statutory Guidance*; DEFRA, 2012; *Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance: Edition 2*; Scottish Executive, 2006; and *Contaminated Land Statutory Guidance – 2012*, Welsh Government, 2012.
- *Guidelines for Environmental Risk Assessment and Management* (DEFRA 2011) (Green Leaves III) offers generic guidance for the assessment and management of environmental risk, however not specifically in the context of contaminated land. CLR11 translates the principles of Green Leaves III to contaminated land management;
- *Groundwater Protection: Principles and Practice* (EA 2013) (GP3) and *Water Pollution Arising from Land Containing Chemical Contaminants 2nd edition* (SEPA 2012) which provide technical guidance for the protection of groundwater resources in England, Wales and Scotland, with a particular focus on risk assessment, including the selection of compliance points.
- *Remedial Targets Methodology* (EA 2006); *Position Statement WAT-PS-10-01 Assigning groundwater assessment criteria for pollutant inputs* (SEPA 2011) (WAT PS-10); *Human Health toxicological Assessment of contaminants in Soil* (EA 2009); *An ecological risk assessment framework for contaminants in soil* (EA, 2008); *Using Soil Guideline Values, Science report* (EA 2009) all offer technical guidance for the derivation and use of assessment criteria for risk assessments for human health, ecology and controlled waters. WAT PS-10 and Remedial Targets Methodology also offer guidance for use in determining compliance points for risk assessment.

Other guidance documents that deal with remediation options appraisal, including cost benefit analysis, and remedial implementation include:

- *Costs and Benefits Associated with the Remediation of Contaminated Groundwater: A review of the issues. R&D Technical Report P278*. (EA, 1999);

- *Cost-Benefit Analysis for Remediation of Land Contamination, R&D Technical Report P316* (EA, 1999);
- Costs and Benefits Associated with the Remediation of Contaminated Groundwater: A framework of assessment. R&D Technical Report P279. (EA, 2000);
- *Costs and Benefits Associated with the Remediation of Contaminated Groundwater: Application and Example R&D Technical Report P2-078/TR*. (EA 2002);
- *Assessing the Value of Groundwater Science Report – SC040016/SR1* (EA, 2007));
- *Land remediation and waste management guidelines* (SEPA, 2009);
- *Remediation position statements* (EA 2010),
- *The Definition of Waste: Development Industry Code of Practice* (Contaminated Land: Applications in Real Environments (CL:AIRE), 2011)
- *EA Position Statement: Definition of Waste: Development Industry Code of Practice (V2)* (EA, 2011); and,
- *Verification of Remediation of Land Contamination*. (EA 2010).

5. THE REMEDIATION PROJECT LIFE CYCLE

This report presents regulatory references relevant to sustainable remediation both in the context of regulatory triggers for remediation, as well as within different phases of the remediation project life cycle. To provide the context for the latter, this section provides a brief summary of the remediation project life cycle.

In accordance with CLR11, the project life cycle for remediation and the management of contaminated land is divided into three phases:

1. Risk assessment;
2. Options Appraisal; and
3. Implementation of remediation.

This process is summarised in Figure 2. The following sections briefly summarise the main features of each phase of the process.

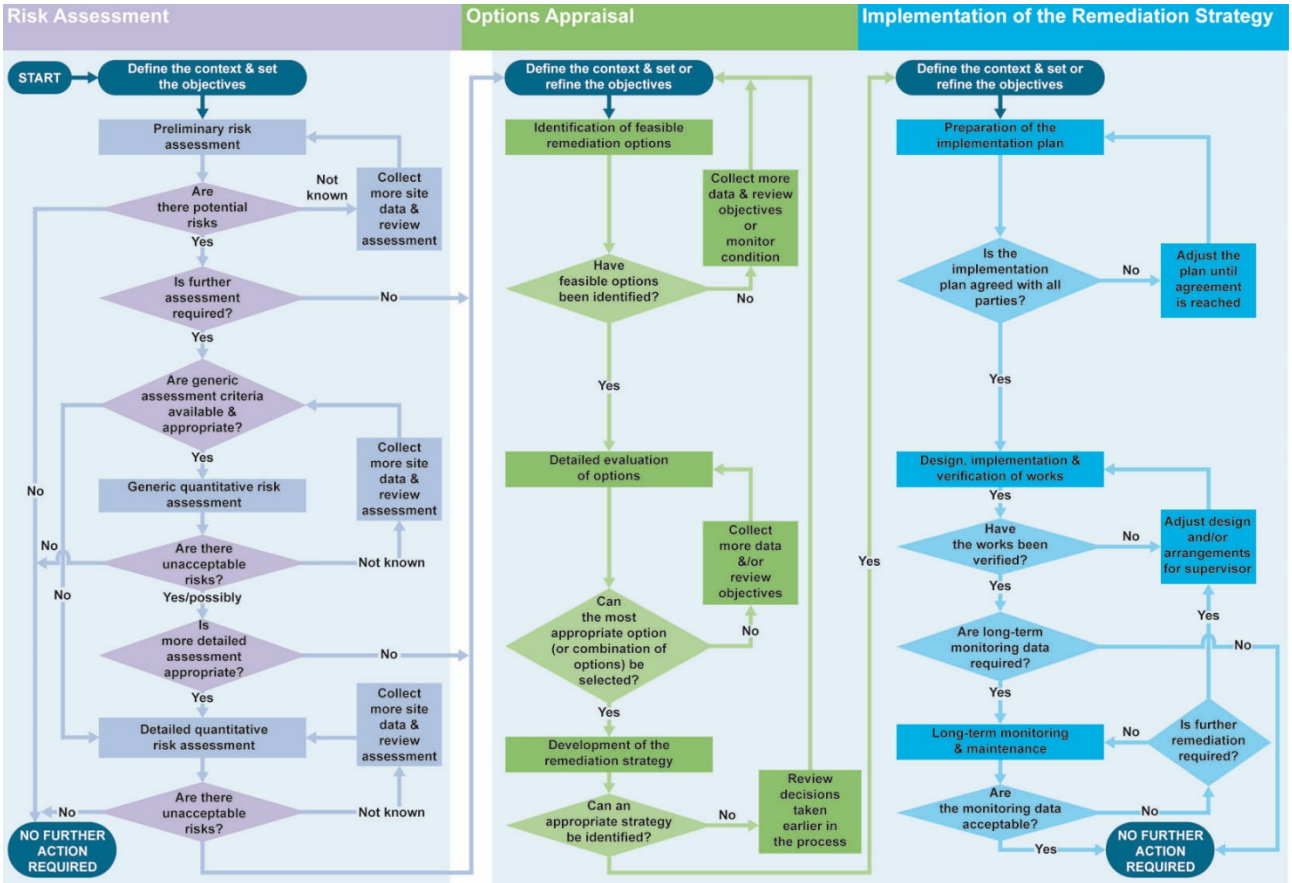

Figure 2: The remediation project life cycle (Source: Model Procedures for the Management of Land Contamination, EA 2004).

5.1 Risk Assessment

The risk assessment phase requires an evaluation as to whether unacceptable risks to human health or other relevant receptors are present for a particular site. The outcome of risk assessment should be a determination as to whether risk management (potentially including active intervention) is required to remove, reduce or control those risks. This risk-based approach applies to the majority of remediation undertaken in the UK, however it is worth pointing out that under the environmental permitting regime, more absolute requirements may apply (e.g. return-to-baseline), and a risk-based approach may not necessarily be appropriate or acceptable in such circumstances.

Environmental risk assessment involves the development of a conceptual site model to assess whether there are any viable "pollutant/contaminant linkages", which relates to the "*linked combination*" (CLR11) of the following three elements:

1. Contaminant: a substance that is in, on or under the land and has the potential to cause harm or to cause pollution of controlled waters[7].

2. Receptor: something that could be adversely affected by a contaminant, such as people, an ecological system, property, or a water body.

3. Pathway: route or means by which a receptor can be exposed to, or affected by, a contaminant.

The three elements can exist independently, but risks can only manifest where all three elements are present and linked. Consequently, risks can be eliminated by removing any one of the linkages between the source, pathway and receptor.

Risk assessments proceed under an iterative, tiered approach, in which risks are firstly assessed at a preliminary qualitative or semi-quantitative stage. If potential linkages or unacceptable risks are identified at the preliminary stage, the assessment progresses to a generic quantitative phase. A subsequent detailed (site-specific) phase of risk assessment may be warranted if potentially unacceptable risks cannot be ruled out using a generic assessment.

Generic and site specific phases can include the comparison of soil, groundwater, and soil vapour concentrations of chemicals of potential concern against generic criteria (e.g. Environmental Quality Standards, EQS, or Drinking Water Standards, DWS) or other relevant site specific criteria. It is important to note that risk assessment relies on an appropriate level of site characterisation and a good understanding of the conceptual site model. Depending on gaps in understanding at a site (i.e., uncertainties in the conceptual site model) progress from preliminary to more complex phases of assessment would typically require intrusive site investigations including the drilling of soil bores, and groundwater and soil vapour wells, to ensure a suitable data set is employed in the assessment; with each step of risk assessment typically requiring further targeted data acquisition.

[7] Note: to be Contaminated Land under EPA 1990 Part 2A, there must be a significant possibility of significant harm, or a significant possibility of significant pollution of controlled waters. Different tests may give rise to the need for remediation under other regimes.

Upon completion of the risk assessment phase, one of the following outcomes would result:

1. **No unacceptable risk identified** – No further action; or

2. **Potential unacceptable risks identified** – Proceed to more detailed site characterisation and risk assessment to provide improved understanding of likelihood of risk, provided emergency measures are not required, and/or institute a precautionary risk management strategy; or,

3. **Unacceptable risk to one or more receptors identified** – Carry out remediation options appraisal and implement a suitable risk-management strategy to protect the receptor(s).

5.2 Remedial/Risk Strategy Development and Remediation Options Appraisal

5.2.1 Objectives of Remedial Options

In the event that unacceptable risks are identified at the risk assessment phase, an evaluation of feasible risk management options and development of an appropriate risk management and/or remediation strategy for the site is required.

Statutory guidance issued by DEFRA and the Welsh Government for Part 2A of the *Environment Protection Act* 1990 defines the aim of remediation in the context of the contaminant linkage model that is employed during the risk assessment phase. Hence: "*The broad aim of remediation should be:*

a) *to remove identified significant contaminant linkages, or permanently to disrupt them to ensure they are no longer significant and that risks are reduced to below an unacceptable level; and/or*

b) *to take reasonable measures to remedy harm or pollution that has been caused by a significant contaminant linkage." (*S 6.5*, Contaminated Land Statutory Guidance,* DEFRA 2012*; Contaminated Land Statutory Guidance for Wales 2012,* Welsh Government 2012*).*

Similarly, CLR 11 defines a remediation option as: "*A means of reducing or controlling the health or environmental risks associated with a particular pollutant linkage*".

Based on the source-pathway-receptor model in CLR11, there are consequently three main ways to address unacceptable risks. These form the basis for the development of remediation options:

1. Remove or treat the (source) of pollutant(s);

2. Remove or modify the pathway(s);

3. Remove or modify the behaviour of receptor(s).

5.2.2 Remedial Options Appraisal

Remedial options appraisal comprises the following stages:

a) Identifying feasible remediation options for each relevant pollutant linkage;

b) Carrying out a detailed evaluation of feasible remediation options to identify the most appropriate option for any particular linkage. This stage can include desk studies or field trials of potentially suitable remedial options.

c) Producing a remediation strategy that addresses all relevant pollutant linkages. This could include a combination of remediation options, where appropriate.

Guidance issued by regulatory authorities indicates that the evaluation of remediation options should not only consider technical and scientific factors, but also economic, legal and social factors.

Early stakeholder engagement in contaminated land management decision making can also bring benefits in improving the delivery of remedial objectives. The importance of stakeholder engagement across all stages of the remediation project lifecycle is captured in the UK legislative and regulatory framework, as demonstrated in Section 8.3.44, below.

The principal outcome of the remedial options appraisal phase is the development of a **Remediation Strategy,** i.e. "*a plan that involves one or more remediation options to reduce or control the risks from all the relevant pollutant linkages associated with the site*." (*CLR11,* 2004). A remediation strategy often requires the endorsement of regulatory authorities (or even a regulatory permit / consent) prior to on-site implementation.

5.3 Remedial Implementation, Monitoring and Verification

Once remedial options appraisal has identified a suitable remedial strategy that addresses all relevant pollutant linkages, a remediation project will enter the implementation stage of the project life cycle. This phase involves: *"Carrying out the remediation strategy and demonstrating that it is, and will continue to be, effective*" (*CLR11*, 2004), and includes the following stages:

1. Preparing a remedial implementation plan;
2. Design, implementation and verification of remediation;
3. Long-term monitoring and maintenance.

The main aim of the implementation stage is to ensure that the proposed remediation strategy achieves the planned objectives efficiently for all relevant pollutant linkages and with appropriate quality assurance. In practice, this phase is often linked to, or can form a phase of, development works at a site. Remedial implementation is therefore often subject to planning controls regulated by local authorities.

The implementation of remedial strategies often require significant engineering and excavation works, solid and liquid waste generation, waste transport, discharges of treated groundwater to sewer or reinjection to groundwater, and emissions to air. Remediation activities are consequently typically subject to planning and regulatory controls including:

- Conditions to a Planning Permission, including requirements for monitoring, verification and submission of a Verification Report;
- Waste management and Environmental Permitting Regulations;
- Consignment Notes for moving Controlled Waste (e.g. *Hazardous Waste (England & Wales) Regulations* 2005, as amended);
- Appropriate permits for groundwater abstractions and discharges to controlled waters under the *Water Resources Act 1991, Water Act 2003* (England) and groundwater regulations in Wales, Scotland and Northern Ireland;
- Appropriate Trade Effluent Consents for discharges to the foul sewerage system.

The monitoring and verification components of remedial implementation would typically involve the collection and analysis of samples of environmental media.

This could include soil validation samples from remedial excavations, as well as groundwater and soil vapour samples collected from the monitoring network that forms part of the remedial strategy. Long-term environmental monitoring plans for groundwater and soil vapour may also be warranted as part of the implementation of remediation.

CLR 11 lists a series of fifteen typical remediation options such as excavation, containment barriers, and in-situ chemical treatment, and pump-and-treat systems. These remedial options are linked to EA Position Statements which provide a summary of the permitting implications associated with each technology, as well as identifying any applicable exemptions from the *Environmental Permitting Regulations 2010,* and any particular enforcement positions that the Environment Agency may apply. These position statements should be taken into consideration in planning for the implementation of a remedial strategy.

6. SUSTAINABILITY CONSIDERATIONS IN STATUTORY TRIGGERS FOR REMEDIATION

Sustainability is a key consideration in the administration and enforcement of the contaminated land regulatory regime in the UK. References demonstrating the requirement for regulators to consider sustainability in decision-making can be found for the following scenarios:

- **Having a site determined as "contaminated land" by a local or regulatory authority**: Local authorities are bound in their obligations to consider social, environmental and economic factors when assessing the contamination status of sites.
- **Receiving an enforcement notice** from a Local or regulatory authorities requiring remedial action. Authorities are required to adopt a balanced approach in determining whether remedial action is required, as well as the extent of remediation required.

6.1 Scenario 1: Having a Site Determined as "Contaminated Land" by Local or Regulatory Authority

Under Part 2A of the Environment Protection Act, local authorities and regulators are required to make determinations as to whether sites within their boundaries are contaminated on the basis of the Part 2A definition of contaminated land. These determinations are to be undertaken on the basis of risk assessments, which, under statutory guidance, need to account for sustainability factors, including the cost and benefits of such a determination

In the event that a site operator or owner receives communications from a regulator or local authority indicating that their site may be subject to a determination as "contaminated", the following references should be reviewed and put forward in communications to the relevant authority to ensure that the *sustainability* of such a determination is taken into account.

Table A: References to support the consideration of sustainability in the determination of a site as "contaminated"

Environment Protection Act 1990 (Part 2A): Contaminated Land Statutory Guidance, DEFRA 2012 Contaminated Land Statutory Guidance – Welsh Government) 2012	S3.35 (d)	*"Risk summaries should as a minimum include: d) A description of the authority's initial views on possible remediation. This need not be a detailed appraisal, but it should include a description of broadly what remediation might entail; how long it might take;* ***likely effects of remediation works on local people and businesses****; how much difference it might be expected to make to the risks posed by the land; and the authority's initial* ***assessment of whether remediation would be likely to produce a net benefit****, having regard to the broad objectives of the regime set out in Section 1."*

Table A: References to support the consideration of sustainability in the determination of a site as "contaminated"		
Environment Protection Act 1990 (Part 2A): Contaminated Land Statutory Guidance, DEFRA 2012 Contaminated Land Statutory Guidance – Welsh Government) 2012	S4.27	*"If the authority considers that it cannot make a decision in line with paragraph 4.26, it* (the determining authority) *should consider other factors which it considers are relevant to achieving the objectives set out in Section 1. This should include consideration of:* *(a) The likely direct and indirect health benefits and impacts of regulatory intervention…* *(b) The authority's initial estimate of what remediation would involve; how long it would take; what benefit it would be likely to bring; whether the* ***benefits would outweigh the financial and economic costs****; and any* ***impacts on local society or the environment*** *from taking action that the authority considers to be relevant."* **Explanatory note:** This clause applies in the event that the determination of the contaminated status of a site cannot be readily made.

6.2 Scenario 2: Receiving an Enforcement Notice from an Authority Requiring Remedial Action

In the event that a site is determined as Contaminated Land under Part 2A EPA or that pollution is being caused by an operation under environmental permitting or environmental liability regimes, the local or regulatory authority may require a site owner, or other "appropriate person" to carry out remediation works. In this scenario, the authority must take a balanced and reasonable approach. UK legislation requires that it must weigh the likely seriousness of harm resulting from site against the possible cost of remediation.

It is worth noting a significant distinction between the duties and powers of authorities and agencies under the Part 2A/Part III regimes compared to other regulatory regimes. Under Part 2A and Part III, the authority/agency has a *duty* to inspect and determine, and to bring about remediation (albeit within the constraints of the test for reasonableness). In other regimes, by contrast, the agencies and authorities have *powers* to act. Such powers are discretionary, and in such circumstances there is a general requirement to '*take account of the likely costs and benefits*' when deciding whether to use those powers, as well as how to use them (e.g. s39 Environment Act (1995).

The following references summarise relevant text in legislation that pertain to situations where an enforcement notice requiring remedial action could be issued. The references would aid in communications with the regulator to ensure sustainability factors have been considered in the authority's decision.

Table B: References promoting the consideration of sustainability by a regulator enforcing remedial action		
Part 2A Environment Protection Act 1990 (England, Wales, Scotland)	Article 78E (4))	*"The only things by way of remediation which the enforcing authority may do, or require to be done, under or by virtue of this Part are **things which it considers reasonable**, having regard to—* *(a) the **cost** which is likely to be involved; and* *(b) the **seriousness of the harm**, or pollution of controlled waters, in question."*
The Waste and Contaminated Land (Northern Ireland) Order 1997 (as amended) (Part III)	Article 43 (4)	*Things by way of remediation which the enforcing authority may do, or require to be done, under this Part are things which it **considers reasonable**, having regard to—* *(a) the **cost** which is likely to be involved; and* *(b) the seriousness of the harm, or pollution of waterways or underground strata, in question.* **Explanatory note**: If an authority determines that a site is contaminated as per the definition under Part III of the Order, the authority can require an "appropriate person" to remediate the site. However, the authority is limited in its ability to require only things which are considered "reasonable". This includes the balancing of costs of remediation against the seriousness of harm.
Water Pollution Arising from Land Containing Chemical Contaminants (SEPA) 2012	S 4(d)(ii)	*The standard of remediation that can be required under Part 2A of the Environmental Protection Act 1990 depends on what can be regarded as **reasonable**, having regard to the **cost** likely to be involved, the **benefit** that would result, the **seriousness of the pollution** and the **best practicable remediation techniques**.*
Environment Protection Act 1990 (Part 2A): Contaminated Land Statutory Guidance, DEFRA 2012 Contaminated Land Statutory Guidance – Welsh Government) 2012	S1.6	*In so doing, the authority should use its judgement to strike a **reasonable balance** between: (a) **dealing with risks** raised by contaminants in land and the **benefits of remediating** land to remove or reduce those risks; and (b) the **potential impacts** of regulatory intervention **including financial costs** to whoever will pay for remediation (including the taxpayer where relevant), **health and environmental impacts** of taking action, **property blight,** and burdens on affected people. The authority should take a **precautionary approach** to the risks raised by contamination, whilst **avoiding a disproportionate approach** given the circumstances of each case. **The aim should be to consider the various benefits and costs of taking action**, with a view to ensuring that the regime produces **net benefits**, taking account of local circumstances.*

Table B: References promoting the consideration of sustainability by a regulator enforcing remedial action		
Environment Protection Act 1990 (Part 2A): Contaminated Land Statutory Guidance, DEFRA 2012 Contaminated Land Statutory Guidance – Welsh Government) 2012	S 6.31	*"In considering the **benefits of remediation**, the enforcing authority should consider: (a) the **seriousness of any harm or pollution** of controlled waters and the various factors that led the land to be determined (e.g. the scale of harm or pollution that might already be occurring; or the likelihood of potential future harm or pollution and the likely impact if it were to occur); (b) the context in which the effects are occurring or might occur; and (c) any estimated **increase in the financial value and utility** of the land as a result of remediation, and **who would benefit** from such an increase. In considering such benefits it is for the authority to decide whether or not to describe such benefits (whether direct or indirect) in terms of monetary value or whether to make a qualitative consideration."*
Environment Protection Act 1990 (Part 2A): Contaminated Land Statutory Guidance, DEFRA 2012 Contaminated Land Statutory Guidance – Welsh Government) 2012	6.21-6.22	*"The enforcing authority should regard a remediation action as being **reasonable** if it is satisfied that the **benefits** of remediation are likely to **outweigh the costs** of remediation.* *In some cases, it might be that there is more than one potential approach to remediation that would be **reasonable**. In such cases the authority should choose what it considers to be the "best practicable technique" having regard to the factors above. Unless there are strong grounds to consider otherwise, the best practicable technique in such circumstances is likely to be the technique that achieves the required standard of remediation to the appropriate timescale, whilst imposing the least cost on the persons who will pay for the remediation."*
Water Act 2003	Part 1, Paragraph 30, Part 4	*"The works or operations which may be specified are works or operations which it appears to the Agency are appropriate for the purpose of remedying or mitigating the effects of the breach or failure to comply, and may include—* *(a) works or operations for the purpose, so far as it is **reasonably practicable** to do so, of restoring any affected waters, including any flora and fauna dependent on them, to their state immediately before the breach or failure to comply."*
Core guidance For the Environmental Permitting (England and Wales) Regulations 2010	S7.3.1	*Other than in exceptional circumstances operators should remove any contamination and return the site to the original condition. However, where an operator can **robustly demonstrate that is unsustainable or not practical to do this**, then the contamination should be removed as far as practicable.*
The Environmental Damage(Prevention and Remediation) Regulations 2009 – England and Wales	Part 1 Section 8, para 3	*"The enforcing authority may at any time decide that no further remedial measures need be taken if—* *(a) the remedial measures already taken have removed any significant risk of adversely affecting human health, water or protected species and natural habitats; and* *(b) the **cost** of the remedial measures needed for restoration to its state before the incident would be **disproportionate to the environmental benefits** to be obtained."*

Table B: References promoting the consideration of sustainability by a regulator enforcing remedial action		
The Environmental Liability (Scotland) Regulations 2009	Schedule 3 Part 1 S6 (3)	*The competent authority may at any time decide that no further remedial measures should be* *taken if—* *(a) the remedial measures already taken secure that there is no longer any significant risk of adversely affecting human health, water or protected species and natural habitats; and* *(b) the **cost** of the remedial measures that should be taken to reach baseline condition or similar level would be **disproportionate to the environmental benefits** to be obtained.*
Environment Act 1995	Part 1, chapter 3, s39, para 1	"(1) *Each new Agency—* *(a) in considering whether or not to exercise any power conferred upon it by or under any enactment, or* *(b) in deciding the manner in which to exercise any such power,* *shall, unless and to the extent that it is unreasonable for it to do so in view of the nature or purpose of the power or in the circumstances of the particular case, **take into account the likely costs and benefits** of the exercise or non-exercise of the power or its exercise in the manner in question.*"
Water Resources Act 1991	S161A (2)	**Issuance of work notices by Environment Agency**: *For the purposes of this section, a "works notice" is a notice requiring the person on whom it is served to carry out such of the following works or operations as may be specified in the notice, that is to say— .* *(a) in a case where the matter in question appears likely to enter any controlled waters, works or operations for the purpose of preventing it from doing so; or .* *(b) in a case where the matter appears to be or to have been present in any controlled waters, works or operations for the purpose— .* *(I) of removing or disposing of the matter; .* *(ii) of remedying or mitigating any pollution caused by its presence in the waters; or .* *(iii) so far as it is **reasonably practicable** to do so, of restoring the waters, including any flora and fauna dependent on the aquatic environment of the waters, to their state immediately before the matter became present in the waters.*

7. DEVELOPMENT CONTROL

This section demonstrates how sustainability is a fundamental principle in both development/local plan preparation (land use forward planning), and Development control (granting of planning permission) as applicable to remediation of contaminated sites.

7.1 National Planning and Legislation

The main legislation and policy documents in the UK which drive national planning strategy, including development plans, and development control, are listed in Section 4.2.1, above.

All of these documents have a major focus on sustainable development, and include policies that promote the conservation of greenfield land by encouraging brownfield development where appropriate. The suitable-for-use approach, which is advocated by domestic planning policy, is consistent with site-specific risk-assessment that underpins sustainable remediation principles.

7.1.1 Scenario 3: Seeking planning permission/discharging planning conditions

The following references provide text that may be helpful in support of planning permissions for developments that include sustainable remediation approaches, voluntary or otherwise. They can be employed to reassert to planning authorities that sustainability is a key objective in development control, and that a sustainable remedial approach can help to achieve this overarching objective. Where available, local and neighbourhood development plans prepared by local authorities should also be reviewed to identify additional references promoting sustainability. A full review of development plans in the UK was outside the scope of this report.

Disciplines outside of soil and groundwater should also be considered relevant in the development control context, including consideration of, but not limited to, the impact of remedial activities on local traffic, neighbourhood amenity, and greenhouse gas emissions.

Table C: References promoting the consideration of sustainable remediation principles in the context of town planning and development control

National Planning Policy Framework (England) 2012	S14	*"At the heart of the National Planning Policy Framework is a presumption in favour of **sustainable development**, which should be seen as a golden thread running through both plan-making and decision-taking.* *For decision-taking this means:* • *approving development proposals that accord with the development plan without delay; and* • *where the development plan is absent, silent or relevant policies are out-of-date, **granting permission unless**:* o *any **adverse impacts of doing so would significantly and demonstrably outweigh the benefits**, when assessed against the policies in this Framework taken as a whole; or* o *specific policies in this Framework indicate development should be restricted"*

Table C: References promoting the consideration of sustainable remediation principles in the context of town planning and development control		
National Planning Framework for Scotland	S15	*"**Sustainable development** is development which meets the needs of the present without compromising the ability of future generations to meet their needs. It therefore has social, economic and environmental dimensions. The Scottish Government's commitment to sustainable development is reflected in its policies on matters such as climate change, transport, renewable energy, energy efficiency, waste management, biodiversity and public health. **There is a statutory requirement that the National Planning Framework should contribute to sustainable development**. Planning authorities have a duty to contribute to sustainable development through their development planning function."*
Planning Policy Wales (6th Ed)	S1.2.1	*The planning system manages the development and use of land in the public interest, contributing to the achievement of sustainable development. It should reconcile the needs of development and conservation, securing economy, efficiency and amenity in the use of land, and protecting natural resources and the historic environment. A well functioning planning system is fundamental for **sustainable development.***
National Planning Policy Framework (England) 2012	Introduction	*"Within the overarching roles that the planning system ought to play, a set of core land-use planning principles should underpin both plan-making and decision-taking. These 12 principles are that planning should (inter alia)…* • *contribute to conserving and enhancing the natural environment and reducing pollution. Allocations of land for development should prefer land of lesser environmental value, where consistent with other policies in this Framework;* • *encourage the effective use of land by reusing land that has been previously developed (brownfield land), provided that it is not of high environmental value"*
National Planning Policy Framework (England) 2012	Para 110 - 111	*In preparing plans to meet development needs, the aim should be to minimise pollution and other adverse effects on the local and natural environment. Plans should allocate land with the least environmental or amenity value, where consistent with other policies in this Framework.* *Planning policies and decisions should encourage the effective use of land by re-using land that has been previously developed (brownfield land), provided that it is not of high environmental value. Local planning authorities may continue to consider the case for setting a locally appropriate target for the use of brownfield land.*
National Planning Framework for Scotland	S90	*The statutory regime for cleaning up contaminated land provides for local authorities to identify sites and bring about their remediation. To facilitate the reuse of brownfield sites and the regeneration of urban areas the Government intends to provide a route for the remediation of sites of low development value or where there are barriers to redevelopment.*

Table C: References promoting the consideration of sustainable remediation principles in the context of town planning and development control		
Planning Policy Wales (6th Ed)	S13.5.1	*"The planning system should guide development to lessen the risk from natural or human-made hazards, including risk from land instability and land contamination. The aim is not to prevent the development of such land, though in some cases that may be the appropriate response. Rather it is to ensure that development is suitable and that the physical constraints on the land, including the anticipated impacts of climate change, are taken into account at all stages of the planning process. However, responsibility for determining the extent and effects of instability or other risk remains that of the developer. It is for the developer to ensure that the land is suitable for the development proposed, as a planning authority does not have a duty of care to landowners."*
Planning and Compulsory Purchase Act 2004	S39, Para 2	When considering regional spatial strategy or local planning documents*: "The person or body must exercise the function with the objective of contributing to the achievement of sustainable development."*
Planning Advice Note (PAN) 33 Development of Contaminated Land	The "Suitable For Use" Approach Section 2 iii	*"The "suitable for use" approach consists of three elements:* *..iii)* ***limiting requirements for remediation to the work necessary to prevent unacceptable risks to human health or the environment in relation to the current use or future use of the land for which planning permission is being sought - in other words, recognising that the risks from contaminated land can be satisfactorily assessed only in the context of specific uses of the land (whether current or proposed), and that any attempt to guess what might be needed at some time in the future for other uses, is likely to result either in premature work (thereby risking distorting social, economic and environmental priorities) or in unnecessary work (thereby wasting resources).****"*

8. PROMOTION OF SUSTAINABLE REMEDIATION PRINCIPLES IN THE CONTEXT OF THE REMEDIATION PROJECT LIFE CYCLE

This section presents key points in EU Directives, and UK legislation, regulations, and guidance that promote sustainability and/or sustainable remediation in the various stages of the remediation project life cycle. It includes, as appropriate, explanatory text to guide the user as to where or how these might be brought to bear in a particular phase of a remediation project.

8.1 Sustainability as an Objective for Remedial Projects

The EC and EU were established by the Treaty of Rome and the Maastricht Treaty. These treaties included sustainable development as a founding principle for the Union. This is demonstrated by the following Articles:

Table D: Sustainability as a principle in founding EU treaties

Document	Section	Relevant text
The Treaty on the Functioning of the European Union (Treaty of Rome) 1957	Article 11	"*Environmental protection requirements must be integrated into the definition and implementation of the Union's policies and activities, in particular with a view to* ***promoting sustainable development****."* (Consolidated version of the treaty on the functioning of the European Union)
The Treaty on European Union (Maastricht Treaty) 1993	Article 3(3)	*"The Union shall establish an internal market. It shall work for the* ***sustainable development*** *of Europe based on* ***balanced economic growth*** *and price stability, a highly competitive social market economy, aiming at full employment and* ***social progress****, and a high level of* ***protection and improvement of the quality of the*** *environment. It shall promote scientific and technological advance."*

8.1.1 Scenario 4: Identifying sustainability as a key project objective

As per the references in the above table, sustainability is a key principle of the EU, and by default as a member of the EU, the UK policy framework. In setting the objectives for a remedial project, sustainability needs to be identified as a key project objective, and sustainable practices should be integral to the project strategy.

The references in Table E below could be applied, as appropriate, in reports, remedial action plans, and correspondence with regulators and local authorities, to provide support for setting remedial objectives with a sustainability focus (i.e. balanced approach, with analysis of costs and net benefits).

Table E: References promoting sustainability as a general principle

Document	Section	Relevant text
Water Framework Directive 2000	Preamble Paragraph 12	"*…in preparing its policy on the environment, the Community is to take account of available scientific and technical data,* ***environmental conditions*** *in the various regions of the Community, and the* ***economic and social development*** *of the Community as a whole and the balanced development of its regions as well as the* ***potential benefits and costs*** *of action or lack of action."*

Table E: References promoting sustainability as a general principle		
Priority Substances Directive 2013	Preamble, Paragraph 1	"*As a matter of priority, causes of pollution should be identified and emissions of pollutants should be dealt with at source, in the most* ***economically and environmentally effective manner****."*
Priority Substances Directive 2013	Preamble paragraph 6	*"in preparing its policy on the environment, the Union is to* ***take account of available scientific and technical data****,* ***environmental conditions*** *in the various regions of the Union, the potential* ***benefits and costs*** *of action or lack of action as well as the* ***economic and social development*** *of the Union as a whole and the* ***balanced development*** *of its regions.* ***Scientific, environmental and socio-economic factors, including human health considerations****, should be taken into account in developing a* ***cost-effective and proportionate policy*** *on the prevention and control of chemical pollution of surface waters..."*
Environment Protection Act 1990 (Part 2A): Contaminated Land Statutory Guidance, DEFRA 2012 Contaminated Land Statutory Guidance – Welsh Government) 2012	s1.4	"*The overarching objectives of the Government's policy on contaminated land and the Part 2A regime are:* *(a) To identify and remove unacceptable risks to human health and the environment.* *(b) To seek to ensure that contaminated land is made suitable for its current use.* *(c) To ensure that the burdens faced by individuals, companies and society as a whole are* ***proportionate****, manageable and compatible with the principles of* ***sustainable development****."*
Environment Protection Act 1990 (Part 2A): Contaminated Land Statutory Guidance, DEFRA 2012 Contaminated Land Statutory Guidance – Welsh Government) 2012	s 1.6	*"Under Part 2A , the enforcing authority may need to decide whether and how to act in situations where such decisions are not straightforward, and where there may be unavoidable uncertainty underlying some of the facts of each case. In so doing, the authority should use its judgment to strike a* ***reasonable balance*** *between: (a) dealing with* ***risks*** *raised by contaminants in land and the* ***benefits*** *of remediating land to remove or reduce those risks; and (b) the* ***potential impacts*** *of regulatory intervention including* ***financial costs*** *to whoever will pay for remediation (including the taxpayer where relevant),* ***health and environmental impacts*** *of taking action, property blight, and burdens on affected people. The authority should take a* ***precautionary approach*** *to the risks raised by contamination, whilst* ***avoiding a disproportionate approach*** *given the circumstances of each case. The aim should be to consider the various* ***benefits and costs*** *of taking action, with a view to ensuring that the regime produces* ***net benefits****, taking account of local circumstances."*

Table E: References promoting sustainability as a general principle		
Environment Protection Act 1990 (Part 2A): Statutory Guidance (Scottish Executive) 2012	"Sustainable development' Paragraph 6	*"the Scottish Executive's objectives with respect to contaminated land are:* *(a) to identify and remove unacceptable risks to human health and the environment;* *(b) to seek to bring damaged land back into beneficial use; and* *(c) to seek to ensure that the cost burdens faced by individuals, companies and society as a whole are **proportionate**, **manageable** and **economically sustainable**.*
Environment Act 1995	Chapter 1, S4 (1)	*"It shall be the principal aim of the Agency (subject to and in accordance with the provisions of this Act or any other enactment and taking into account any likely costs) in discharging its functions so to protect or enhance the environment, taken as a whole, as to make the contribution towards attaining the objective of achieving **sustainable development** mentioned in subsection (3) below*".
Environment Act 1995	Chapter 1, S4 art 39	"(1) *Each new Agency—* *(a) in considering whether or not to exercise any power conferred upon it by or under any enactment, or* *(b) in deciding the manner in which to exercise any such power,* *shall, unless and to the extent that it is unreasonable for it to do so in view of the nature or purpose of the power or in the circumstances of the particular case, take into account the likely **costs and benefits** of the exercise or non-exercise of the power or its exercise in the manner in question*."
Groundwater Protection: Principles and Practice (GP3) (EA) 2013	Part 1, Section 3: Our approach to managing groundwater: Sustainable Development:	*"**Sustainable development** is important when we make decisions. We will consider not only the **environmental benefits and impacts** of activities, disposal, discharge and development, but also the **social and economic benefits and impacts**, including the impacts on natural resources and climate change. We will also seek to take account of short-term and long-term effects, and to avoid decisions that generate short-term economic, social or environmental benefits at disproportionate long-term impact.*
Groundwater Protection Policy for Scotland v3 (SEPA) 2009	Section A1.1.3	"*European and national legislation require that pollution must be prevented and that the groundwater resource is managed in a **sustainable way**. In terms of statutory guidance on sustainable development, it is clear that SEPA must adopt the **precautionary principle** where appropriate, **take account of costs and benefits**, consider impacts on **biodiversity**, **not unnecessarily constrain economic development** and assess, understand and **minimise the impacts of emissions on health**.*"

Table E: References promoting sustainability as a general principle		
Groundwater Protection Policy for Scotland v3 (SEPA) 2009	Section A2.1.1	*"SEPA will address groundwater protection in the context of **sustainable development**, taking account of **social and economic factors** where appropriate. SEPA will base its decision making on available sound science, taking a long term view, adopting a **risk based approach** and using the **precautionary principle** when necessary."*
CLR11 Model Procedures (EA) 2004	S 1.1, Understanding environmental policy	*"The goal is to find solutions that identify and deal with risks from contamination in a **sustainable way**."*
CLR11 Model Procedures (EA) 2004	S 1.2, Managing risks from land contamination - Costs and Benefits	*"…"**cost–benefit analysis**" is an inherent part of the management of environmental risks in a **sustainable way**, and is a formal component of particular stages of regulatory regimes."*

8.2 Risk Assessment

The UK regulatory framework generally establishes that risk assessment is an iterative process which balances uncertainty against data acquisition cost. Both of these factors feed in to decisions that promote a sustainable approach to risk management. Promotion of sustainable principles in regulatory and guidance documents issued by the UK government generally relate to the quantitative phases of risk assessment, including in the following scenarios:

- **The selection of compliance points:** UK technical guidance endorses the use sustainability assessments such as the SuRF-UK framework for selecting compliance points.
- **Determining remedial target concentrations:** Cost-benefit assessments may support the derivation of remedial targets.
- **Evaluating Risk**: e.g. In circumstances where reported analytical concentrations exceed remedial target concentrations.

Specific sections of text from the UK regulatory framework reflecting the above principles are provided below:

8.2.1 Scenario 5: Determining, applying, and modifying compliance and assessment points

GP3 (England and Wales) and WAT PS-10 (Scotland) provide guidance on default compliance points (e.g. 50m, 250m) for use in hydrogeological risk assessment. The guidance indicates that sustainability should be considered when applying or modifying compliance points. The following references should be considered and applied, as appropriate, to provide justification for deriving or modifying assessment and compliance points used risk assessments.

Table F: References in regulatory guidance promoting sustainability in deriving and modifying compliance points		
Document	**Section**	**Relevant text**
Groundwater protection: Principles and Practice (GP3) (EA) 2013	Section 2 (p187-188)	"*The 'default' compliance distance for resource protection may be altered according to the following additional considerations:* • *WFD...* • *Plausible future use of groundwater…* • *Natural Attenuation…* • ***Sustainability assessment:** An increase of the distance to compliance point location, over and above the distances outlined in Table 8.2 may also be justified if supported by a **sustainability assessment**; this may include a qualitative, semi-quantitative or quantitative **sustainability appraisal** as described by SuRF-UK (2010)."* • *Environmental standards…*
Groundwater protection: Principles and Practice (GP3) (EA) 2013	p183	*"Hazardous substances demand special consideration as the requirement is to prevent their entry into groundwater. Level 3–4 compliance points should only be applied to hazardous substances where:* • *the contaminant has already entered groundwater and it can be shown that returning impacted groundwater to its natural background quality is not achievable or warranted following due consideration of **technical feasibility**, or **sustainability considerations**;* • *remediation to prevent entry of the contaminant at the water table is impractical due to the distribution and nature of contamination, or could be achieved only at **unreasonable cost** and that those costs cannot be mitigated/recouped through other measures.* *In both cases, you need to provide proper justification that explains why the compliance point should not be set at, or as close as practically possible to, the point at which the contaminants are entering the saturated zone."*
Position Statement WAT-PS-10-01 Assigning groundwater assessment criteria for pollutant inputs (WAT-PS-10) (SEPA) 2011	n/a	**Explanatory note:** WAT PS-10 provides Scottish guidance on default compliance points for use in hydrogeological risk assessment. It is less explicit in its inclusion of sustainability as a factor for consideration in determining and modifying compliance and assessment points, however, considerations of resource potential, which are linked to sustainability are applicable, as per below.
WAT-PS-10 (SEPA) 2011	Section 7.3 (Assessment points and limits for the groundwater resource)	*Where present or planned future land- use limits the exploitation of the groundwater resource for the foreseeable future. The most likely example is the presence of sewered urban areas, forestry, or major infrastructure development. In this instance, the assessment point should be located at the downgradient extent of the limiting land use, subject to a maximum distance of 250m (SEPA considers that a distance of 250 metres represents a **reasonable balance** between the need to allow **sustainable development** and need to protect the potential future human use of groundwater).*

Table F: References in regulatory guidance promoting sustainability in deriving and modifying compliance points		
WAT-PS-10 (SEPA) 2011	S7.3 Assessment points and limits for the groundwater resource	*"The assessment point for protecting the resource potential should be identified within the groundwater body or localised aquifer at a distance from a source beyond* ***which future developers could reasonably expect*** *to abstract groundwater taking into account the following guidance. SEPA defines '****reasonably****' in this context using a default distance based on established principles used in codes of good agricultural practice and current Scottish building standards, with consideration of current and potential future land use in the proximity of the site. The distance between the boundary of the pollutant source and the assessment point should be set within the groundwater body at a 'default' distance of 50m from the downgradient boundary of the source. The distance can be more than 50m in the following circumstances:* • *Where present or planned future land- use limits the exploitation of the groundwater resource for the foreseeable future. The most likely example is the presence of sewered urban areas, forestry, or major infrastructure development. In this instance, the assessment point should be located at the downgradient extent of the limiting land use, subject to a maximum distance of 250m. Note that the existing concentrations of pollutants or current ownership of the site should not influence this decision. or* • *Where topography is so steep or inaccessible that it limits development of land for activities that will require groundwater supply. In this instance, the assessment point should be set at the downgradient extent of the limiting topography up to a maximum distance of 250m. or* • *Where concentrations of the relevant substances are naturally in excess of appropriate quality standards, such that requirements for treatment render* ***future development of groundwater economically less viable****. The assessment point should be set at 250m.* • *Where a major groundwater discharge zone occurs closer to the source than the point selected for resource protection, resource potential considerations are not appropriate and assessment points will be derived from factors only related to protection of 'at risk' ecosystems and existing abstractions."*

8.2.2 Scenario 6: Deriving remedial target concentrations

UK guidance, principally the EA's Remedial Targets Methodology (2006), promotes the use of sustainability principles in deriving remedial targets for risk assessment. When selecting site-specific criteria, an assessment of sustainability factors, including costs and benefits, should be applied and clearly documented. The references in the following table should be reviewed and applied, as appropriate, to provide justification for such an approach.

Table G: References in regulatory guidance promoting sustainability in deriving remedial target concentrations

Document	Section	Relevant text
Remedial Targets Methodology (EA) 2006	Executive summary, para 1	*"The methodology is based on a phased approach to risk assessment and management as set out in government guidance. This approach is underpinned by progressive data collection and analysis, structured decision-making and **cost-benefit assessment**."* **Explanatory note:** The EA's *Remedial Targets Methodology* (2006) describes the process of deriving remedial target values for controlled waters against which a decision as to the requirement for remediation can be made. The document contains numerous references to sustainability principles, and includes a chapter (Chapter 9) on Cost-Benefit Assessment.
Remedial Targets Methodology (EA) 2006	S 2.3 (p15)	"*The remedial targets derived from this analysis and used to support decisions regarding the need to remediate should:* • *be relevant to the site;* • *relate to the actual intended (planned) or plausible use of the most sensitive environmental receptor such as future land or groundwater use;* • *be achievable within a reasonable (agreed) timescale;* • *take account of the uncertainties in the assessment in terms of providing protection to the identified receptor(s);* • *take account of the **feasibility** of achieving the targets and the **associated costs**;* • *take account of background water quality."*
Remedial Targets Methodology (EA) 2006	S 4.1 (p25)	*"In deriving remedial targets for contaminated soils where contamination of groundwater has not occurred, stringent target concentrations may initially be set in order to prevent groundwater contamination. The **costs and benefits** of undertaking remediation then need to be **assessed** and, if the **balance** is unacceptable, a less stringent target may be set and the process repeated. The aim should always be to secure the **best net environmental outcome** that can reasonably be achieved and, as a minimum, to prevent pollution*."
Remedial Targets Methodology (EA) 2006	S 6.1(para 5)	*"In setting a remedial target for groundwater, it is important to consider whether remediation to this standard is **achievable or cost-beneficial**. Experience with pump-and-treat systems indicates that it is not generally possible to return groundwater to background quality. For this reason, the target concentration is usually set at an environmental standard appropriate to the use of the aquifer rather than as background quality*."

Table G: References in regulatory guidance promoting sustainability in deriving remedial target concentrations		
Remedial Targets Methodology (EA) 2006	S2.3 (p15)	"*A slightly different procedure is used depending on whether the source of contamination is soil or groundwater.* *For groundwater, contamination will already have occurred. In this case, the methodology recognises that complete remediation of groundwater (to pristine quality) is* ***not always achievable or cost-beneficial****, but seeks to prevent new pollution or to undertake best endeavours to do so."*
Remedial Targets Methodology (EA) 2006	S4.2 (p28)	*"If setting the target concentration as a quality standard such as a drinking water standard is less onerous than achieving background quality, then deriving the remedial target in this way may mean that some deterioration in groundwater quality could occur. The acceptability of this should be assessed in relation to:* • *the sensitivity of the receptor at risk;* • *the current or potential use of the water resource;* • *whether higher standards of remediation (based on background quality) are achievable,* ***reasonable and cost-effective****;* • *the degree to which downgradient quality will deteriorate as a result of the observed soil or groundwater contamination."*
Groundwater protection: Principles and Practice (GP3) (EA) 2013	S8 P176	*"In the case of contaminated sites (including some instances of contamination from recent as well as old activities), we recognise that pollutants may have already entered groundwater. Our objective is then to manage impacts to the wider environment to tolerable levels in a* ***sustainable and risk-based manner****."*

8.2.3 Scenario 7: Evaluating risk

In evaluating data for the purposes of risk assessment, particularly in circumstances where reported analytical concentrations exceed remedial target concentrations, UK regulations promote further assessment on the basis of both technical and non-technical factors to determine whether remedial action is required. Such further assessment, which can include an analysis of costs and benefits, is a necessary measure to ensure that disproportionate measures are not undertaken in response to exceedances that may not necessarily be environmentally significant. In some situations, further site characterisation may be more appropriate.

The following references should be applied, as appropriate, in assessments where exceedances of assessment criteria are reported but the exceedances may not necessarily be significant. In such situations, sustainability assessments for carrying out remediation may be applicable to provide support for no further action, or further site characterisation such as additional monitoring rounds to assess concentration trends or natural attenuation capacity. However it is important to note that, in the event that viable pollutant linkages **are** identified, UK regulations dictate that some form of action is required, and that costs should be a factor in deciding what form of action or precaution to take, rather than whether to take action:

"*Cost-benefit assessment is not a factor in deciding whether to take action in such cases but may be a consideration in determining which precautions are necessary*." (*Environmental Permitting Guidance Groundwater Activities For the Environmental Permitting (England and Wales) Regulations* 2010, S 4.22)

Table H: References in the regulatory framework promoting sustainability in risk evaluation

Document	Section	Relevant text
Remedial Targets Methodology (EA) 2006	S 2.3, para 6	*"If the observed soil or groundwater contamination exceeds the target concentration, then a decision will need to be made on whether to undertake remediation or to upgrade the level of assessment. This decision will be based on:* • ***cost-benefit evaluation**, e.g. the cost of further site characterisation and detailed risk evaluation is warranted in relation to the potential decrease in the cost of the remedial solution;* • *what additional information is required and can be obtained;* • *the timescale - the decision to proceed to a more detailed risk assessment should only be made if any ongoing or additional risk involved in delaying the decision to implement the remedial action is acceptable."*
Remedial Targets Methodology (EA) 2006	S9.1	*"Where observed concentrations lie close to the remedial target, the decisions regarding the need for remedial action should consider:* • *…number of measurements…* • *confidence that can be attached to parameter values…* • *sensitivity of the receptors..* • *…location of compliance points* • *the **costs and benefits** of implementing remedial measures* *These factors may identify that further site characterisation is required. The decision to implement remedial measures should take into account all these factors and other wider policy considerations."*
Remedial Targets Methodology (EA) 2006	S 2.5 (p22)	"*It is important that ConSim and any other model or analytical package should be regarded as a tool in the assessment process. Professional judgement will always be needed to integrate the results from such tools with:* • *other technical and professional guidance;* • ***cost-benefit considerations**;* • ***policy, planning and legislative requirements**."* **Explanatory note:** This reference recognises the limitations of a purely technical approach to risk assessment, e.g. based on model outputs from software packages, and makes note that other factors, including non-technical and sustainability-related factors, are to be taken into consideration when evaluating data.

Table H: References in the regulatory framework promoting sustainability in risk evaluation		
Groundwater protection: Principles and Practice (GP3) (EA) 2013	p171	"*If discernibility is to be based on measured concentrations in monitoring boreholes, it is important to make the distinction between small exceedances that are significant in terms of the requirement to 'prevent' input and those that might result in* ***disproportionate measures*** *at the point of discharge when they are effectively trivial and have* ***no environmental significance***." **Explanatory note:** This text is framed in the context of the prevent/limit requirements for inputs of hazardous and non-hazardous substances contained in the Water Framework Directive and Groundwater Directive. The guidance promotes the use of a sustainable approach for the interpretation and assessment of data that may exceed remedial targets in order to avoid a disproportionate remedial response.

8.3 Remedial Options Appraisal and Development of Remedial Strategy

EU and UK law and guidance endorses sustainability appraisals and cost-benefit analysis as major considerations in remedial options appraisal. References in regulatory documents that promote sustainability principles have been identified for the following scenarios:

- **Incorporating sustainability assessments in remedial options appraisal:** The use of sustainability assessments within remedial options appraisal is promoted by the contaminated land regulatory framework. Sustainability assessments, including cost-benefit assessments, should follow a transparent process and be clearly documented. UK guidance is somewhat limited in providing directions for carrying out sustainability appraisals (since SR is a new concept), however both GP3 and GPLC 1 make reference to framework guidance issued by SuRF-UK.
- **Incorporating Cost-benefit analysis in remedial options appraisal:** In accordance with EA guidance (e.g., *Costs and Benefits Associated with the Remediation of Contaminated Groundwater: Framework for Assessment* R&D P279; *Cost-Benefit Analysis for Remediation of Contaminated Land*, 1999), cost-benefit assessment can form a core component of a sustainability assessment. The SuRF-UK framework presents a tiered approach to sustainability assessment, with quantitative methods (e.g., CBA) used where qualitative or semi-quantitative methods are not able to differentiate the relative sustainability of remedial options.
- **Considering sustainable remedial alternatives** when remedial objectives cannot be met or source treatment is not a feasible option
- **Stakeholder engagement** is fundamental aspect of all stages of a remediation project and must be considered prior to the commencement of any on-site works.

The relevant document text is provided in the report tables below.

8.3.1 Scenario 8: Conducting a remedial options appraisal - considerations of sustainability

The remedial options appraisal is triggered in the event that risk assessment identifies pollutant linkages for a site. As noted in Section 4.2.3, above, where viable pollutant linkages are confirmed for a site, some form of response is required and cost is not a factor in determining the requirement

to take action. Rather, consideration of cost supports the determination of the appropriate form of action taken.

EU and UK level guidance provides extensive support for the inclusion of sustainability assessments as part of remedial options appraisal. A number of documents specifically endorse sustainable remediation approaches, whilst acknowledging the limited guidance available in assessing the sustainability of a particular remedial approach. UK technical guidance endorses the assessment framework issued by SuRF-UK for carrying out sustainability appraisals (*A Framework for Assessing the Sustainability of Soil and Groundwater Remediation, SuRF-UK, 2010*).

It is also important to note that whilst UK legislation and guidance promote sustainability assessments, including cost-benefit analysis, as part of the remedial options appraisal, they also indicate that any such assessment should follow a valid, documented procedure. This should be borne in mind in the preparation of any sustainability appraisal. As stated in GPLC 2:

"*Any scheme should be proportional and balance the costs of the required remediation and the environmental benefit it achieves. This is key to delivering a sustainable solution".*

Cost-benefit arguments should be ***properly documented*** *where they influence a remediation strategy.* ***It is not acceptable to merely state that the costs outweigh the benefits****." (Guiding Principles of land contamination (GPLC 2)* (EA) 2010, S 2.0, para 3).

The following references should be reviewed and applied as appropriate to provide justification for carrying out a sustainability assessment as part of remedial options appraisal.

Table I: References in the EU and UK regulatory framework that promote sustainability in remedial options appraisal

Document	Section	Relevant text
Environmental Liabilities Directive 2004	Annex 2, Art 1.3.1	*"The reasonable remedial options should be evaluated, using best available technologies, based on the following criteria:* • *The effect of each option on* ***public health and safety****,* • *The* ***cost*** *of implementing the option,* • *The likelihood of success of each option,* • *The extent to which each option will prevent future damage, and avoid collateral damage as a result of implementing the option,* • *The extent to which each option* ***benefits to each component of the natural resource and/or service****,* • *The extent to which each option* ***takes account of relevant social, economic and cultural*** *concerns and other relevant factors specific to the locality,* • *The length of time it will take for the restoration of the environmental damage to be effective,* • *The extent to which each option achieves the restoration of site of the environmental damage,* • *The geographical linkage to the damaged site."*

Table I: References in the EU and UK regulatory framework that promote sustainability in remedial options appraisal		
Environmental Liabilities Directive 2004	Annex 2, Art 1.3.3	*"Notwithstanding the rules set out in section 1.3.2. and in accordance with Article 7(3), the competent authority is entitled to decide that no further remedial measures should be taken if:* *a) the remedial measures already taken secure that there is no longer any significant risk of adversely affecting human health, water or protected species and natural habitats, and* *b) the **cost of the remedial measures** that should be taken to reach baseline condition or similar level would be **disproportionate to the environmental benefits** to be obtained."*
The Environmental Damage(Prevention and Remediation) Regulations 2009 – England and The Environmental Liability (Prevention and Remediation) Regulations (Northern Ireland) 2009	Part 1, Section 8 and Schedule 4, part 1, S6	*The remediation options must be evaluated using best available methods, and based on—* *(a) the effect of each option on public health and safety;* *(b) the **cost** of implementing the option;* *(c) the **likelihood of success** of each option;* *(d) the extent to which each option will prevent future damage, and avoid collateral damage as a result of implementing the option;* *(e) the extent to which **each option benefits each component of the natural resource or service**;* *(f) the extent to which each option takes account of **relevant social, economic and cultural concerns** and other relevant factors specific to the locality;* *(g) the length of time it will take for the restoration of the environmental damage to be effective;* *(h) the extent to which each option achieves the restoration of the site of the environmental damage;*

Table I: References in the EU and UK regulatory framework that promote sustainability in remedial options appraisal		
CLR 11 Model Procedures 2004	S3.1 (p23)	*"objectives (of remediation options appraisal) will be linked to:...(inter alia)* • ***Sustainability of the strategy*** *(i.e., how well it meets other* ***environmental objectives****, for example on the use of energy and other material resources, and avoids or* ***minimises adverse environmental impacts*** *in off-site locations, such as a landfill, or on other environmental compartments, such as air and water);* • ***Cost of the strategy*** *(bearing in mind that the person who makes the decision about remediation may not be the person who has to pay);* • ***Benefits of the strategy*** *– all remediation strategies should deliver direct benefits (the reduction or control of unacceptable risks) – but many have merits that extend well beyond the boundaries of the site; for example, remediation may enhance the amenity or ecological value of an area or contribute towards improved economic activity by removing blight or encouraging regeneration;* • ***Legal, financial and commercial context*** *within which the site is being handled including the specific legal requirements that remediation has to comply with, and the views of stakeholders on how unacceptable risks should be managed."*
EA Guiding Principles on Land Contamination (GPLC1) 2010	S 2.0 (continued)	*"During options appraisal, you narrow down the feasible options by considering whether separately or in combination they are:* • *effectively going to achieve the required standard of remediation;* • *able to achieve the above objectives;* • *robust over the necessary design life;* • *able to work fast enough;* • ***a sustainable solution****;* • ***socially acceptable****;* • *available commercially;* • ***cost effective****.* *The best all-round option or combination of options should be developed into your remediation strategy".*
EA Guiding Principles on Land Contamination (GPLC2) 2010	S 2.0, Para 24	*"There are often opportunities to* ***reuse material****, after treatment if necessary. When considering the options you should take account of* ***sustainability****. The preferred order of ways to manage waste is called the waste hierarchy."*

Table I: References in the EU and UK regulatory framework that promote sustainability in remedial options appraisal		
EA Guiding Principles on Land Contamination (GPLC2) 2010	S 2.0, Para 21	*"**Sustainable remediation** is part of the wider concept of **sustainable development**. This is a **core principle in contaminated land policy and planning legislation**…* *Guidance on how to assess sustainability in remediation is limited, but this is a developing area. The SuRF-UK (Sustainable Remediation Forum) initiative has been established to improve understanding in this area, and they have developed A framework for assessing the sustainability of soil and groundwater remediation.* *When comparing remediation options, you should think about environmental factors, such as:* • ***resource use** (for example raw materials, energy and water);* • ***emissions** (to all environmental media and waste generation);* • ***the costs** (not only financial) of the options verses the benefits."*
Environment Protection Act 1990 (Part 2A): Contaminated Land Statutory Guidance, DEFRA 2012 Contaminated Land Statutory Guidance – Welsh Government) 2012	S6.1.3	*Where more than one significant contaminant linkage has been identified on the land, the enforcing authority should consider whether **reasonable actions** for addressing each linkage individually would result in the optimum approach for achieving the overall remediation of the land. If a more **integrated approach** would be more **practicable and more cost effective** whilst still delivering the same (or a better) overall standard of remediation the enforcing authority should generally favour this approach.*
Groundwater Protection: Principles and Practice (GP3), EA 2013	Part 2: Position Statement J. Land Contamination - Achieving sustainable remediation (p101)	*"**Sustainable remediation** seeks to manage unacceptable risks to human health and the environment (including groundwater), while optimising the **environmental, economic and social impacts**. **Sustainable remediation appraisal** requires consideration of a wide range of **environmental, social and economic factors**, including, for example, climate change impacts such as greenhouse gas emission from the remedial works or the site itself, worker safety and cost.* *The Sustainable Remediation Forum UK (SuRF-UK) has produced a framework for assessing the sustainability of soil and groundwater remediation (SuRF-UK 2010). The framework document sets out why **sustainability issues associated with remediation needs to be factored in from the outset of a project** and identifies opportunities for considering sustainability at a number of key points in a site's redevelopment or risk management process."*

Table I: References in the EU and UK regulatory framework that promote sustainability in remedial options appraisal		
Groundwater Protection: Principles and Practice (GP3), EA 2013	Part 2: Position Statement J. Land Contamination - Achieving sustainable remediation (p101)	***"Promote appropriate sustainable remediation:*** *We encourage the use of* ***sustainable and effective remedial measures*** *to prevent or address groundwater pollution from sites affected by contamination. This includes the* ***recycling of water and soils where appropriate****. However, these operations must not result in an unacceptable release to groundwater and must where necessary have appropriate permits and controls."*
Guidelines for Environmental Risk Assessment and Management Green Leaves III (DEFRA) 2011	S 4.1	*"Options appraisal is the process of identifying and selecting the most appropriate risk management strategy given the constraints of the decision-maker. This may involve scoring, weighting and/or reporting different risk management options. Various criteria are used for identifying the 'best' option, according to context, but a common framework is to seek to maximise some long-term definition of* ***human well-being*** *such as* ***environmental security****,* ***net social benefit*** *or value for money (risk reduction per unit cost)*
Remedial Targets Methodology (EA) 2006	S 9.4	*"The assessment should be subject to a final review based on the following important questions:* • *Is the remedial target concentration and the proposed remedial measures appropriate,* ***achievable and cost beneficial****? For example, remediation of groundwater to background levels may not always be achievable either technically or cost effectively.* • *Are the timescales for implementation of the remediation scheme appropriate with respect to:* o *the capabilities of those undertaking the remediation;* o *the principle of* ***sustainable development."***

8.3.2 Scenario 9: Incorporating cost-benefit assessment in remedial options appraisal

In UK guidance, references are also made to the use of cost-benefit assessment in remedial options appraisal. Whilst less explicit in their endorsement of sustainable remediation, such references nevertheless promote an equivalent underlying principle. UK guidance indicates that cost-benefit assessment may be used as a method to undertake a sustainability assessment, if the costs and benefits are considered broadly (i.e., the economic, social and environmental costs and benefits).

The following references should be reviewed and applied as appropriate to provide justification for employing cost-benefit analysis to remedial options appraisal.

Table J: References in the EU and UK regulatory framework that promote cost-benefit assessment in remedial options appraisal

Document	Section	Relevant text
CLR 11 Model Procedures 2004	S 3.4	*"Appraisers should also be checking that the strategy continues to meet site-specific objectives and is **acceptable on cost–benefit grounds**. A useful first check is to confirm that the proposed remediation strategy will deal effectively with all of the relevant pollutant linkages identified in the conceptual model defined at the beginning of options appraisal. This should be followed by re-assessment of the combined strategy using the evaluation criteria already established and a finalised **cost–benefit analysis** based on **revised cost estimates**."*
EA Guiding Principles on Land Contamination (GPLC1) 2010	s 2.0, p 7 (table)	*"Develop remediation strategy* • *consider the zoning and timing of remediation* • *decide how the strategy will be verified* • *review **costs and benefits*** • *develop a practical strategy for the remediation"*
Guidelines for Environmental Risk Assessment and Management Green Leaves III (DEFRA) 2011	S4.2	*"Systematic appraisal is important to ensure that the decision-maker is clear about the objectives and how to decide where the **balance** lies between the benefits from the reduction of the risk and the **costs** and **implications for society** of introducing potential control measures. A systematic appraisal of options will be the process of identifying, quantifying and weighting the **costs and benefits** of the measures which have been identified as means of implementation. This process must include all implications of the potential options, and not just those that can be quantified.*

Table J: References in the EU and UK regulatory framework that promote cost-benefit assessment in remedial options appraisal		
Common Implementation Strategy (CIS) Guidance Note no. 17, EC 2007	S 4.2.2	*"Site clean up should be directed towards preventing any hazardous substances from entering groundwater (POCs 0 & 1) unless it can be demonstrated by risk assessment and **cost benefit analysis** that this is infeasible, or one of the exemptions described in article 6(3)(a-f) applies...* *Once the appropriate remediation has been undertaken, this will in many cases result in a stable endpoint where there are no further inputs to groundwater. A plume of contamination may still remain however, as it is often too **costly** or **not technically feasible** to completely clean up groundwater back to pristine conditions. Under these circumstances, it would not be **reasonable** to expect Member States to undertake further measures for clean up of all pollution, and this is allowed for under the exemptions to prevent or limit in Article 6 (3) of the Groundwater Directive."* **Explanatory note:** This section discusses how Cost-Benefit Analysis and Risk Assessment may demonstrate that site clean-up may be unfeasible, and that this may in some circumstances be acceptable.

8.3.3 Scenario 10: Considering sustainable alternatives when remedial objectives cannot be met

In some instances, remedial options appraisal will fail to identify options that meet the remedial objectives. UK and EU guidance recognise that alternative options, such as those that treat or isolate the receptor, should also be considered as potentially more sustainable options. The Groundwater Directive (2006) also provides for exemptions to the requirement for remedial action, should there be sufficient, documented justification (see Common Implementation Strategy (CIS) Guidance Note no. 17, EC 2007, S5.3, reference quote provided in the table below). This justification should be based on an assessment of costs against likely environmental benefits that demonstrates that either the remedial action may do more harm than good to human health or the environment; or that it would infer unreasonably high cost compared to the environmental benefit.

The following references should be applied as appropriate to provide justification for selecting a remedial approach that may not necessarily meet the remedial objectives, but which is justified on the grounds of sustainability.

Table K: References in the EU and UK regulatory framework that promote sustainable remedial alternatives to when remedial objectives cannot be met		
Document	**Section**	**Relevant text**
CLR 11 Model Procedures 2004	S3.1 p24, column 2	*Where there appear to be no options that will meet remediation and other objectives, it may be necessary to review the initial basis upon which options appraisal has been carried out. Sometimes other technical solutions may come forward or it may be possible to accept a lesser standard of remediation (e.g., by changing the layout or use of the site) or to make adjustments in other areas, such as providing additional health and safety protection or carrying out long-term monitoring.* *In some cases (e.g., where the location of pollutants makes it impossible to carry out remediation effectively) it may be necessary to implement a long term monitoring programme to track changes in the behaviour and movement of pollutants. Such a decision and all the associated monitoring work should be fully documented and a monitoring plan, which incorporates objectives, methods and criteria, needs to be produced.*
Environment Protection Act 1990 (Part 2A): Contaminated Land Statutory Guidance, DEFRA 2012 Contaminated Land Statutory Guidance – Welsh Government) 2012	Section 6(d), para 6.36	*The enforcing authority should strive to minimise impacts of remediation on health and the environment (and comply with any relevant regimes that might require this, for example the health and safety, planning and environmental permitting regimes). If the authority considers that health or environmental* ***impacts*** *of a particular remediation approach are likely to* ***outweigh the likely benefits*** *of dealing with the risk posed by the contamination, it should consider whether an alternative approach to remediation is preferable, even if it may deliver a lower standard of remediation than other techniques*
Environment Protection Act 1990 (Part 2A): Contaminated Land Statutory Guidance, DEFRA 2012 Contaminated Land Statutory Guidance – Welsh Government) 2012	Part 6.18 and 6.19	*Where the authority considers that it is* ***not practicable*** *or reasonable to remediate land to a degree where it stops being contaminated land, the authority should consider whether it would be reasonable to require remediation to a lesser standard. The broad aim should be to manage or remediate the land in such a way that risks are minimised as far as is* ***reasonably practicable****.* *In cases where the purpose of remediation is to remedy harm or pollution that has already been caused, the enforcing authority should decide what is a suitable standard of remediation having regard to the guidance on* ***reasonableness*** *below. In some cases it may be reasonable to require land or waters to be restored to their former state. In other cases it* ***may not be practicable and/or reasonable*** *to do this. In such cases* ***the authority should consider whether it would be reasonable to require remediation to a lesser standard****.*

Table K: References in the EU and UK regulatory framework that promote sustainable remedial alternatives to when remedial objectives cannot be met		
Remedial Targets Methodology (EA) 2006	S 9.4	*"In evaluating the target and remedial target concentrations, together with any remedial measure(s), consideration should be given as to whether there will be a short- or medium-term increase in the volume of groundwater contamination between the source of contamination and the receptor. Whether this is acceptable will be a* ***balance*** *between* ***protecting the environmental target*** *and the* ***cost and practicality*** *of doing so. In exceptional circumstances (e.g. if the predicted duration of the impact at the receptor is very short), it may be more effective to treat or isolate the receptor than to remediate groundwater per se."*
Common Implementation Strategy (CIS) Guidance Note no. 17, EC 2007	S 5.3, para e)	*"An example of 'measures that would increase risks to human health or the quality of the environment as a whole' could be treatment of polluted soil by excavation that would disturb the impermeable layers in the soil, protecting the deep groundwater used for drinking water production.* *In some cases contaminated soil or sediment may cause an input of pollutants into groundwater that is significant (at least at a local scale) so that exemption (b) does not apply, however (full)* ***remediation would do more harm than good*** *to the environment. (Full) remediation may for instance cause noise disturbing wildlife, may need* ***disproportionate amounts of energy or other resources****, etc.* *In some cases* ***other solutions may be possible****, providing partial remediation. Remediation of contaminated sediment settled on the bottom of surface water may in some cases not be possible without causing considerable re-suspension of contaminated material which would lead to ecological damage or be harmful to swimming water quality or to the use of surface water for drinking water production. A* ***more careful remediation technique may be suitable****, but if this were* ***disproportionately expensive****, exemption (ii) would apply. In general,* ***remediation*** *of polluted soil or sediment* ***that would infer unreasonably high cost compared to the environmental benefit*** *would be a* ***case for exemption*** *(ii). What is 'unreasonable' is to be determined in case by case assessments, which according to WFD Article 14 should be made with participation of all relevant parties, and be reported in a transparent way."* **Explanatory note***:* This reference relates to the application of the exemptions to the prevent/limit clauses in the Water Framework Directive and Groundwater Directive. CIS Guidance Note 17 provides this example of how the consideration of sustainability might be applied in remedial options appraisal. The exemption referred to in the text relates to one that would apply in the event that remedial measures would increase risks to human health or the environment (GWD, Art 6(3) e) ii))

8.3.4 Scenario 11: Engaging with stakeholders

Engaging with stakeholders throughout the project life cycle and particularly neighbouring property owners and the local community is fundamental to the social considerations required of sustainable remediation and is endorsed by the UK regulatory framework.

The following references from UK regulations and guidance promote stakeholder engagement in the context of contaminated land management.

Table L: References in the UK regulatory framework supporting stakeholder engagement

CLR11 2004	S3.1 p24, right-hand column	*There may be differing views amongst stakeholders about what constitutes appropriate remediation: for example, the site owner's view about what is sufficient to redevelop a site, the regulator's view as to what is required on legal grounds or to comply with best practice, and the views of neighbouring property owners about what needs to be done to protect their land. The selection and evaluation process has to be able to balance all these factors so the necessary decisions can be made, bearing in mind that regulatory approval will often be the key driver.*
CLR11 2004	S4.2, right-hand column	*The manager should also confirm that the implementation plan has been agreed with the relevant parties. Relevant parties that may need to be consulted when completing the implementation plan include the:* • *Professional team working on other aspects of the project;* • *Client (if separate), including the legal team;* • *Local authority* *(planning and environmental health);* • *Environment Agency or SEPA and other regulatory bodies such as HSE, English Nature, English Heritage and equivalent bodies elsewhere in the UK;* • *Statutory undertakers;* • *Prospective purchasers;* • *Prospective insurers and funders;* • *Neighbours to the site;* • *Local interest groups.*
Guidelines for Environmental Risk Assessment and Management Green Leaves III (DEFRA) 2011	S4.3.6	*While it may not be necessary to involve the same people in all elements of the process (e.g. it might be appropriate to involve members of the local public in the scoping of the risk issues and framing of questions), certain groups may take on active roles within the decision-making process. It is also likely that those who were involved in the planning of the risk assessment will want to be involved in the post-assessment stages. This can be beneficial, as good decisions are often informed by the knowledge and concerns of stakeholders and the public, and are understood and supported by the people who may be directly affected by them.*

Table L: References in the UK regulatory framework supporting stakeholder engagement		
Town and Country Planning (Scotland) Act 1997 (as amended)	Paragraph 12, Section 1 and paragraph 43, Section 1c	*b) that persons who may be expected to wish to make representations to the authority about the proposals are made aware that they are entitled to do so, and* *(c) that such persons are given an adequate opportunity of making such representations. ...before granting or refusing planning permission for any development, to consult such authorities or persons as may be prescribed by the regulations or the order or by directions given by the Secretary of State under the regulations or the order.*
Environment Act 1995	Section 7, Part 1(c)	*"It shall be the duty of each of the Ministers and of the Agency, in formulating or considering—any proposal relating to any functions of the Agency—* *(i) to have regard to the desirability of protecting and conserving buildings, sites and objects of archaeological, architectural ,engineering or historic interest;* *(ii) to take into account any effect which the proposals would have on the beauty or amenity of any rural or urban area or on any such flora, fauna, features, buildings, sites or objects; and* *(iii) to have regard to any effect which the proposals would have on the* ***economic and social well-being of local*** *communities in rural areas.*

8.4 Remedial Implementation, Monitoring and Verification

Although assessments of sustainability will have largely taken place during the options appraisal of a remediation project, sustainability remains a major factor in remedial implementation, as this is the stage in which planned sustainability gains are realised.

Guidance on remedial implementation relate to sustainable practices on-site during remediation works, including the recycling of wastes, and other measures to minimise resource use. There is naturally a regulatory overlap with waste guidance. Limited guidance is also offered with respect to a sustainable approach to the monitoring and verification stage of implementation. Guidance on considering costs and benefits in designing and implementing a remedial monitoring programme is also offered by the EU.

8.4.1 Scenario 12: Implementing sustainable remedial and waste management practices

Sustainable remedial practices that are endorsed by regulatory guidance focus on techniques that minimise the generation of waste and resource use, and, if appropriate, accord with the waste hierarchy. The use of on-site or in-situ options are encouraged by regulatory authorities, as are the re-use and/or recycling of waste soil or groundwater generated during a remedial programme.

The following references should be applied, as appropriate, to provide justification on sustainability grounds for remedial works that would minimise the generation of wastes such as excavated soils. Examples would include using trial pitting to provide improved delineation of impact thereby avoiding a “blanket” excavation approach, or for the reuse of soils excavated as part of a remedial programme.

Table M: References in the EU and UK regulatory framework that support minimizing waste generation during remediation		
Document	**Section**	**Relevant text**
Waste Framework Directive 2008	Article 4(1)	"*The following waste hierarchy shall apply as a priority order in waste prevention and management legislation and policy:* • *prevention;* • *preparing for re-use;* • *recycling;* • *other recovery, e.g. energy recovery; and disposal.…* *Member States shall take into account the general* ***environmental protection principles*** *of* ***precaution and sustainability****, technical feasibility and* ***economic viability****, protection of resources as well as the overall* ***environmental, human health, economic and social impacts****, in accordance with Articles 1 and 13"*
The Waste (England and Wales) Regulations 2011	Part 5 (12, 1)	*An establishment or undertaking which imports, produces, collects, transports, recovers or disposes of waste, or which as a dealer or broker has control of waste must, on the transfer of waste, take all such measures available to it as are reasonable in the circumstances to apply the following waste hierarchy as a priority order—* *(a) prevention;* *(b) preparing for re-use;* *(c) recycling;* *(d) other recovery (for example energy recovery);* *(e) disposal.*
The Waste and Contaminated Land (Northern Ireland) Order 1997	Schedule 3, Part 4	*"Encouraging the prevention or reduction of waste production and its harmfulness, in particular by—* *(a) the development of clean technologies more sparing in their use of natural resources;* *(b) the technical development and marketing of products designed so as to make no contribution or to make the smallest possible contribution, by the nature of their manufacture, use or final disposal, to increasing the amount or harmfulness of waste and pollution hazard."*
Groundwater Protection: Principles and Practice (GP3), EA 2013	Part 2: Position Statement J. Land Contamination - Achieving sustainable remediation (p101)	***"Promote appropriate sustainable remediation:*** *We encourage the use of* ***sustainable and effective remedial measures*** *to prevent or address groundwater pollution from sites affected by contamination. This includes the* ***recycling of water and soils where appropriate****. However, these operations must not result in an unacceptable release to groundwater and must where necessary have appropriate permits and controls."*

Table M: References in the EU and UK regulatory framework that support minimizing waste generation during remediation		
EA Position Statement: PS 006 Version 2	n/a	**Explanatory note**: The EA released a position statement in response to the CL:AIRE publication on the Definition of Waste: Development Industry Code of Practice. In the position statement, the EA indicated its support for the adoption of the Code of Practice in determining whether excavated materials to be used in development projects are classified as waste.
EA Position Statement: PS 006 Version 2	Appendix 1, sustainable waste management in Land Development.	*"Management of material at the site should be undertaken in accordance with the **sustainable waste management principles** of (in order of preference) waste reduction, re-use, recovery and finally, disposal.*
EA Position Statement: PS 006 Version 2	Appendix 1, sustainable waste management in Land Development – Re-use excavated material.	*"In certain circumstances, excavated material re-used in the development of land may not be waste, and hence not subject to waste regulatory control, provided that the aims and objectives of the Waste Framework Directive are not undermined and that its use will not harm human health or the environment.* *We consider this may be the case for excavated material used on the site where it was produced or at other sites when;* • *it is used in appropriate amounts* • *it is suitable for that use directly without treatment its use will not cause harm to human health or the environment.*
EA Position Statement: PS 006 Version 2	Appendix 1, sustainable waste management in Land Development – Recover material.	*"Where the materials cannot be used directly without treatment then recovery options should be considered. We encourage the use of on-site treatment technologies and have issued a series of remediation position statements covering each of the main technologies, explaining how we apply the regulations."*
EA Position Statement: PS 006 Version 2	Appendix 1, sustainable waste management in Land Development – Reduce waste generated.	*"**Reduce the generation of waste materials**, perhaps by reviewing the layout of the development, ensuring that land use is related to the contamination identified or encountered and appropriate levels of site investigation to characterise and delineate contamination on site have been undertaken."*

8.4.2 Scenario 13: Deviating from the waste hierarchy where justified on sustainability grounds

In some situations, conformance with the waste hierarchy in a remedial strategy may not be feasible for technical, economic, human health, or environmental reasons. This is acknowledged by the EU and UK regulatory framework. The following references should be applied, as appropriate, to provide justification for a remedial strategy that does not conform to the waste hierarchy.

Table N: References in the EU and UK regulatory framework to justify a deviation from the waste hierarchy

Waste Framework Directive 2008	Preamble, para 31	"*The waste hierarchy generally lays down a priority order of what constitutes the best overall environmental option in waste legislation and policy, while departing from such hierarchy may be necessary for specific waste streams when justified for reasons of, inter alia,* ***technical feasibility****,* ***economic viability*** *and* ***environmental protection****".*
Waste Regulations (England & Wales), 2011	Part 5 s12	*"…an establishment or undertaking may depart from the priority order in paragraph (1) so as to achieve* ***the best overall environmental outcome*** *where this is justified by* ***life-cycle thinking*** *on the overall impacts of the generation and management of the waste.* *(3) When considering the overall impacts mentioned in paragraph (2), the following considerations must be taken into account—* *the general environmental protection principles of* ***precaution and sustainability****;* *technical feasibility and* ***economic viability;*** *protection of resources;* *the overall* ***environmental, human health, economic and social impacts****."*
The Waste and Contaminated Land (Northern Ireland) Order 1997	Article 23, para 4 and 7	*In considering what information to include in the plan under paragraph (3)(b)(iv) the district council shall have regard to the desirability, where* ***reasonably practicable****, of giving priority to recovering waste.* *Without prejudice to paragraph (5), a district council shall, in preparing the plan and any modification of it, consider, in consultation with such persons as the council considers appropriate and as agree to participate in the consultations—* *(a) what arrangements can* ***reasonably*** *be expected to be made for recovering waste; and* *(b) what provisions should be included in the plan for that purpose.*

8.4.3 Scenario 14: Implementing a monitoring and verification programme

The following references relate to sustainability principles applicable to the monitoring and verification stage of a remediation programme. The first could be adopted to provide justification on cost-benefit grounds of the implementation of a remedial monitoring programme. The latter is a more general statement regarding the importance of a verification programme particularly with regard to considerations of the sustainability of different remediation techniques.

Table O: References in the EU and UK regulatory framework promoting sustainability in monitoring and implementation of a remedial strategy

CIS Guidance Document (No. 17)	S4.5.2 (p25)	*When designing Prevent and Limit monitoring programmes, the following need to be considered:* • *Zero monitoring (upgradient and/or background monitoring)...* • *The monitoring intervals (frequency)…* • *Construction (technical) characteristics of the monitoring wells….* • *Sampling methods, sample preservation and analysis methods…* • *The parameters monitored at each well should be indicative of the type of pollutant(s) and their expected impact. Possible indicator parameters (redox, pH, electrical conductivity, temperature, salts) could be used to* ***reduce the monitoring effort****.* • *The* ***cost-benefit*** *of the number of wells versus the level of information that will be obtained.*

Table O: References in the EU and UK regulatory framework promoting sustainability in monitoring and implementation of a remedial strategy		
Verification of Remediation of Land (Report: SC030114/R1) EA 2010	S1.2 (p2)	*Benefits that may be obtained by appropriate verification of remediation include:* • *Demonstration of compliance with legal and contractual requirements.* • *Evidence for corporate or government reporting purposes.* • *Evidence to regulators, landowners and other interested parties that remediation has met agreed targets in both the long and short term.* • *Greater confidence for future owners and generations in the quality of remediated land.* • *Better understanding and increased confidence in the efficacy of innovative treatments.* • *Identification of failed remediation where occupants of the land would continue to be exposed to unacceptable risks or landowners to liability.* • *Potential cost savings focussing on the collection of appropriate and necessary data to satisfy specific remediation criteria.* • *Better understanding of the **sustainability of different remediation techniques** (economic, social and environmental performance)*.

9. FUTURE DIRECTIONS

9.1 International Perspective

The most recent survey by the EC's Joint Research Centre completed in 2012 estimates that 2.5 million sites are potentially contaminated across Europe (Van Liedekerke et al. 2014). There is some concern that the remediation of these sites is not always being carried out in a sustainable fashion. The scale of both land contamination problems themselves and the responses to them makes achieving sustainability in contaminated land remediation an important debate. This has resulted in activities by several networks and projects in Europe (e.g. SuRF-NL, SuRF-Italy, NICOLE Working Group) developing sustainable remediation concepts and ideas. These are part of a global proliferation of sustainable remediation development activities (summarized in Bardos 2014).

There is a remarkable degree of consensus across these initiatives about what a vision of "sustainable remediation" might be. The emerging international consensus is that in broad terms sustainable remediation is the achievement of a net benefit overall across a range of environmental, economic and social concerns that are judged to be representative of sustainability. Whilst the scope of sustainability is potentially broad ranging over these three elements there is also a developing consensus that what sustainability encompasses is highly site specific and depends on opinions from a range of stakeholders with interests in the site in question. As such, sustainability is subjective rather objectively quantifiable. However, while sustainability is not capable of direct measurement, there is general agreement that it is possible to assess sustainability on a site specific basis, compare possible rehabilitation options, and monitor sustainability "performance" once a chosen option is implemented. A number of initiatives also agree that a tiered approach is likely to be the most efficient route to effective sustainability assessment, beginning with simple qualitative methods and focusing more complicated assessments only on aspects of sustainability where there is a failure to reach a clear consensus.

Given the close collaboration between these initiatives (for example via a secretariat provided by CL:AIRE), and the degree of consensus existing already, it seems likely that overall frameworks, definitions and methodologies related to sustainable remediation will be refined over coming years; but will not be subject to major shifts in approach. Potentially, there could be an increasing use of ecosystem service concepts in line with developments in general sustainability thinking (e.g. as per UK government guidance: *What Nature can Do for You: A Practical Introduction to Making the Most of Natural Services, Assets and Resources in Policy and Decision Making*, DEFRA, 2010).

Sustainable remediation thinking is likely to be further consolidated by a descriptive standard being developed under the auspices of ISO, and has been given additional impetus in Europe by a joint position statement from the NICOLE and COMMON FORUM networks, representing industry/service provider and regulatory interests respectively.

The draft Soils Framework Directive included sustainability in its considerations, but after a number of years of failure to agree the text it was dropped by the European Commission (EC) in 2013 (www.commonforum.eu). Although the draft SFD has been withdrawn, the desire to have such legislation has not disappeared with it. As such, it is thought that some form of soils legislation will be re-proposed by the EC but its scope and nature are not yet known.

However, EC concern that sustainability is not sufficiently considered in remediation decision making by the Public Sector was made manifest in a call for research proposals under the Horizon 2020 (H2020) funding programme, which closed in April 2014, (SC5-8-2014: Preparing and promoting innovation procurement for soil decontamination). Award of this project to the successful tenderer to commence the research study is expected to take place towards the end of 2014. The European Environment Agency will be letting a project on land recycling from June 2014 focussing on identifying wider environmental impacts, for example benefits other than those directly related to land use of brownfield development (Negotiated procedure EEA/NSV/14/003). This seems likely to be linked to some form of LCA based metric or metrics.

These initiatives suggest that there is also support for sustainable remediation, or at least the thinking aligned with it, in the regulatory and policy development parts of the European Commission. It is not known how closely their opinions would follow the existing descriptions of sustainable remediation from the various initiatives mentioned above. It would therefore appear that the ISO drafting work could have a pivotal role, if completed in a timely fashion, by presenting a consolidated technical description for future EC decision making.

9.1.1 UK trends

The SuRF-UK project (*www.claire.co.uk/surfuk*) has had a significant influence on remediation thinking in the UK and beyond. The 2010 framework was supported by the four environment agencies, and has influenced subsequent regulatory guidance, even if it has not formally been part of it. The development of more detailed guidance about indicators (2011) and assessment approaches (2014) seems likely to support better implementation of sustainability in practical contaminated land management within the UK, and a consolidation of approach.

Considerations of sustainability have also recently been extended to portfolio-wide contaminated land management practices. This is particularly relevant for site owners and property developers with multiple sites that demonstrate the need for potential remedial action. To this end, CL:AIRE has developed guidance for a "*Cluster Approach*", which aims to facilitate the remediation and/or development of a number of sites that are located in relative close proximity and share a treatment facility located on a single site. The EA has recognised this approach in its Position Statement on the Definition of Waste (v2) (EA, 2011), and this may have significant implications for the remedial programmes carried out by site owners and operators with a portfolio of multiple sites.

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APPENDIX A

SUSTAINABILITY REFERENCES IN THE REGULATORY AND TECHNICAL FRAMEWORK FOR REMEDIATION PROJECTS IN THE EUROPEAN UNION AND UNITED KINGDOM (EXCEL SPREADSHEET)

[APPENDIX A - REGULATORY AND TECHNICAL FRAMEWORK.XLS – FILE ATTACHED TO PDF]

APPENDIX B

METHODOLOGY

Methodology:

The following methodology was employed to achieve the objectives for this report:

1. EU Directives and UK legislative (Acts and Regulations), regulatory, and good practice guidance documents pertinent to the contaminated land regime in the UK were identified by review of regulatory guidance. A complete list of guidance documents reviewed as part of this project is presented in Appendix A of this report.

2. Relevant documents were collected from internet sources.

3. Documents were systematically searched with electronic word search tools for references potentially relevant to sustainable remediation. The following search terms were applied:

    - *Sustainable/Sustainable development/Sustainable remediation/Sustainability*
    - *Remedial/remediation*
    - *Remedy*
    - *Proportionate / Proportionality*
    - *Polluter pay(s)*
    - *Feasible*
    - *Cost (effective)*
    - *Benefit*
    - *Balance*
    - *Stakeholder*
    - *Reasonable/unreasonable*
    - *Necessary*
    - *Green Remediation*
    - *Options Appraisal*
    - *Economic/Environmental/Social (multiple combinations)*
    - *Socio-economic*
    - *Consult(ation)*
    - *Involvement*
    - *Party/parties*
    - *Impact Analysis*
    - *Brownfield*

4. Where search terms were identified within a section of document text, the relevant text was reviewed to assess its context and relevance to sustainable remediation.

5. Applicable regulatory references were captured within an Excel-based review log (provided as Appendix C).

6. Applicable references were compiled and used in the preparation of this report. Not all references listed in the review log are presented in the report text, however the complete list of relevant references is provided in Appendix C.

APPENDIX C

REGULATORY REFERENCE SUMMARY (EXCEL SPREADSHEET)

[APPENDIX C – REGULATOR REFERENCE SUMMARY.XLS – FILE ATTACHED TO PDF]