Incorporating Resilience and Adaptation into the SuRF-UK Sustainable Remediation Framework

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SuRF
SUSTAINABLE REMEDIATION FORUM UK

The business of sustainability

ERM

SuRF-UK in a nutshell

- SuRF-UK is the United Kingdom's Sustainable Remediation Forum.
- It was established in 2007 to advance the development of sustainable remediation, and published a UK framework in 2010.
- It is a collaboration of regulators, industry, academics and consultants independently co-ordinated by the UK contaminated land knowledge hub CL:AIRE.
- A member of International Sustainable Remediation Alliance (ISRA).

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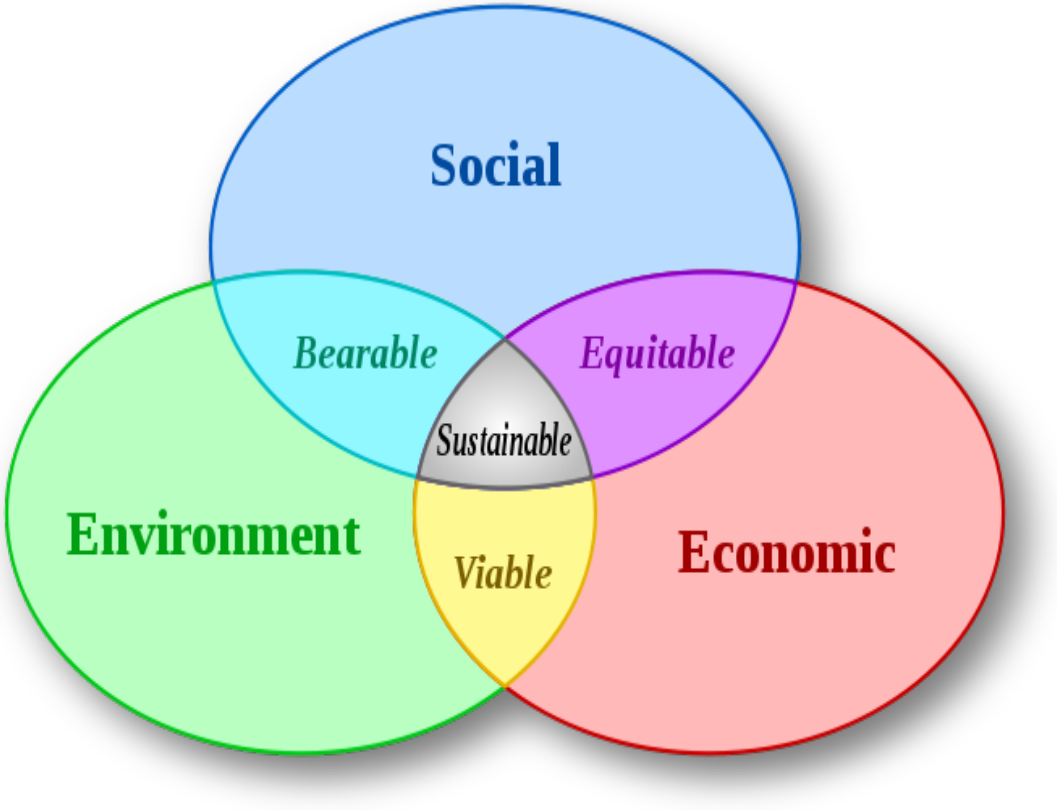
Sustainable Remediation - definition

Sustainable remediation is defined in the ISO 18504:2017 international standard as:

“ the elimination and/or control of unacceptable risks in a safe and timely manner whilst optimizing the environmental, social and economic value of the work”

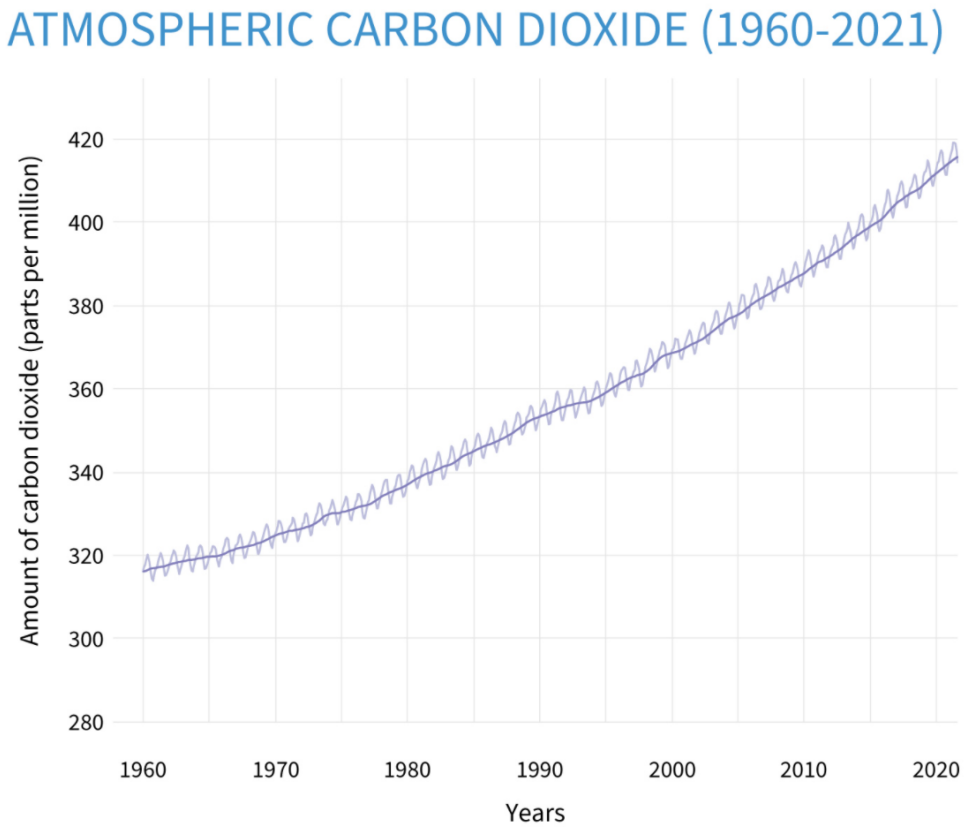


Sustainable & Resilient Remediation

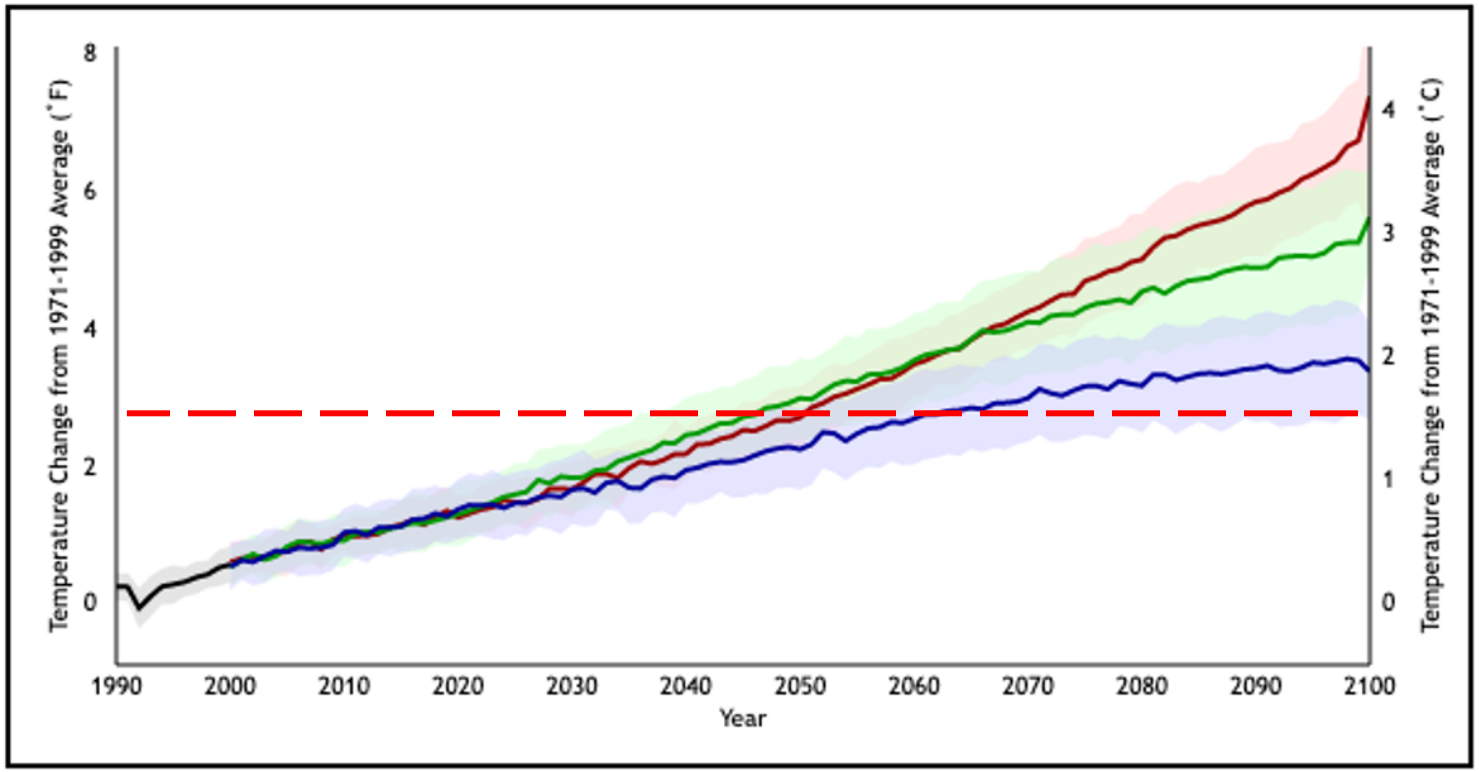
Sustainable resilient remediation (SRR) is an optimized solution to cleaning up and reusing a hazardous waste site that limits negative environmental impacts, maximizes social and economic benefits, and creates resilience against increasing threat of extreme weather events, sea-level rise, and wildfires.

ITRC 2021 Sustainable Resilient Remediation

Climate Change: What's the latest?



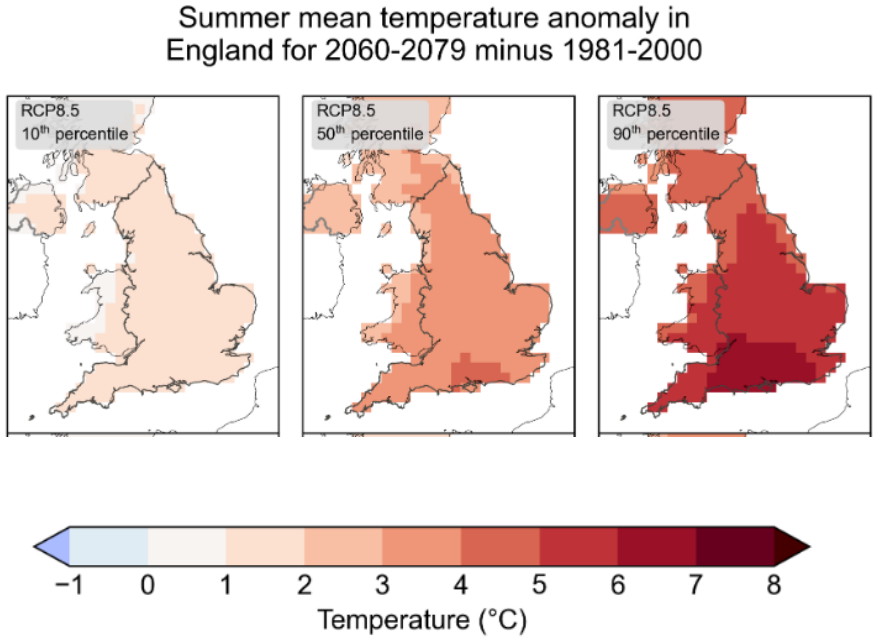
Climate Change: Atmospheric Carbon Dioxide | NOAA Climate.gov

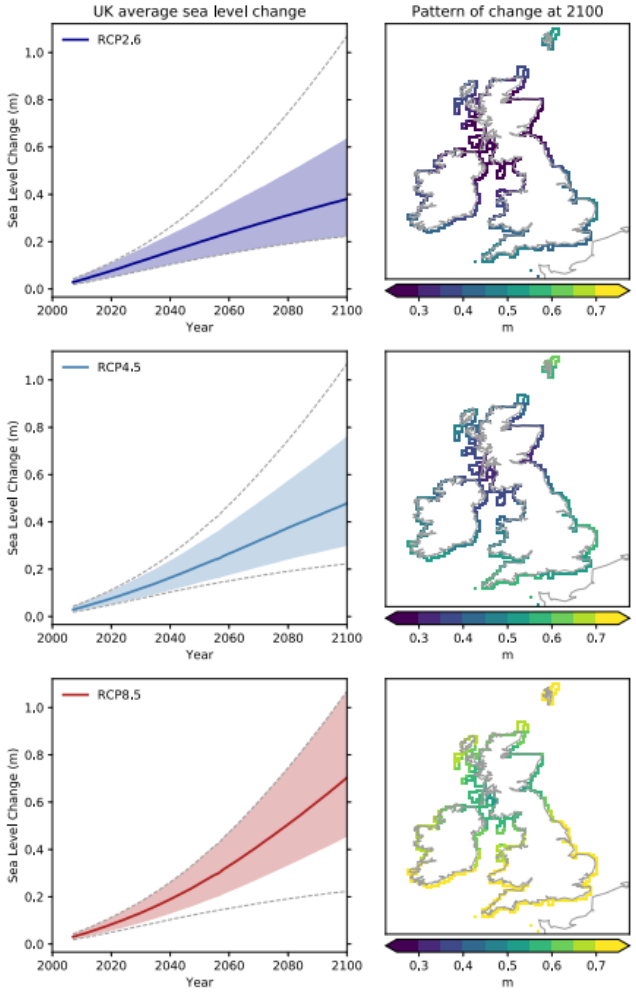


Climate Change: Global Temperature Projections | NOAA Climate.gov

Climate change and its impacts are here to stay

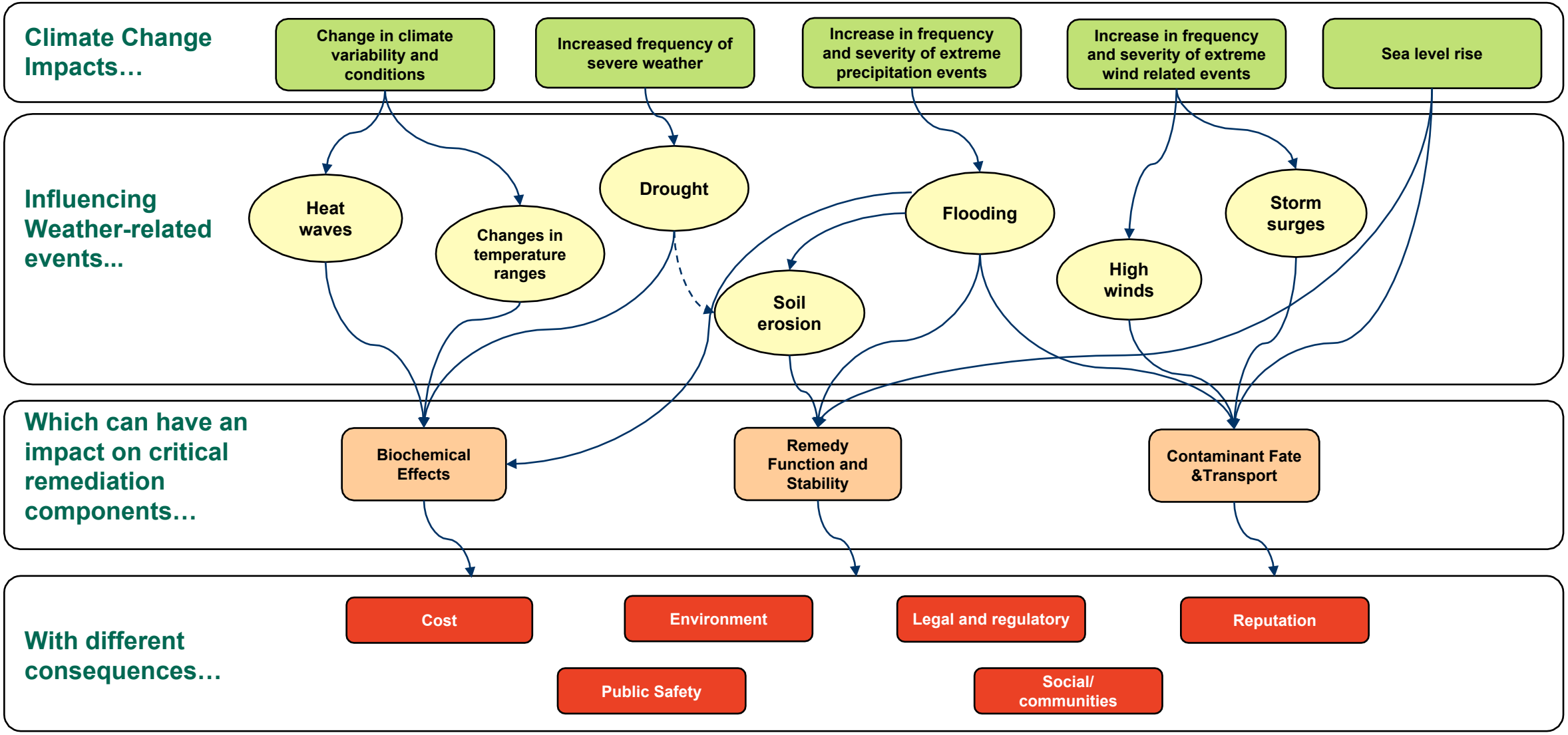
What can we expect ?





"a greater chance of warmer, wetter winters and hotter, drier summers"
UK Met Office UKCP18 National Climate Projections

Climate Change Impacts: Causes and Consequences



Climate Change Impacts on Contaminants & Remediation

CBS NEWS

327 toxic Superfund sites in climate change, flooding bulls-eyes: AP

Across the nation, more than 800,000 homes are located near flood-prone toxic sites. Houses are at risk of contamination if intense flooding brings water into them, and many more people could be affected if the contamination seeps into the ground, finding its way into drinking water.

Search UK edition

The Guardian

For 200 years

News website of the year

Toxic waste revealed as eroding coastlines expose old landfills

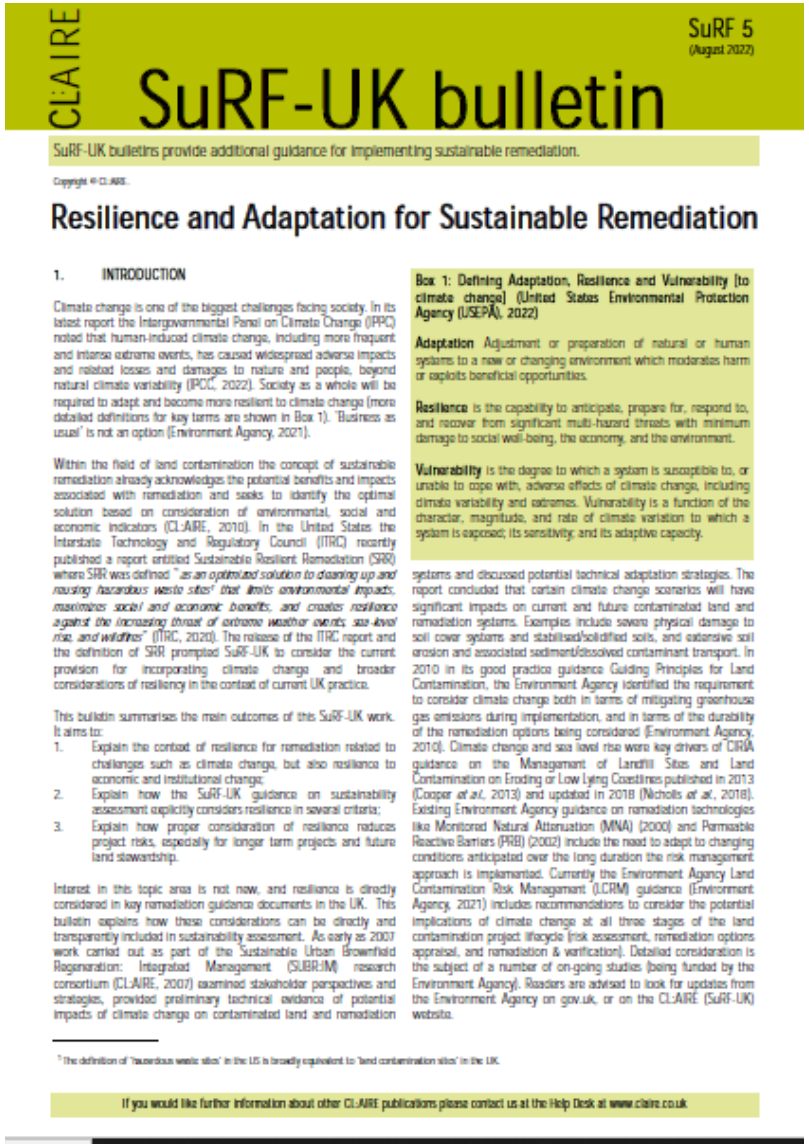
Floods and rising sea levels are washing hazardous waste from old rubbish tips into the sea at thousands of sites globally

SuRF-UK Bulletin

Published August 2022

Highlighted opportunities to incorporate resiliency and adoption within context of SuRF-UK framework.

- Selection of appropriate indicators at outset of project
- Consideration in development of remedial strategy
- Evaluation for specific technologies
- Incorporation of SMPs that consider resiliency during implementation



CL:AIRE

SuRF 5
(August 2022)

SuRF-UK bulletin

SuRF-UK bulletins provide additional guidance for implementing sustainable remediation.

Resilience and Adaptation for Sustainable Remediation

1. INTRODUCTION

Climate change is one of the biggest challenges facing society. In its latest report the Intergovernmental Panel on Climate Change (IPPC) noted that human-induced climate change, including more frequent and intense extreme events, has caused widespread adverse impacts and related losses and damages to nature and people, beyond natural climate variability (IPCC, 2022). Society as a whole will be required to adapt and become more resilient to climate change (more detailed definitions for key terms are shown in Box 1). 'Business as usual' is not an option (Environment Agency, 2021).

Within the field of land contamination the concept of sustainable remediation already acknowledges the potential benefits and impacts associated with remediation and seeks to identify the optimal solution based on consideration of environmental, social and economic indicators (CL:AIRE, 2010). In the United States the Interstate Technology and Regulatory Council (ITRC) recently published a report entitled Sustainable Resilient Remediation (SRR) where SRR was defined "*as an optimized solution to cleaning up and reusing hazardous waste sites[1] that limits environmental impacts, maximizes social and economic benefits, and creates resilience against the increasing threat of extreme weather events, sea-level rise, and wildfires*" (ITRC, 2020). The release of the ITRC report and the definition of SRR prompted SuRF-UK to consider the current provision for incorporating climate change and broader considerations of resiliency in the context of current UK practice.

This bulletin summarises the main outcomes of this SuRF-UK work. It aims to:

1. Explain the context of resilience for remediation related to challenges such as climate change, but also resilience to economic and institutional change;
2. Explain how the SuRF-UK guidance on sustainability assessment explicitly considers resilience in several criteria;
3. Explain how proper consideration of resilience reduces project risks, especially for longer term projects and future land stewardship.

Interest in this topic area is not new, and resilience is directly considered in key remediation guidance documents in the UK. This bulletin explains how these considerations can be directly and transparently included in sustainability assessment. As early as 2007 work carried out as part of the Sustainable Urban Brownfield Regeneration: Integrated Management (SUBRIM) research consortium (CL:AIRE, 2007) examined stakeholder perspectives and strategies, provided preliminary technical evidence of potential impacts of climate change on contaminated land and remediation

Box 1: Defining Adaptation, Resilience and Vulnerability (to climate change) (United States Environmental Protection Agency (USEPA), 2022)

Adaptation Adjustment or preparation of natural or human systems to a new or changing environment which moderates harm or exploits beneficial opportunities.

Resilience is the capability to anticipate, prepare for, respond to, and recover from significant multi-hazard threats with minimum damage to social well-being, the economy, and the environment.

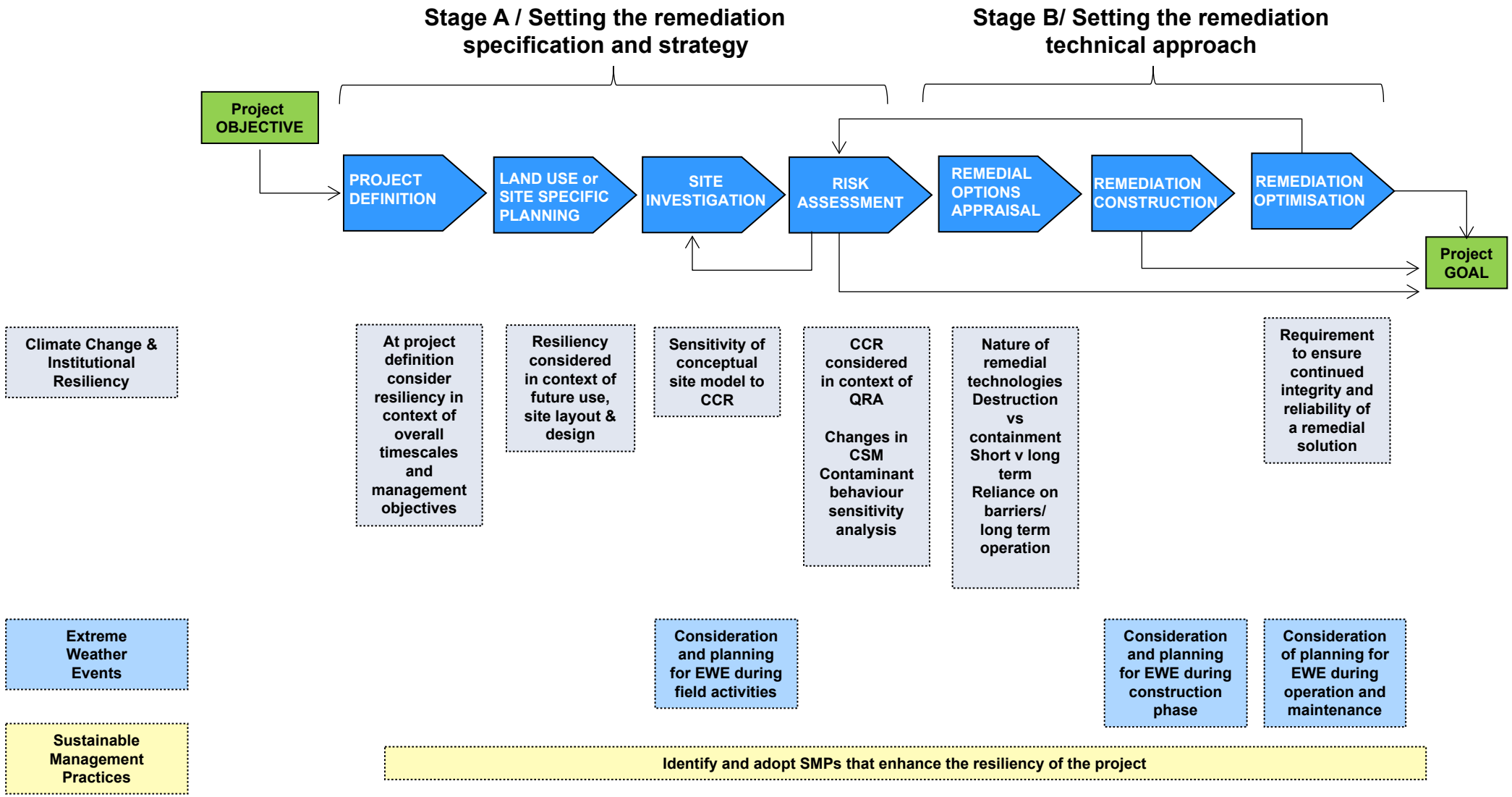
Vulnerability is the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate variation to which a system is exposed; its sensitivity; and its adaptive capacity.

systems and discussed potential technical adaptation strategies. The report concluded that certain climate change scenarios will have significant impacts on current and future contaminated land and remediation systems. Examples include severe physical damage to soil cover systems and stabilised/solidified soils, and extensive soil erosion and associated sediment/dissolved contaminant transport. In 2010 in its good practice guidance Guiding Principles for Land Contamination, the Environment Agency identified the requirement to consider climate change both in terms of mitigating greenhouse gas emissions during implementation, and in terms of the durability of the remediation options being considered (Environment Agency, 2010). Climate change and sea level rise were key drivers of CIRIA guidance on the Management of Landfill Sites and Land Contamination on Eroding or Low Lying Coastlines published in 2013 (Cooper *et al*, 2013) and updated in 2018 (Nicholls *et al*., 2018). Existing Environment Agency guidance on remediation technologies like Monitored Natural Attenuation (MNA) (2000) and Permeable Reactive Barriers (PRB) (2002) include the need to adapt to changing conditions anticipated over the long duration the risk management approach is implemented. Currently the Environment Agency Land Contamination Risk Management (LCRM) guidance (Environment Agency, 2021) includes recommendations to consider the potential implications of climate change at all three stages of the land contamination project lifecycle (risk assessment, remediation options appraisal, and remediation & verification). Detailed consideration is the subject of a number of on-going studies (being funded by the Environment Agency). Readers are advised to look for updates from the Environment Agency on gov.uk, or on the CL:AIRE (SuRF-UK) website.

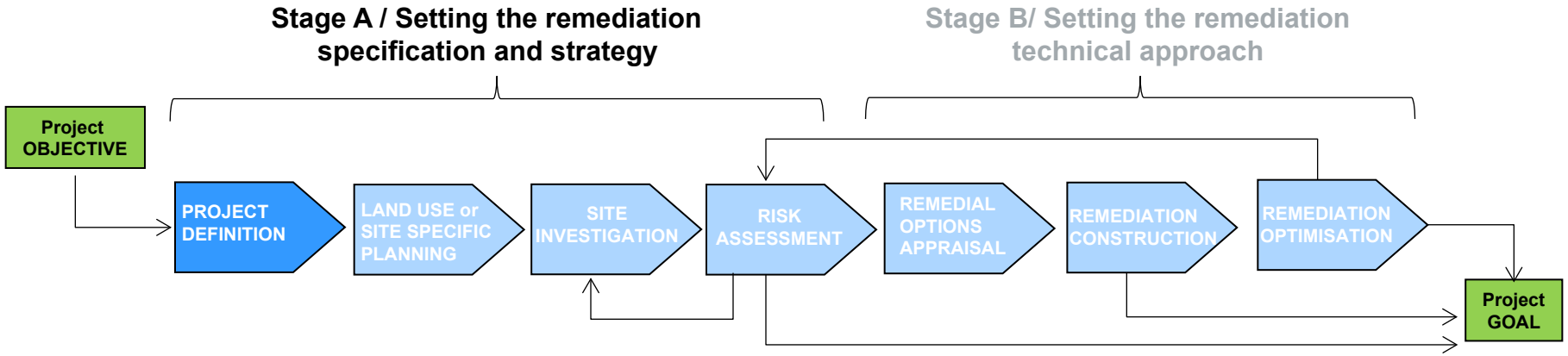
[1] The definition of 'hazardous waste sites' in the US is broadly equivalent to 'land contamination sites' in the UK.

If you would like further information about other CL:AIRE publications please contact us at the Help Desk at www.claire.co.uk

Consideration of resiliency in context of remediation lifecycle



Consideration of resiliency in context of remediation lifecycle

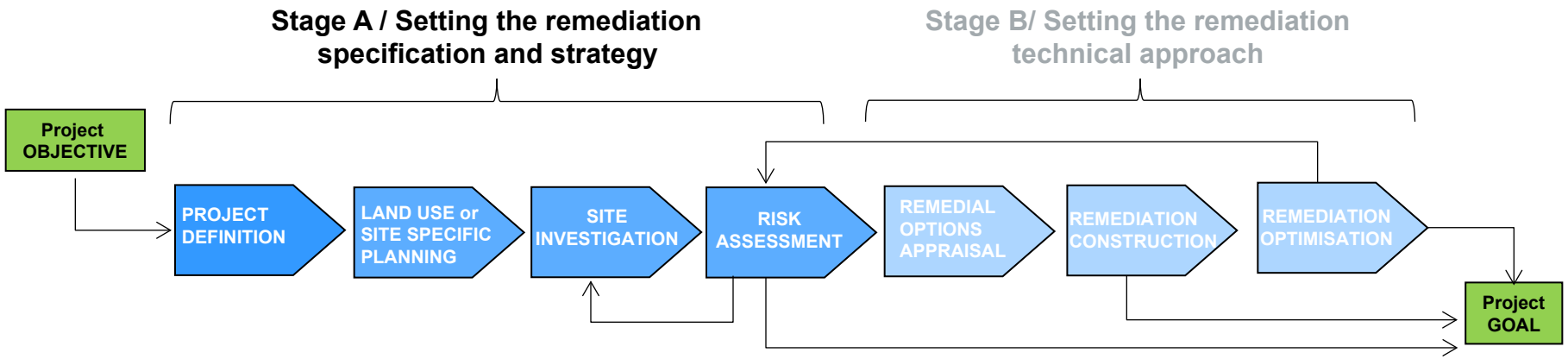


Incorporating sustainability indicators at project definition SuRF-UK SR2 document

Environment	Social	Economic
Emissions to Air	Human health & safety	Direct economic costs & benefits
Soil and ground conditions	Ethics & equity	Indirect economic costs & benefits
Groundwater & surface water	Neighbourhoods & locality	Employment & employment capital
Ecology	Communities & community involvement	Induced economic costs & benefits
Natural resources & waste	Uncertainty & evidence	Project lifespan & flexibility

- Robustness of solution to climate change effects
- Ability to respond to changing regulation or its implementation
- Robustness of solution to altering economic circumstances
- Requirements for ongoing institutional controls

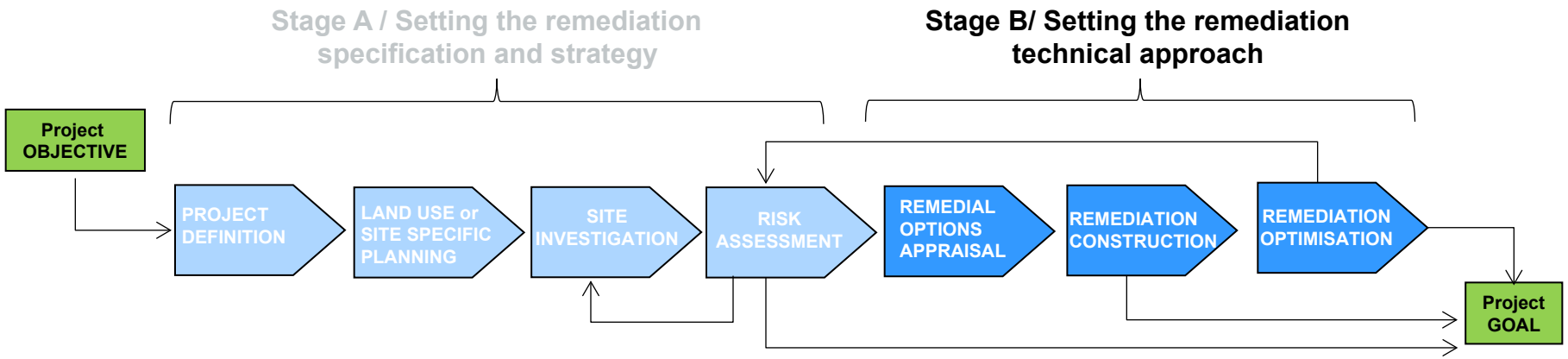
Consideration of resiliency in context of remediation lifecycle



Examples of more detailed analyses that could be completed during Part A:

- Consider resiliency in future site use
- Sensitivity of CSM to resiliency
- Climate Change Vulnerability Assessments
  - Example of the approach set out in the ITRC SRR document
  - Using country specific resources
- Account for resiliency in risk assessment
  - Example of the Society of Brownfield Risk Assessment (SoBRA) report published Aug 2022

Consideration of resiliency in context of remediation lifecycle

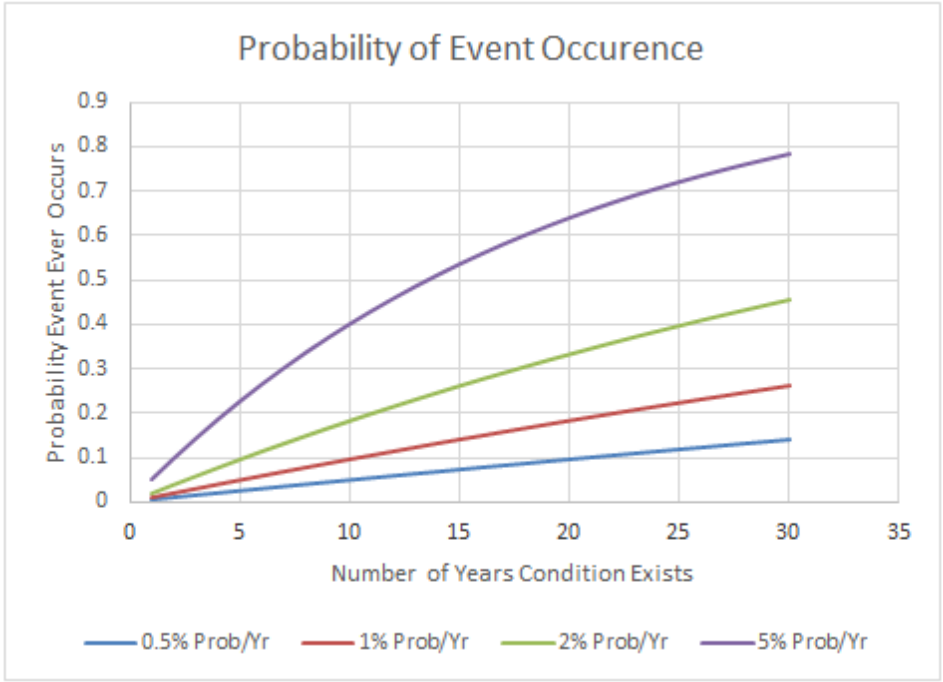


Examples of more detailed analyses that could be completed during Part B:

- Consider resilience of remediation options in sustainability assessment
- Assess the longevity of the solution
- Incorporate in project planning & hazard assessments
- Opportunities for using land stewardship approach
  - Example of network for industrially coordinated sustainable land management in Europe (NICOLE) approach

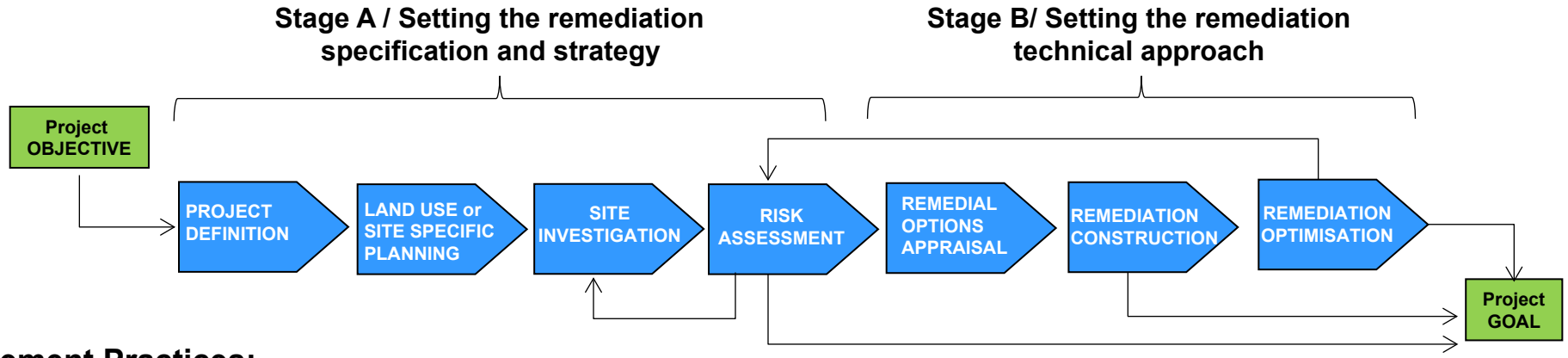
Sensitivity of remedial technologies to climate change

- The sensitivity of remedial technologies will vary on a geographical and site specific basis
- All technologies can be vulnerable to extreme weather events during implementation phase but can be anticipated / mitigated during design stage
- Technologies that rely on containment / engineered controls or that are designed with long term operation may be more at risk from both increased frequency of extreme weather events and longer term climatic changes. Conversely technologies that are rapid or destroy contamination may be less sensitive.
- These should be considered in a revised Conceptual Model using resources that enable assessment of likely changes



Probability of extreme weather event or wildfire occurring vs. length of time.
ITRC SRR Team in ITRC SRR Guidance 2021

Consideration of resiliency in context of remediation lifecycle



Sustainable Management Practices:

- Relevant across whole project lifecycle
- Use the latest guidance
- Examples could be…

SMP	SMP Benefit
Plan site layout with regard to minimising the physical remediation required	• The potential impacts from climate change could also be incorporated into the site plan to ensure remediation is more robust
Request that the functional performance specifications of products are supplied	• Ensuring that the operational limits of materials and equipment can operate in the event of extreme weather events or other climate change impacts
Set sustainability criteria in the specification to motivate suppliers to provide more sustainable products and services	• Drives a culture of sustainability across the supply chain.

Conclusions

- Sustainable remediation provides the framework for balanced remedial options appraisal
- Resiliency and adaption to climate change can and should be considered as part of the development of a sustainable solution
- Climate change resiliency is unlikely to be the key variable in remedial technology selection but is certainly one that is increasing in recognition and importance
- Resources and guidance are available to guide the assessment but further work and examples are needed to share best practices

Resources

CL:AIRE, 2022, Resilience and Adaptation for Sustainable Remediation SuRF-UK Bulletin SuRF 5 https://www.claire.co.uk/projects-and-initiatives/surf-uk

ITRC (Interstate Technology & Regulatory Council), 2021,Sustainable Resilient Remediation SRR-1. Washington, D.C.: Interstate Technology & Regulatory Council, SRR Team. www.itrcweb.org

SOBRA, 2022, Guidance on Assessing Risk to Controlled Waters from UK Land Contamination Under Conditions of Future Climate Change https://sobra.org.uk/resources/reports/

NICOLE (2020), Land Stewardship, Investing in The Natural, Social and Economic Capital of Industrial Land https://test.nicole.org/wp-content/uploads/2022/11/Landstewardship.pdf