Sustainable Remediation

Optimizing Liability Portfolio Management & Remediation in a Low Carbon Economy

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Optimizing Liability Portfolio Management & Remediation in a Low Carbon Economy

What is it?

Sustainable remediation has been recently 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”

While the definition is clear there is no single unit or metric of sustainability and regulatory requirements are often not clear or vary in different jurisdictions

ERM will work with you to understand the boundaries of sustainability that are relevant to your site or portfolio of sites and develop an approach and series of indicators that are relevant to your company and applicable regulations

When is it applicable?

The principles of sustainable remediation can be applied at any stage in the life cycle of the management of contaminated land, from planning, through site investigation, remedial options appraisal and implementation.

The earlier that sustainable remediation is applied in the life cycle the more benefit is realized.

ERM can help you identify opportunities for applying the principles and practices of sustainable remediation wherever your sites sit in the project lifecycle and help you select and measure relevant economic, social and environmental indicators that reflect your corporate objectives.

What are the benefits?

ERM’s approach to sustainable and resilient remediation helps our clients manage individual or portfolios of sites through:

- providing bottom line benefits to the balance sheet whilst managing the risks associated with contaminated sites;
- transforming sites from liabilities into assets; and
- help deliver our client’s sustainability aspirations through recognizing and contributing to corporate sustainability key performance indicators and or the UN sustainable development goals (SDGs)

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The management of contaminated sites has the primary objective of reducing risks and both, short and long term liabilities. However, the act of remediation may also have significant environmental, social and economic impacts.

ERM as a leading organization in delivering resilient, sustainable solutions for our clients can help optimize and implement the remedial alternative with the greatest net benefits and align the management of your contaminated sites with your corporate sustainability goals as we face the challenge of transitioning to a low carbon economy.

Click through the links listed to the right for more information.

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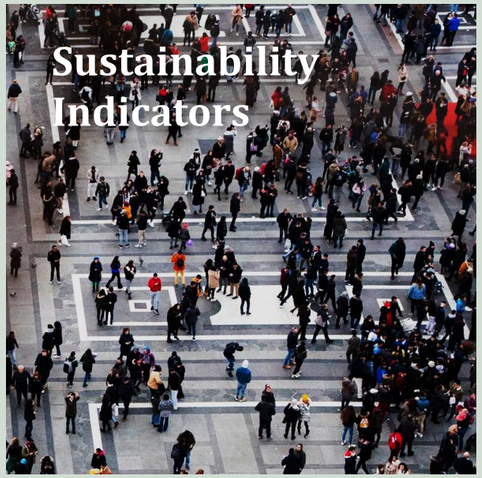

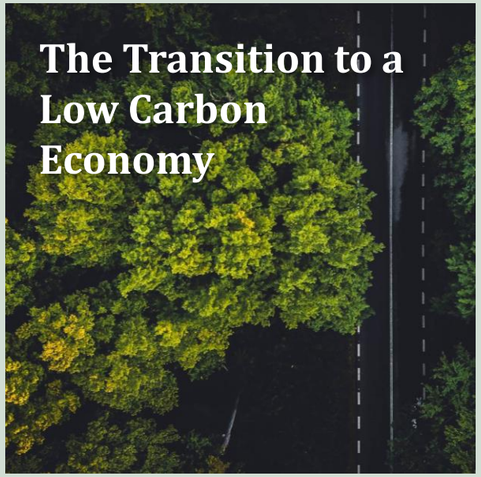

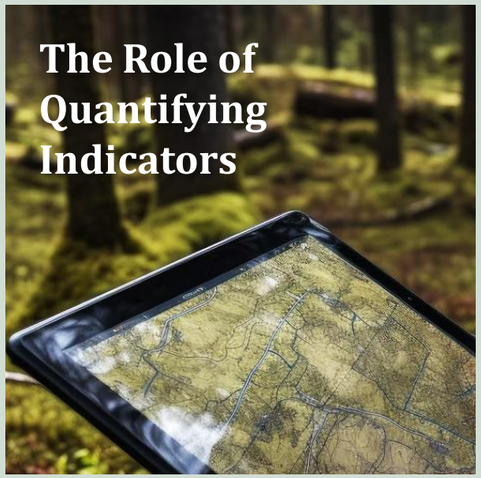

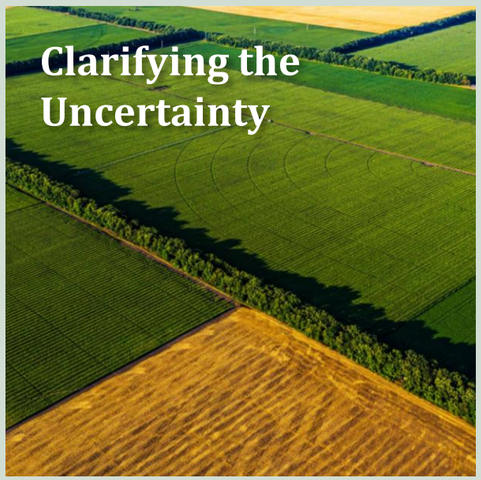

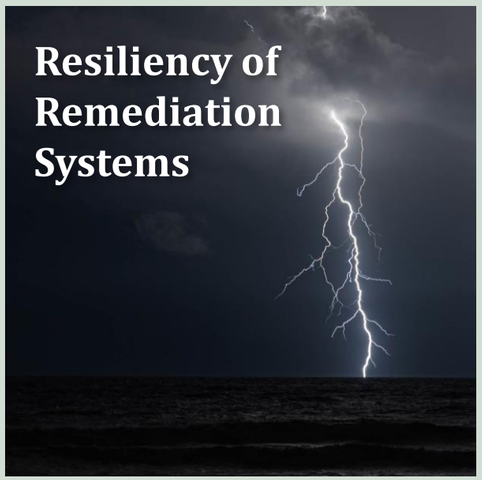

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Case Studies & Additional Information

ERM delivers innovative solutions for the world's leading organizations everyday. Find out how we have helped companies manage their environmental liabilities by clicking the links below.

1. Turning a Business Liability into a Community Asset
2. Beneficial Site Reuse While Minimizing Impact to Community
3. Delivering Remediation in Complex Setting
4. Enabling Sustainable Site Redevelopment
5. Incorporating Sustainable Remediation Across the Project Life Cycle
6. Tracking and Reporting Sustainability Related Considerations Across Portfolio
7. Reduction in Environmental Footprint and Cost Savings
8. Remediation Optimization Through Implementation of Sustainability Principles

For more information on ERM's Liability Portfolio Management and Remediation Services, please contact:

erm.grouplpmr@erm.com

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How ERM can help…

Liability Portfolio Management

Collectively, the management of portfolios of contaminated sites can have a significant influence in terms of a number of sustainability indicators. Increasingly clients are using the benefits of big data management and visualisation techniques to track key metrics for managing their remediation portfolios. Sustainability indicators can be integrated into these dashboards to feed back into overall company performance, to identify and track the benefits of the approach and enable sharing of good practice.

ERM will work with you to identify and track a series of indicators that are relevant to your company and use the findings to identify opportunities to improve performance and maximize sustainability gains for the benefit of the business.

Individual Site Assessment

For individual sites the incorporation of sustainable remediation principles can be integrated around the business goals, regulatory framework and procedures that may apply for a given location to assist in identifying the optimum management solution from an environmental, social and economic perspective and then delivering these benefits during implementation.

ERM has successfully applied sustainable remediation practices at sites across the world using a variety of qualitative and quantitative techniques and can help develop an appropriate approach for a given site or specific circumstances.

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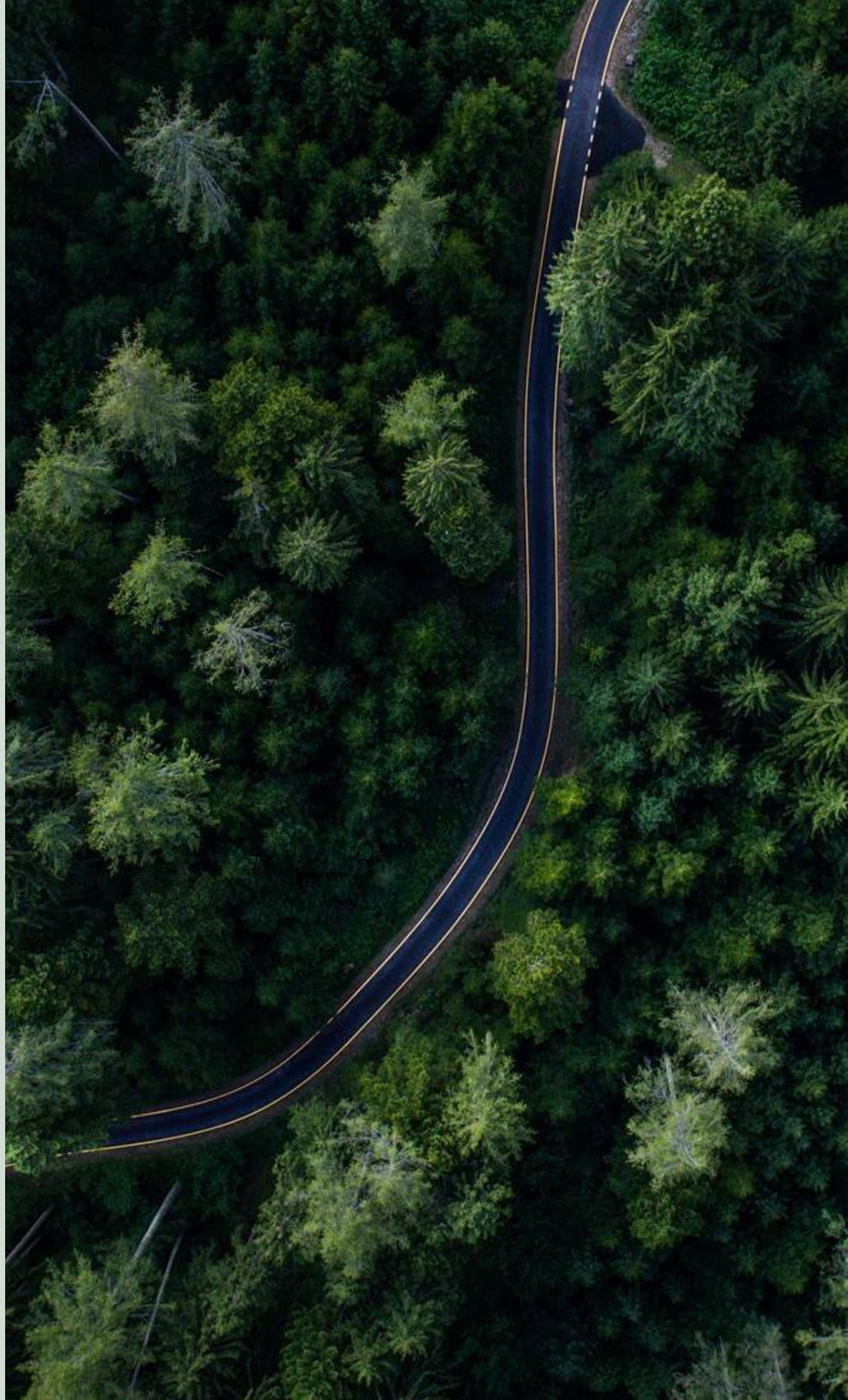


ERM OVERVIEW

8000+
Professionals

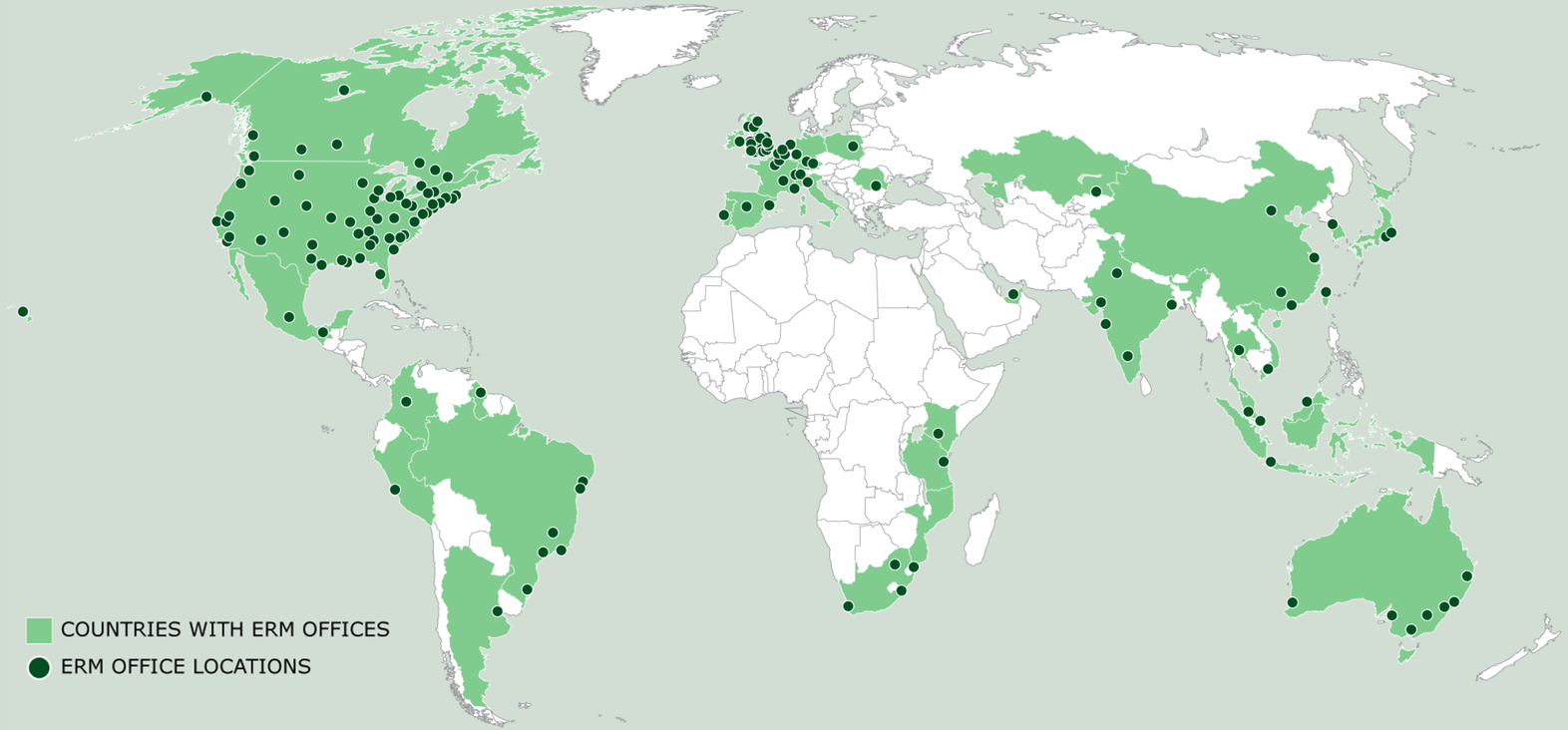
40
Countries & territories

Climate change consulting Leader
Verdantix Green Quadrant 2023

150+
Offices

50+
Years of experience

#1
Sustainability service provider – HFS 2022



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70%
of Fortune 100

55%
of Fortune 500

Sustainable Remediation Case Studies

OPTIMIZING LIABILITY PORTFOLIO MANAGEMENT & REMEDIATION IN A LOW CARBON ECONOMY

Turning a Business Liability into a Community Asset

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CLIENT: Alco

LOCATION:
Ohio, United States

SECTOR/SERVICE:
Chemical/RM

ERM's approach demonstrated the value of incorporating social, economic and environmental concerns early in the remedy selection and remedial design process that reduced costs and were minimally intrusive to the local community while meeting remedial goals. Provided City with a property that is usable, providing jobs for the local community without having to develop another greenspace.

- 100+ year old manufacturing site in the center of a small town surrounded by residential properties
- Site closed and abandoned in the early 2000's
- Site impacted with heavy metals and chlorinated solvents in soil and groundwater
- Worked with City to apply for state redevelopment fund dependent on successful remediation that would be protective of any future use of the property and protective of adjacent residential properties
- Semi-quantitative assessment identified remedy that included small, surgical excavation, shallow trenching and biostimulation via source area substrate injections that was minimally intrusive to the local community while still meeting remedial goals
- Saved 40% over full-scale excavation while returning property to City for beneficial reuse Currently being used for City engineers office and warehousing

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Beneficial Site Reuse While Minimizing Impact to Community

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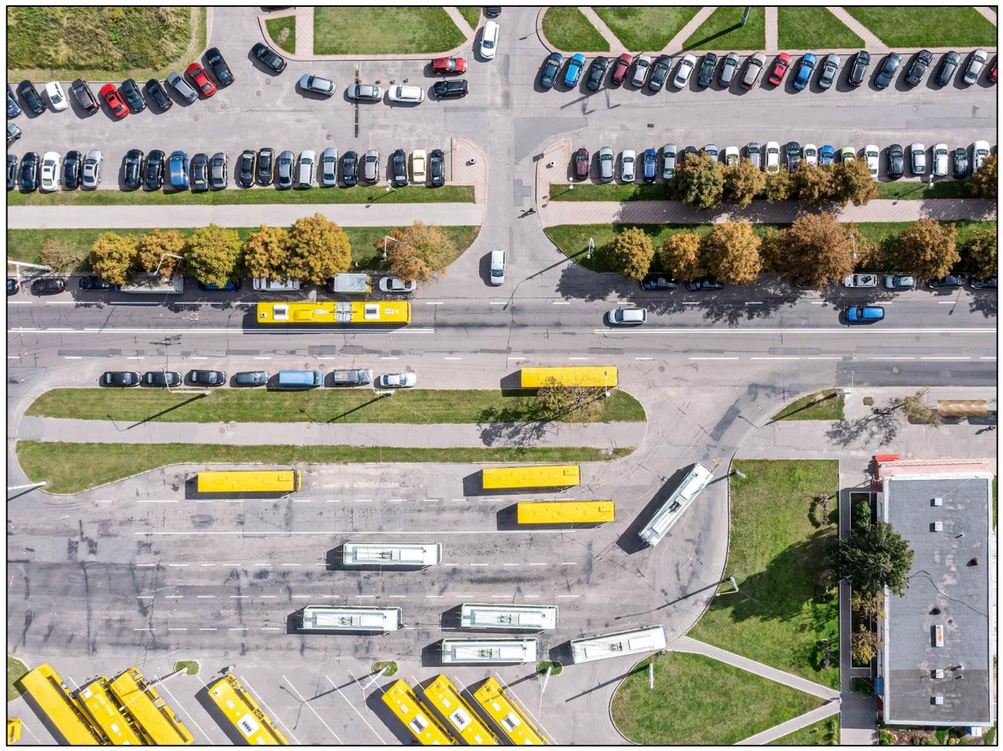
CLIENT: Confidential

LOCATION:
Barranquilla, Colombia

SECTOR/SERVICE:
Chemical/RM

Working closely with adjacent school was critical to safely implement remedial strategy. Strategy was considerably less intrusive, lower cost and more sustainable than alternative dig and haul approach that would have taken longer and created traffic problems on narrow streets while still meeting remedial goals.



- Former bronze smelting facility in Barranquilla, Colombia.
- Operated since the 1950's, ceased operation early 2000's.
- Current owner wanted to use impacted area for employee parking.
- Elevated CrVI and lead identified in shallow soil in 2012.
- Remedy selected in 2016 via semi-quantitative assessment considering adjacent residential properties and particularly immediately adjacent elementary school, beneficial reuse, cost and protection of human health. Coordinated remediation with holiday shutdown of adjacent school and adjacent property owner.
- Remediation was a multi-pronged approach that included shallow soil mixing to chemically reduce CrVI, stabilize lead and cap with asphalt to allow for beneficial reuse with no impact to local community saving almost 30% over dig and haul with beneficial reuse of Site.

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Delivering Remediation in Complex Setting

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CLIENT: World Bank

LOCATION:
India

SECTOR/SERVICE:
Chemical/RM

Capacity Building for Industrial Pollution Management Project (CBIPMP) funded by the World Bank. Orphan site (public & private land) in the eastern part of India: Investigations, remediation design; monitoring and validation of remediation. Chromium bearing sludge dumped (over 30+ years) along a highway by some industries (no longer in operation). Significant redevelopment using waste: filling in low lying area; access roads to industrial/commercial establishments, residences.

As part of programme ERM undertook a remedial options appraisal supplemented by multi criteria analysis (MCA) using sustainability indicators derived from SuRF UK framework.

Given proximity of sites to community and potential interruption of business a detailed social environmental impact assessment was undertaken to identify potential conflicts and provide for early mitigation. Included extensive consultation with the local community.

Broad consent from land owner and occupiers was obtained and outputs formed the basis for a detailed management plan and stakeholder engagement to accompany RAP

The value to the project team was the incorporation of socio–economic concerns early in the remedy selection and remedial design process. Through increased trust, this provided a positive impact and maximized support of remediation activity.

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Enabling Sustainable Site Redevelopment

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CLIENT: Confidential

LOCATION:
United Kingdom

SECTOR/SERVICE:
Remediation Management

Incorporating the sustainability in the remedial options assessment process enabled benchmarking of the engineered approaches to a natural attenuation approach in the context of the redevelopment of the site and provided additional support in negotiations with the regulator and ultimately was the most cost effective option

The site was part of a pharmaceutical manufacturing facility but had previously been used for coal gas manufacturing.

The site was in an area designated by the Local Authority and Mayor of London Office as a high priority for inward investment with grants to attract high technology businesses.

The risk to human health and the environment had to be carefully and realistically assessed against the benefits of site redevelopment

As part of programme, ERM undertook a remedial options appraisal supplemented by multi criteria analysis (MCA) using sustainability indicators derived from SuRF UK framework.

- Much of the environmental benefit came from excavation - rapid contaminant mass removal of a relatively small area of site, undertaken during the construction of the facility
- Much of the social and economic benefit came from Monitored Natural Attenuation - the low cost, unobtrusive, longer term monitoring during construction and the first 4 years of operation

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Incorporating Sustainable Remediation Across the Project Life Cycle

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CLIENT: Confidential

LOCATION:
United Kingdom

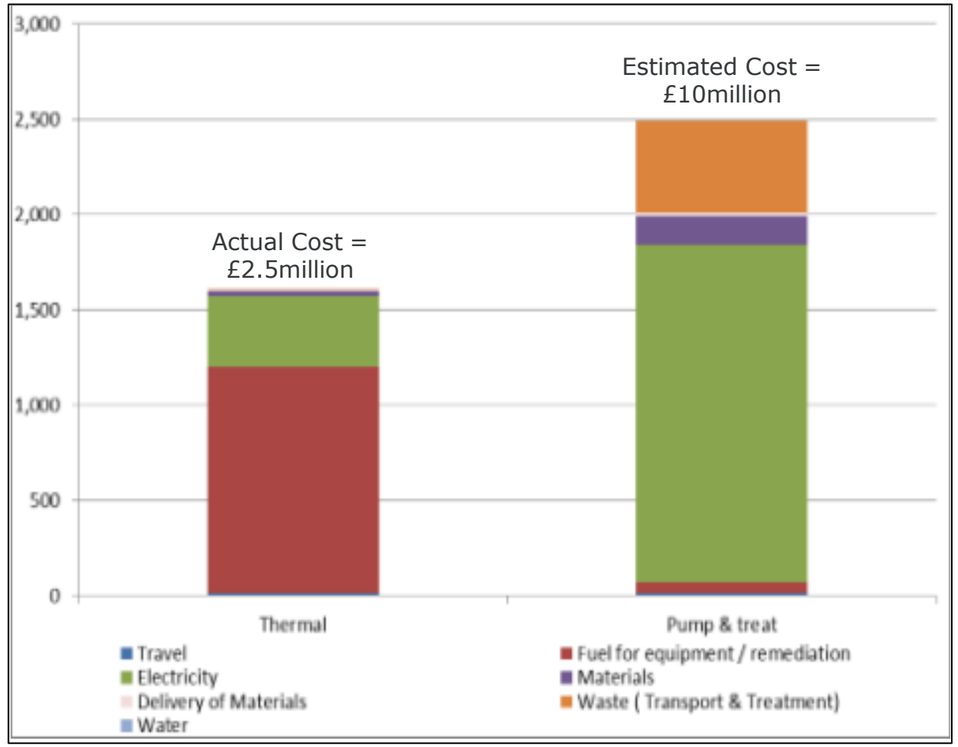
SECTOR/SERVICE:
Remediation Management

A complex site - chlorinated solvents in fractured bedrock and Pump & Treat envisaged as solution - thermally enhanced DPVE selected as alternative. Sustainability considered throughout project. Project boundaries set by corporate policies, timescale and business objectives. Site specific sustainability indicators identified, and metrics were agreed: predominantly Environmental, Economic – reflecting nature of site, but included protection of human health key social metric.

High resolution site characterisation formed the basis for developing robust conceptual model and minimised waste generated, eliminated multiple mobilisations and reduced time on site, manual handling and multiple journeys. Minimised carbon footprint of works 13.5 tonnes CO2e c.f. 33 tonnes CO2e estimated.

Steam injection within challenging geological/ hydrogeological scenario (confined, fractured rock aquifer - contaminants of concern: TCE, cis 1,2-DCE and vinyl chloride). 1,000kg+ of contaminant mass recovered in <3 months post thermal treatment EVO injection to treat residual plume outside thermally treatment footprint combining technologies.

ERM's approach demonstrated the value of incorporating sustainable remediation across the life cycle of the project and challenged the traditional approach with ultimately the overall business benefits being reduced costs and emissions associated with a number of environmental indicators.



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Tracking and Reporting Sustainability Related Considerations Across Portfolio

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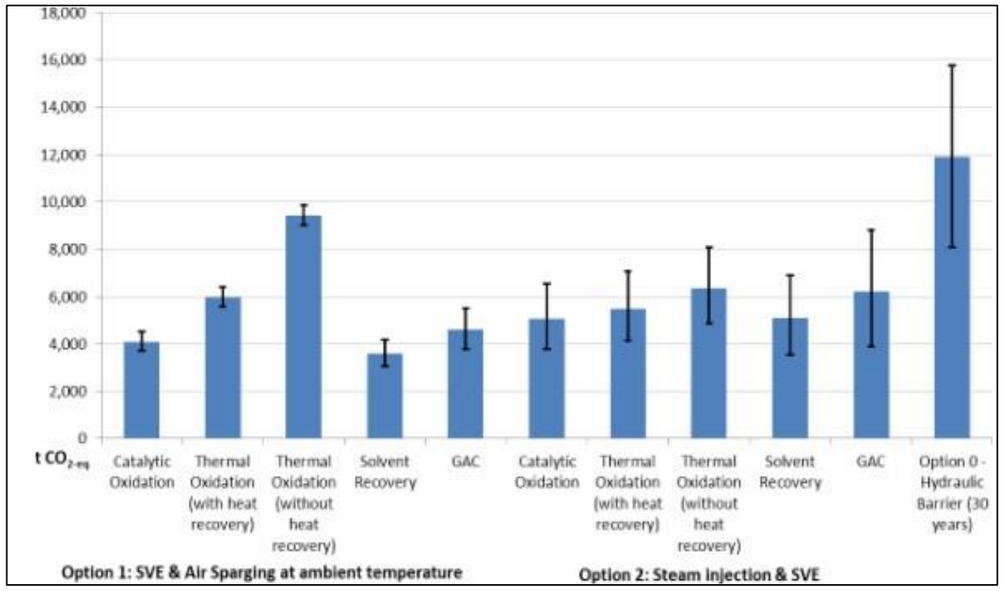
CLIENT: Confidential

LOCATION:
Europe

SECTOR/SERVICE:
Remediation Management

Contribution to sustainability indicators tracked, reductions in cost and a number of environmental indicators at a number of sites, sharing shared learnings and best practices across company



- ERM assisting with management of liabilities at nine sites across the EMEA region through investigation, risk assessment and where necessary remediation

- In addition to traditional metrics, progress is tracked monthly according to corporate sustainability indicators supplemented by other indicators from SuRF UK framework and highlights are shared amongst teams.
- Teams are encouraged to adopt sustainable management practices at each stage of work and consider during procurement to extent possible under local regulatory regime
- Individual actions and benefits (mostly environmental and economic) to date include:
- Include assessment of sustainability in remedial options appraisal (MCA and LCA of some indicators)
- Reduce requirement for active soil remediation as a results of consideration of site-specific risk assessment
- Transition from active to passive remediation at a number of sites
- Reduced costs and environmental footprint ($750k and 514 tCO2-eq in first year)

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Reduction in Environmental Footprint and Cost Savings

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CLIENT: Confidential

LOCATION:
Rhode Island,
United States

SECTOR/SERVICE:
Remediation Management

ERM's sustainability approach provided the client a savings of over $26K in just the first year.

Additionally, the approach eliminated piped and/or trucked water, eliminated running new power or using generators, and automation minimized zero emissions (No GHGs - CH4, CO2, N2O).

ERM was retained to design, build, and operate a sustainable in situ chemical oxidization (ISCO) system for a confidential client in Rhode Island. The entire system is designed using Green Technologies. It is completely powered by the sun and is remotely operated via internet-based telemetry.

The site's remediation system has been operating off-grid and injection has been taking place carbon-free. ERM implemented the following systems:

- Solar-powered remediation system – The ISCO system is completely powered by the sun, using an ERM-designed 2.4 kW solar photovoltaic array with a battery-backed inverter system
- Remote operation and monitoring – The system is remotely operated via internet-based telemetry and allows reduced field visits, saving our client labor expenses
- Automated pumping system – ERM designed, built, and installed an automated manifold and pumping system that safely sends the oxidant mixture into a well field

ERM's sustainable site solution provided a refreshed outlook on more "traditional" remedial implementation in three key areas:

- Power Supply: Use sunlight to power system
- Rainwater Collection: Use rainwater for solution
- Operation: Remote, real-time automation for query, control and data-logging

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Remediation Optimization Through Implementation of Sustainability Principles

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CLIENT:
Confidential

LOCATION:
Brazil

ERM's sustainability approach resulted in 650 fewer lorry movements through populated areas reducing the potential for accidents and also resulted in a 24% reduction of waste transportation diesel consumption.

ERM helped Client reduce environmental footprint through the remediation and disposal of over 24,000 tons of hazardous materials associated with former lagoons at an agricultural chemical production facility in Brazil.

Client was focused on making the remediation project be as sustainable as possible. The following activities were performed to remove and dispose of excavated wastes and impacted soils at the identified areas:

- Excavation, transportation and off-site disposal into a co-processing facility of all perceived impacted soil and buried waste;
- Segregation, storage and reutilization of clean soil as backfill; and
- Restoration activities.

Other best management practices included the use of the same trucks to haul waste and also transport the clean soil and the use of a live stream feed so that Client stakeholders could watch the project from their remote offices, eliminating travel and therefore fuel and time efficiencies. The Client project manager also used the camera to scan in and direct others on site as needed, which helped to save costs on construction management. This also allowed Client stakeholders in the USA and Africa to follow field work more closely.

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Additional Information

OPTIMIZING LIABILITY PORTFOLIO MANAGEMENT & REMEDIATION IN A LOW CARBON ECONOMY

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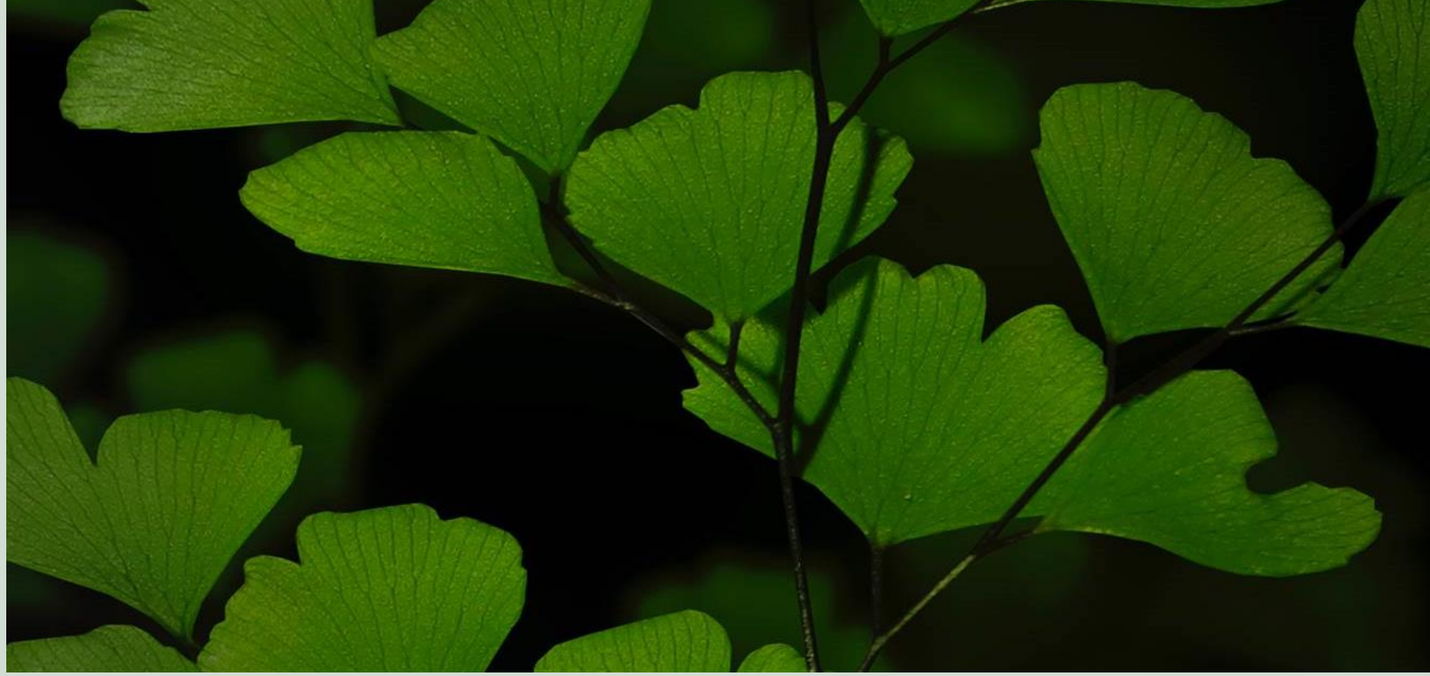
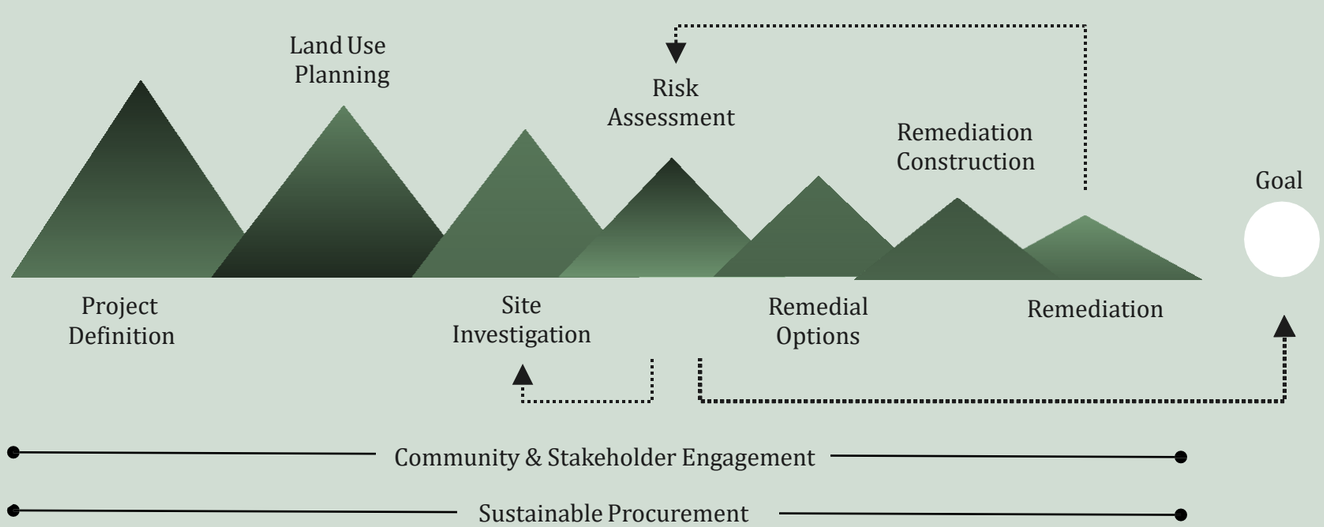
Sustainable Remediation Through the Project Life Cycle

ERM's recognizes that the principles of sustainable remediation can be applied throughout the life cycle of a project and not merely at the remedial options appraisal stage. A critical decision that can have far reaching effects on the nature and scope of any remediation is the basis for deciding whether remediation is required, and this can be influenced by land use planning, the conceptual site model and the assessment of site specific risks. Decisions made at this stage can have far greater consequences to overall sustainability than the remedial options appraisal itself. When a remedial options appraisal is completed then ideally the principles of sustainability should be carried forward through the construction and optimization phases where key metrics can be tracked, practices to mitigate or enhance adopted and benefits realized.





Setting the remediation specification and strategy
Are there unacceptable risks?
Is remediation really required?

Setting the remediation technical approach
Selecting the technology, maximizing the environmental, social, and economic value

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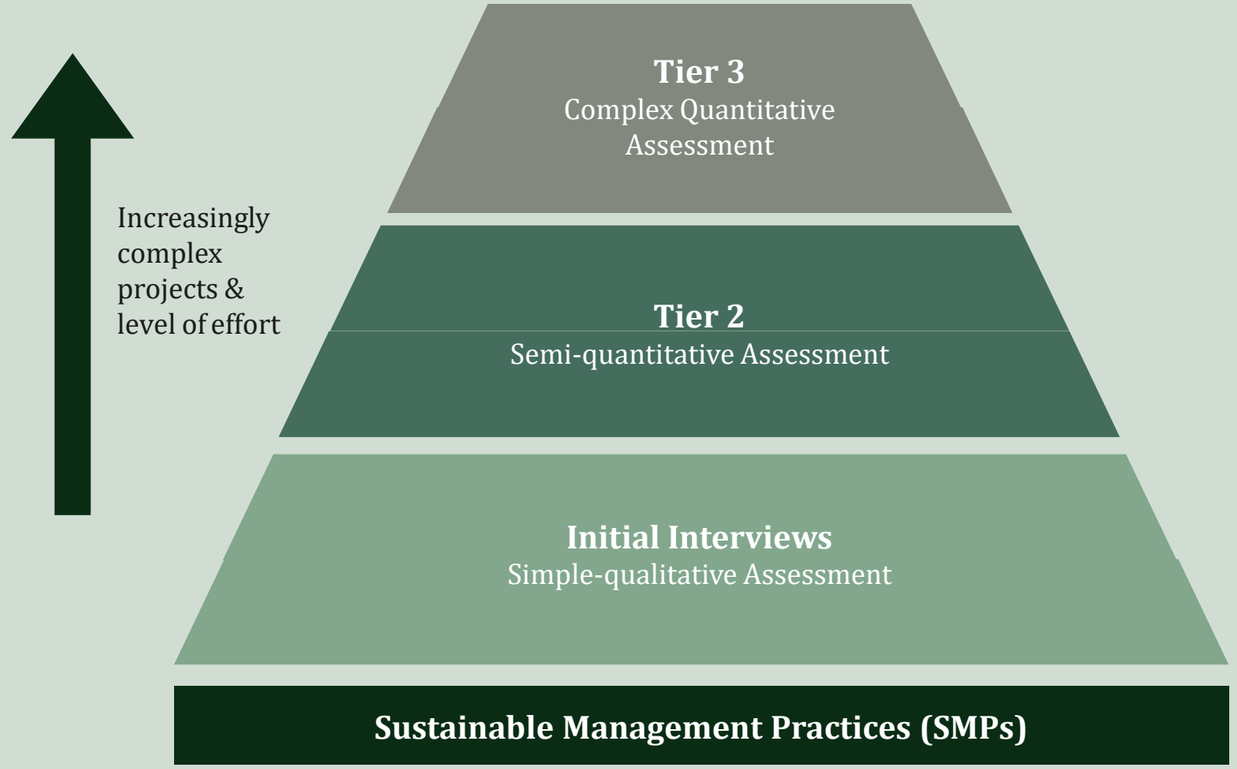
The Tiered Approach to Sustainability Assessment

"As a general rule, the simplest form of sustainable remediation assessment that allows a robust decision to be made should be adopted" ISO 18504:2017

Similar to the principles applied in risk based corrective action, sustainable remediation assessments are typically undertaken using a tiered approach where the degree of effort and complexity increases with the complexity of the project. For the majority of sites then simple qualitative or semi quantitative measures are used to evaluate sustainability. More complex quantitative assessment such as carbon foot printing or cost benefit analysis are only used at more complex sites or where there is significant uncertainty.

ERM adopts this approach in our assessments to ensure that the resources and effort used to implement a sustainable remediation assessment are suitable and appropriate to client and project needs.



Adapted from tiered approach to sustainability assessment © CL:AIRE 2015

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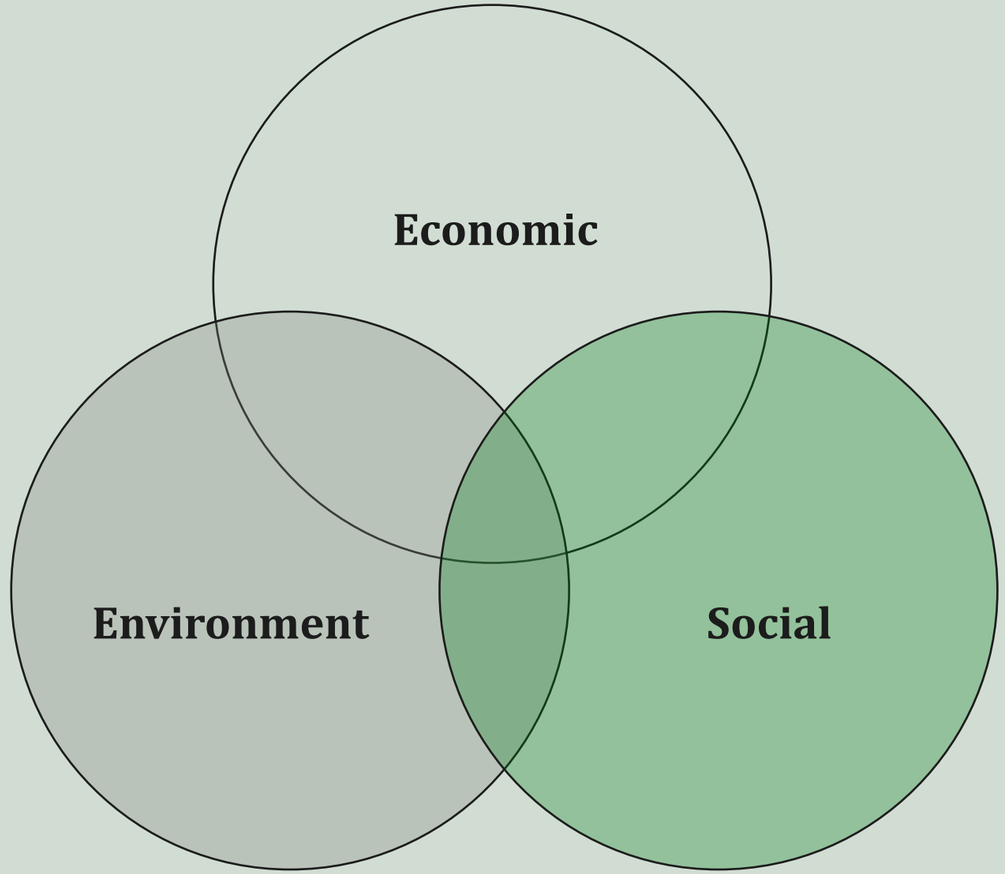
Sustainability Indicators

There is no single unit or measure of sustainability and some aspects cannot be readily quantified. The selection of appropriate environmental, social and economic indicators is therefore a key part of any sustainability assessment. ERM draws on the range of published indicators and integrates them with projects goals and objectives.

ERM focuses on those indicators that are both relevant to a site and are likely to offer significant differentiation between the remedial alternatives under consideration.

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



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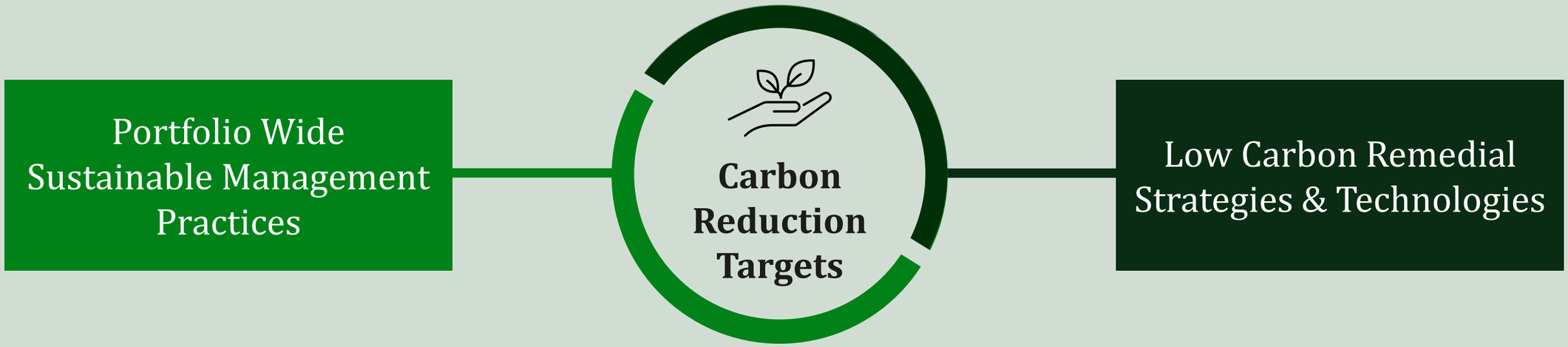
Sustainable Remediation & the Low Carbon Economy

Adopting sustainable remediation principles can contribute to carbon reduction targets

Climate change is dramatically shifting how business is done. Investors have underscored the urgency with which organizations need to tackle climate issues, demanding Boardrooms address, at a minimum, climate risk transparency and business resilience. As the transition to a low carbon economy accelerates, a breadth of stakeholders are putting pressure on companies to raise the bar on how they reduce their impact, mitigate risks, and seize market opportunities.

For existing portfolios the carbon footprint and other sustainability indicators associated with ongoing management can be added into your company's overall sustainability metrics and other sustainable management practices. Adopting sustainable remediation principles can help maximize sustainability metrics for assets when they are being retired and redeveloped. Where appropriate, low carbon remedial technologies can be deployed to minimize the footprint of remediation works.



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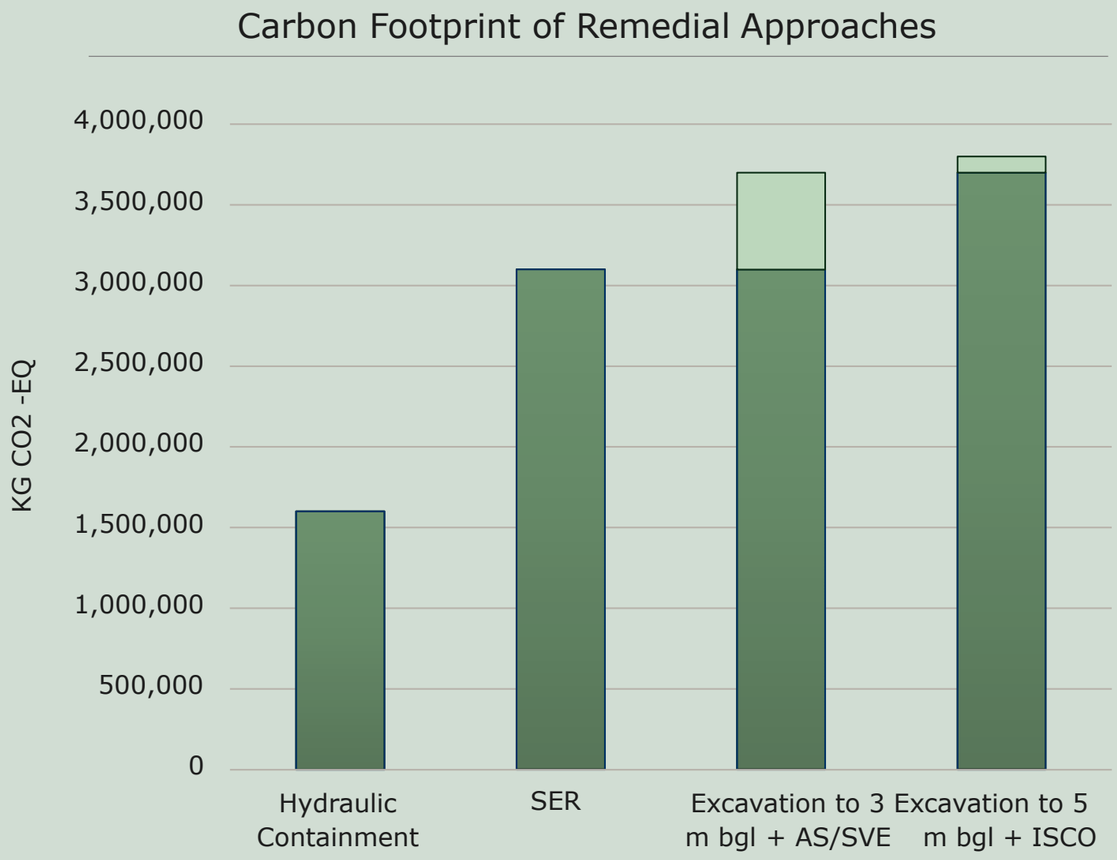
The Role of Quantifying Indicators

A sustainable alternative is one that provides the optimum balance between environmental, social and economic costs and benefits.

There is no single quantifiable metric to assess this balance, but a range of tools are available that can quantify one or more indicators (ex. a life cycle assessment or the carbon footprint of a given technology).

This measurement alone does not provide an overall indication of sustainability, but can be integrated with other lines of evidence for other indicators to form part of a holistic sustainability assessment.



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Sustainable Remediation & the Sustainable Development Goals

In 2015 the United Nations General Assembly adopted the 2030 Agenda for Sustainable Development, which seeks to establish global consensus for the next 15 years.

The 17 Sustainable Development Goals (SDGs) aim to address some of the world's pressing economic, social and environmental challenges.

UN member states are expected to use the SDGs to frame their development agendas, and there is a recognition that the private sector will play an important role in achieving them.

The SDGs present an opportunity for business-led solutions and technologies to be developed and implemented to address the world's biggest sustainable development challenges.

A number of sectors have or are in the process of mapping out potential interactions and opportunities with SDGs.

SuRF UK has mapped out the potential synergies between the SDGs and sustainable remediation indicators. ERM can work with you to ensure alignment between SDGs that may have been adopted at a corporate level with a site or portfolio specific approach for tracking and reporting.

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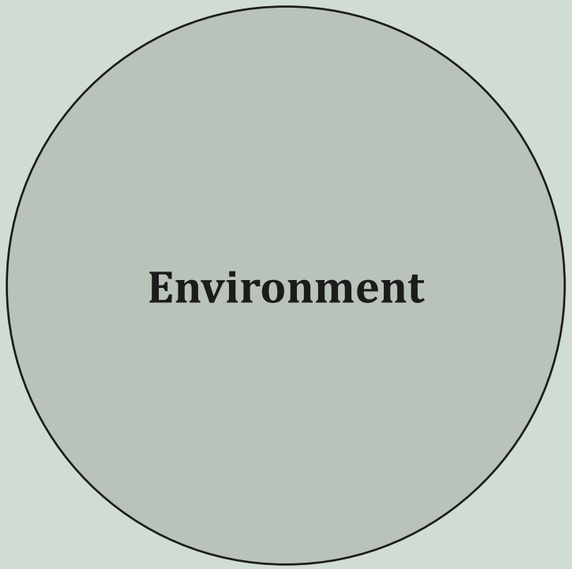
Clarifying the Uncertainty

Green Remediation is the practice of considering all environmental effects of remedy implementation and incorporating options to minimize the environmental footprints of clean- up actions.



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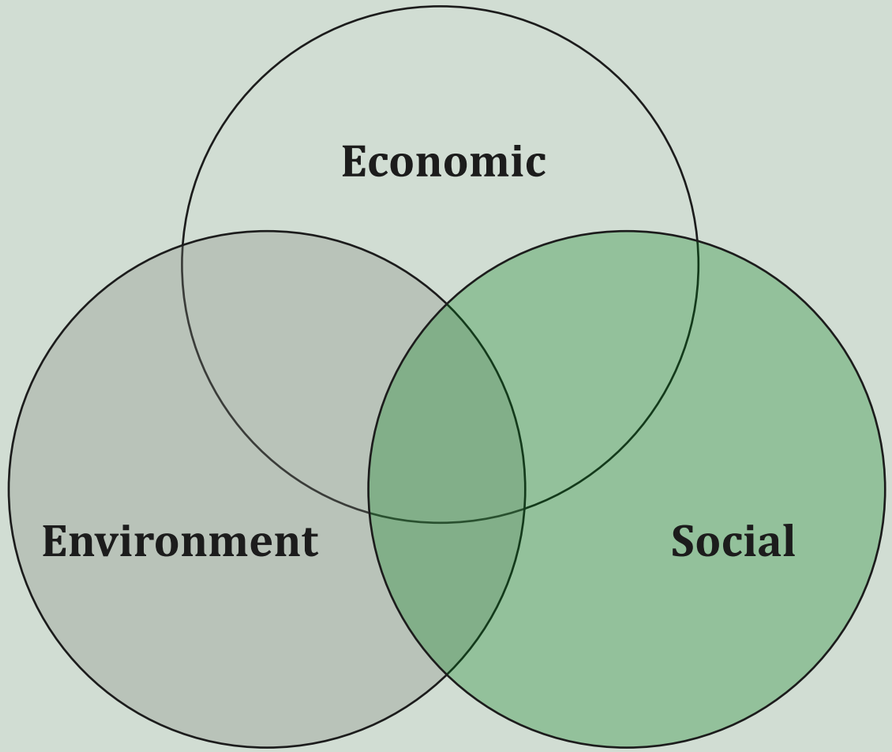

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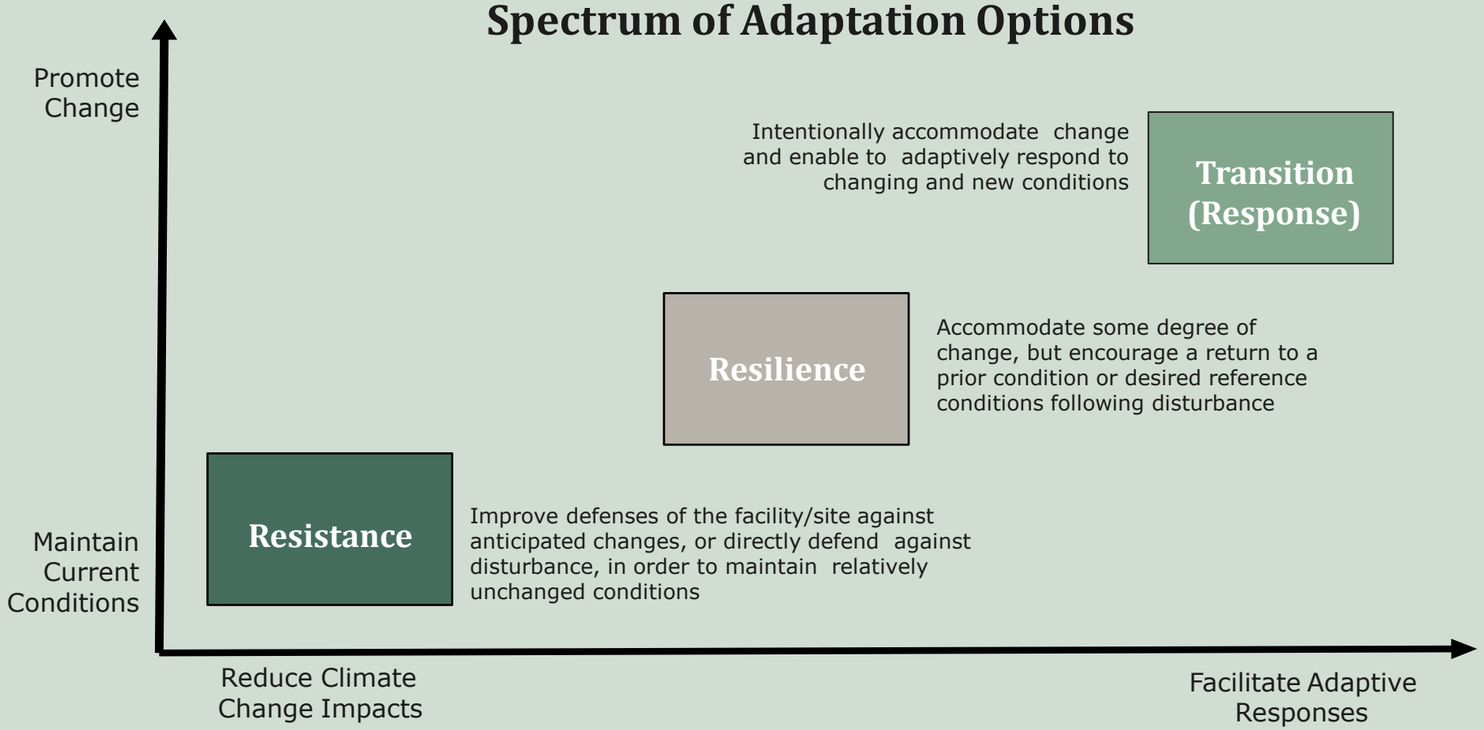
Climate Change Risks and Sustainable Resilient Remediation at Liability Sites

Extreme weather events and wildfires due to climate change can cause considerable damage to, and even catastrophic failure of, existing remediation systems, significantly increasing company exposure to additional financial, legal and reputational risks.

ERM works with our clients to mitigate risk by assessing liability sites at any stage of the project life cycle using the 3 Rs – Resistance, Resilience and Response, depending on the project need including building resiliency into sustainable remediation design/implementation of new systems, adapting existing systems or rebuilding/redesigning damaged systems.

Spectrum of Adaptation Options



- Stakeholders
- Containment Breaches
- Infrastructure
- Surrounding Community
- Increased Costs
- CSR
- Company Value
- Company Reputation

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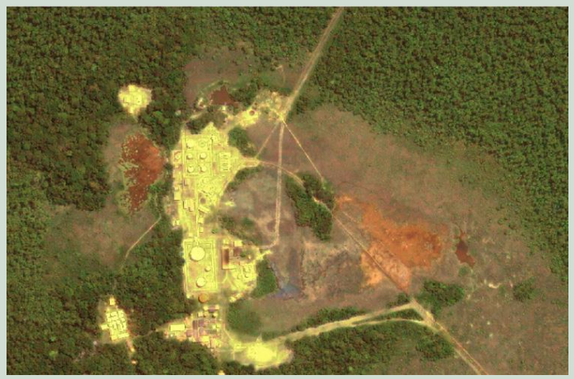
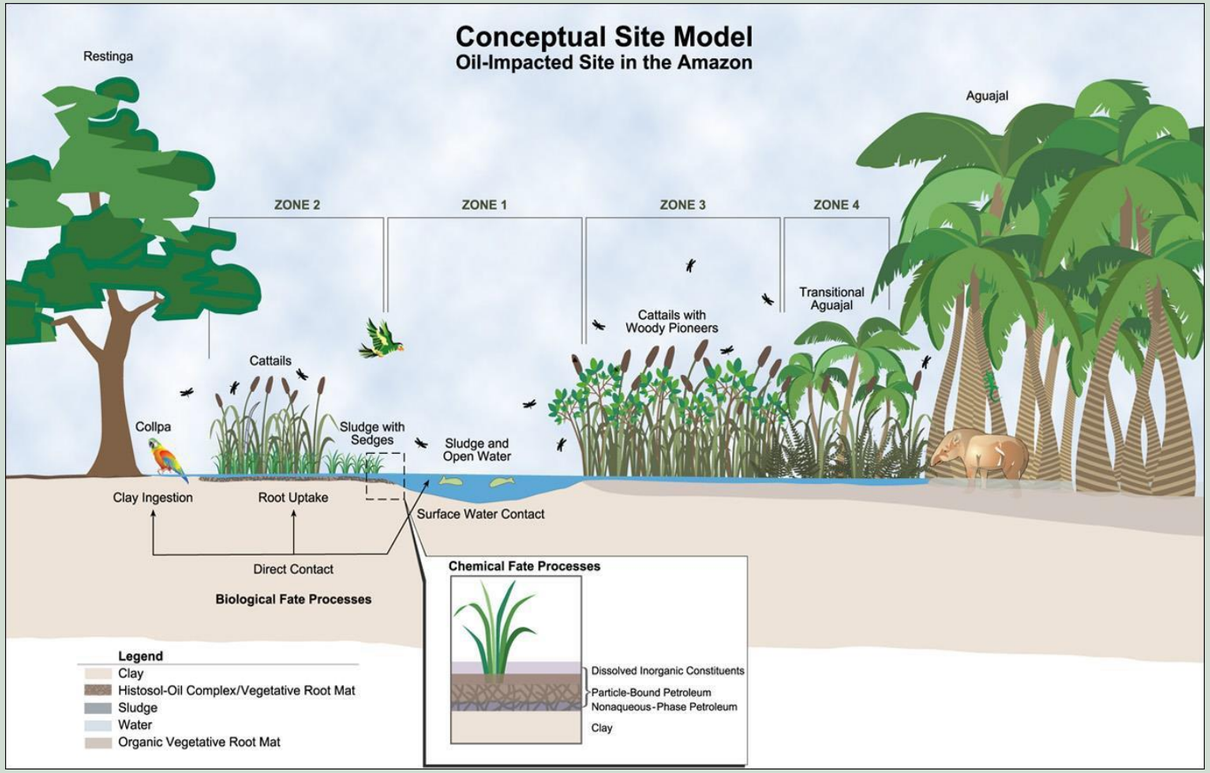
Nature Based Remediation Solutions

Nature based remediation solutions aligns with sustainable remediation incorporating elements of local natural ecological systems and/or processes into remedial strategies.

Nature based solutions can be implemented as early as the investigation phase by utilizing phytoforensics and molecular biological tools (MBTs) to characterize contaminant impacts.

Nature based solutions remediation can include: phytoremediation, in situ bioremediation, engineered wetlands, monitored natural attenuation (MNA) and natural source zone depletion (NSZD) for cost effective, sustainable and resilient treatment of contaminated soils, groundwater and surface water and can also be incorporated into an NBS redevelopment strategy.





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