Keystone Environmental

Knowledge-Driven Results

Brownfield Re-use + Sustainable Remediation = Sustainable Development

Environmental Services Association of Alberta (ESAA)
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Environmental Consulting

Engineering Solutions

Assessment & Protection

KeystoneEnviro.com

OUTLINE

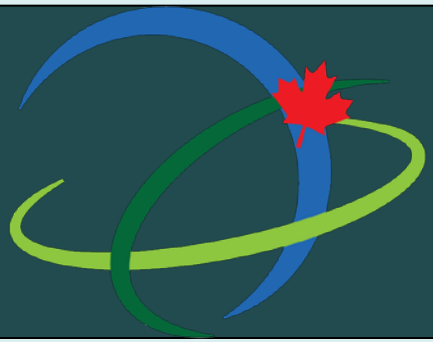
1. Introduction
2. Definitions
3. SuRF and Development
   - UK
   - US
   - Canada
4. Case Studies
5. Lessons Learned

SuRF CANADA

- Professional network promoting sustainable remediation (SR)
- Since May 2011 with representatives from industry, land owners, provincial and federal government, and academia
- Partnerships and collaboration both nationally and internationally to innovate and raise awareness

- Goal = SR becomes “business as usual”

SuRF FORUM SUR LA RÉHABILITATION DURABLE

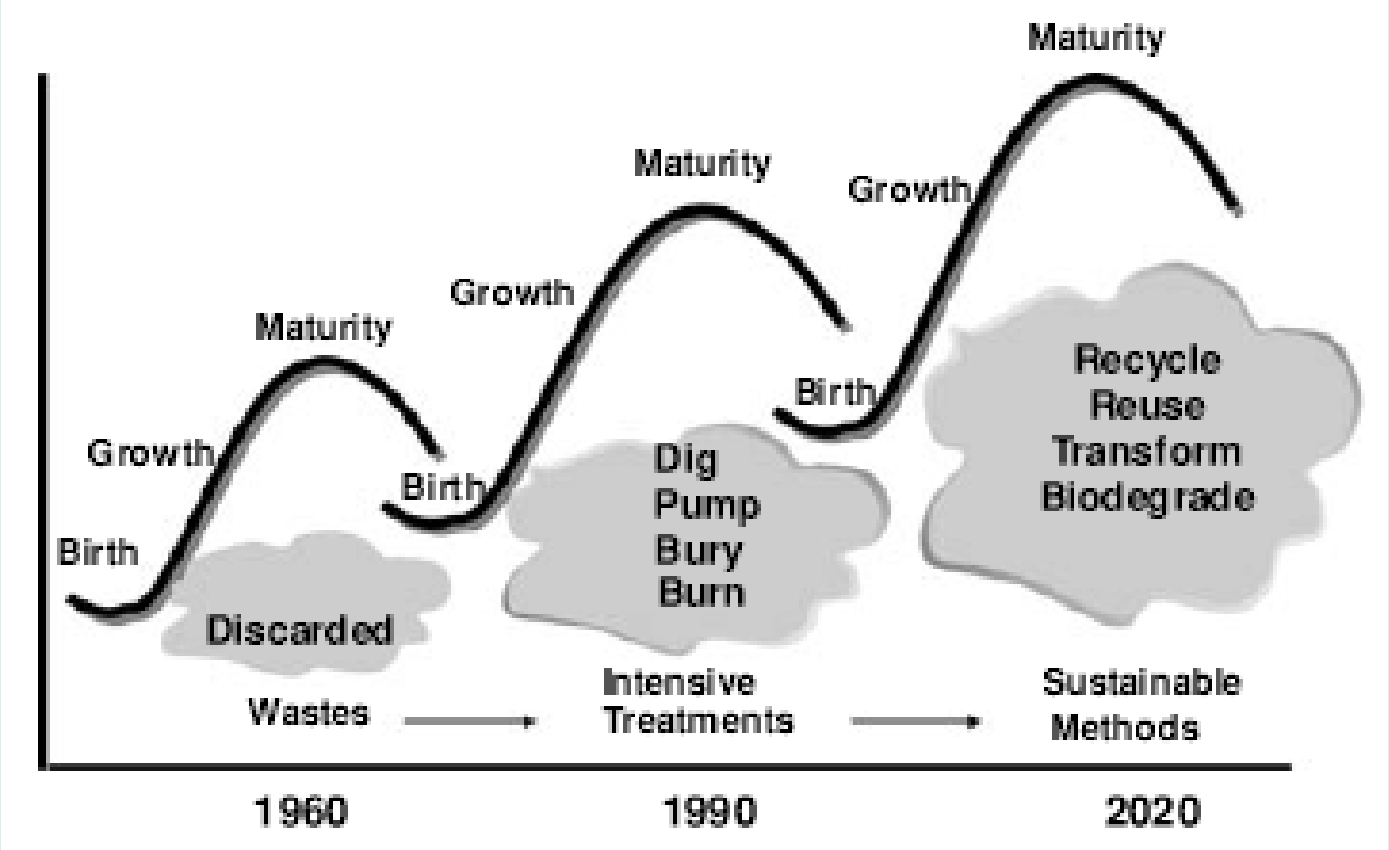


SuRF SUSTAINABLE REMEDIATION FORUM

Join the LinkedIn Group

EVOLUTION OF REMEDIATION

"Sustainable Remediation. A UK Perspective", Smith, J., Batelle 9th Int'l Conference, Monterey (May 2014)

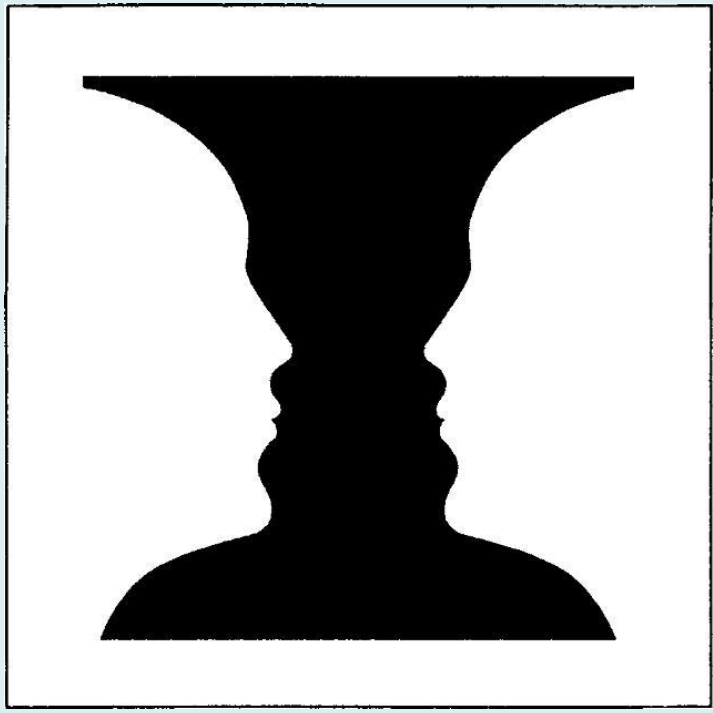


Knowledge:	**Ignorance**	**Recognition**	**Increasing understanding (and expectation)**	
Response:	**Apathy**	**Outrage**	**Increasingly objective response**	
Remediation:	**None**	**Every Molecule**	**Risk-based**	**Sustainable risk-management**

A COMMON UNDERSTANDING

Terms, objectives, scope and metrics must be clearly understood by all parties

- Is it soccer or football?
  Is football the same as football?
- “Best Practice” : consistently superior results; a benchmark; evolves with improvements
- “Safe” : protected from or not exposed to danger
  - Hazard vs. Risk
- “Clean-up” : removal of contaminants or risks



Source: http://funeyetest.com

SUSTAINABLE DEVELOPMENT

“Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”

(World Commission on Environment and Development, 1987, the Brundtland Report)

SUSTAINABLE REMEDIATION

(SuRF-UK, 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."

(SuRF CANADA, 2012)

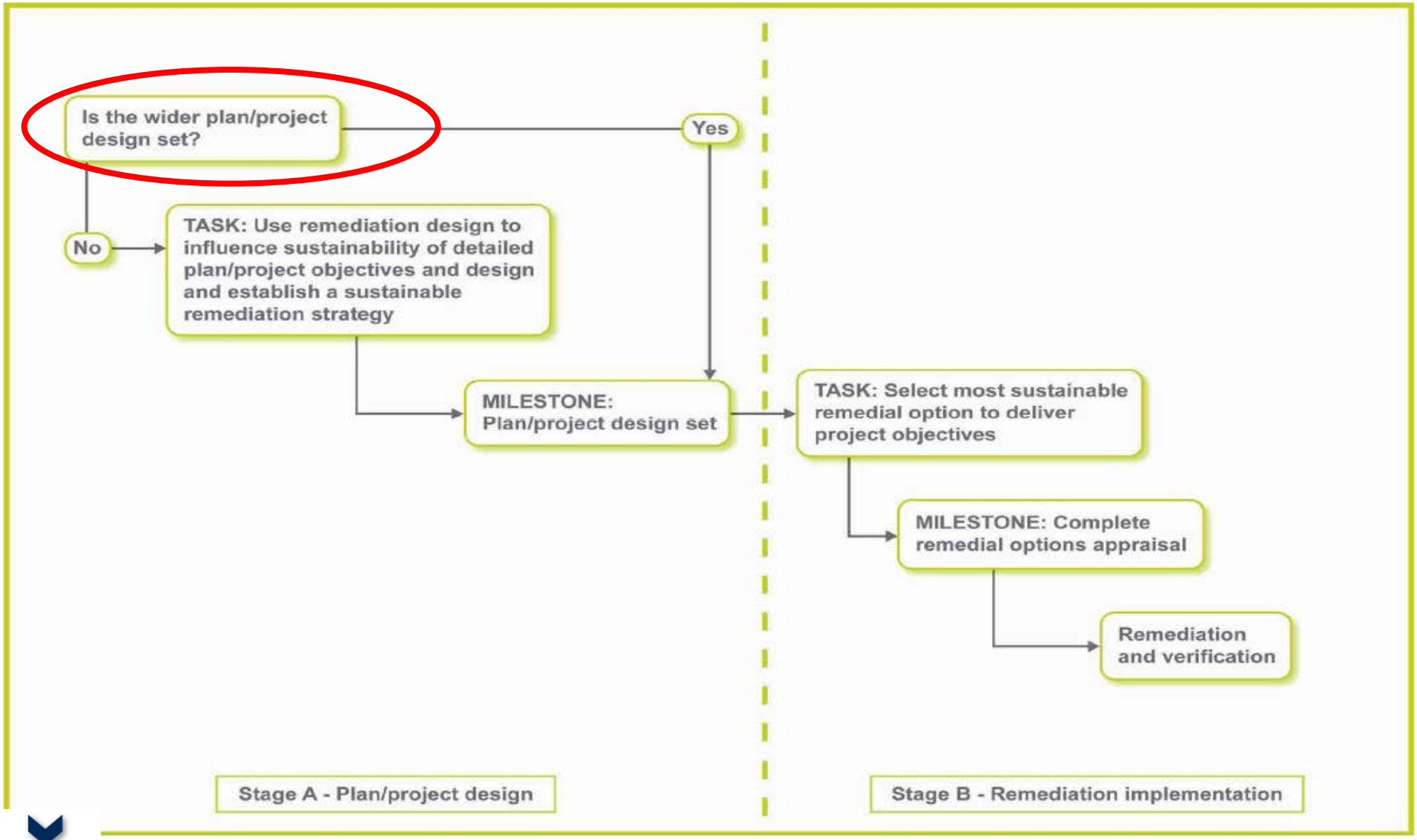
"Sustainable Remediation considers the **environmental, social, economic impacts** of a project to ensure an optimal outcome, while being protective of human and environmental health, both at a local level and for the larger community.

www.SuRFCanada.org

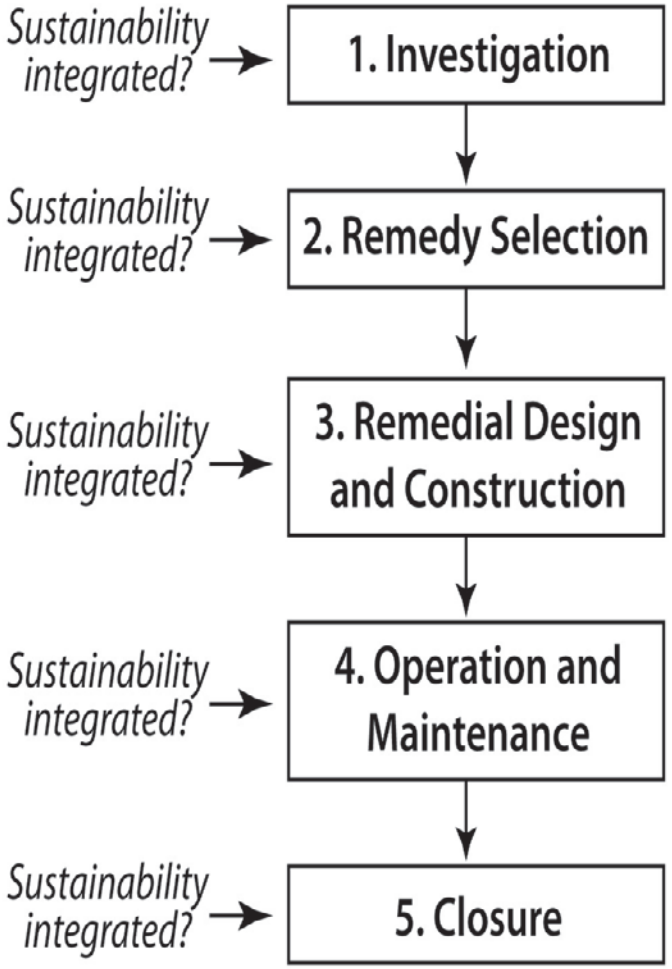
SuRF-UK : KEY PRINCIPLES

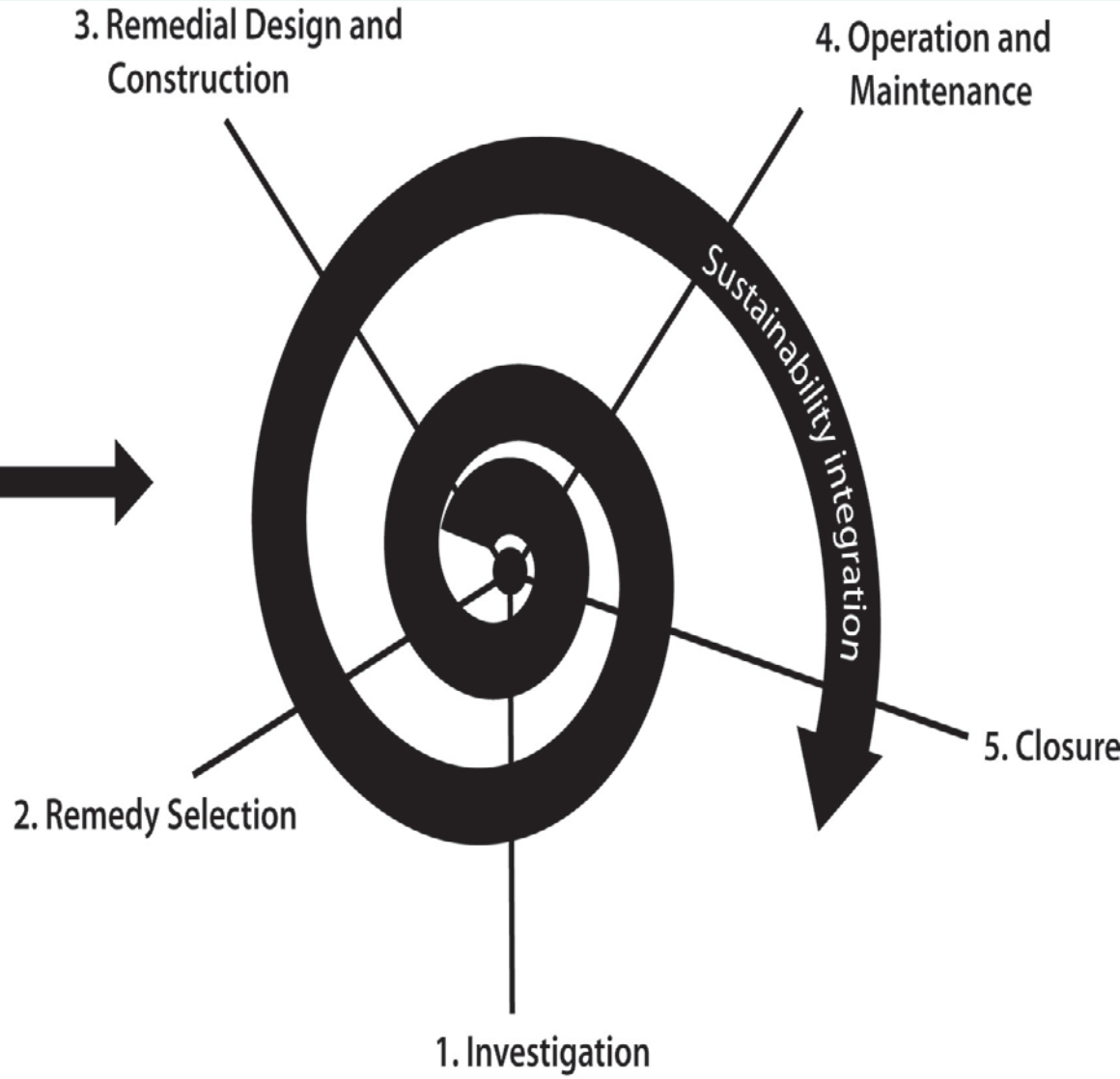
- Protection of human health and the environment
- Safe working practices (for workers and local communities)
- Consistent, clear, and reproducible decision-making
- Transparent reporting (including assumptions and uncertainties)
- Good governance and stakeholder involvement
- Sound science

SuRF-UK : FRAMEWORK



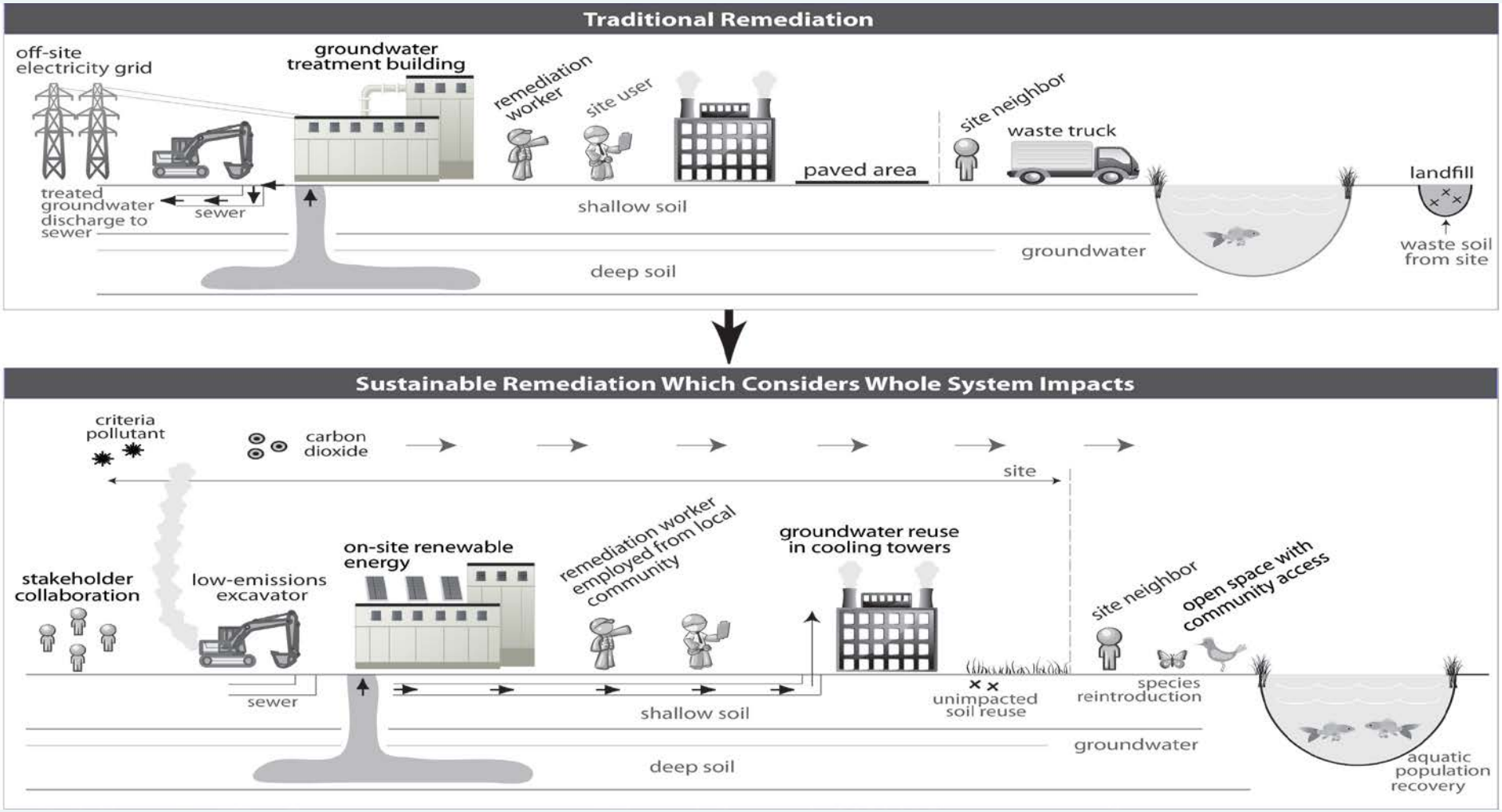
SuRF-US : FRAMEWORK





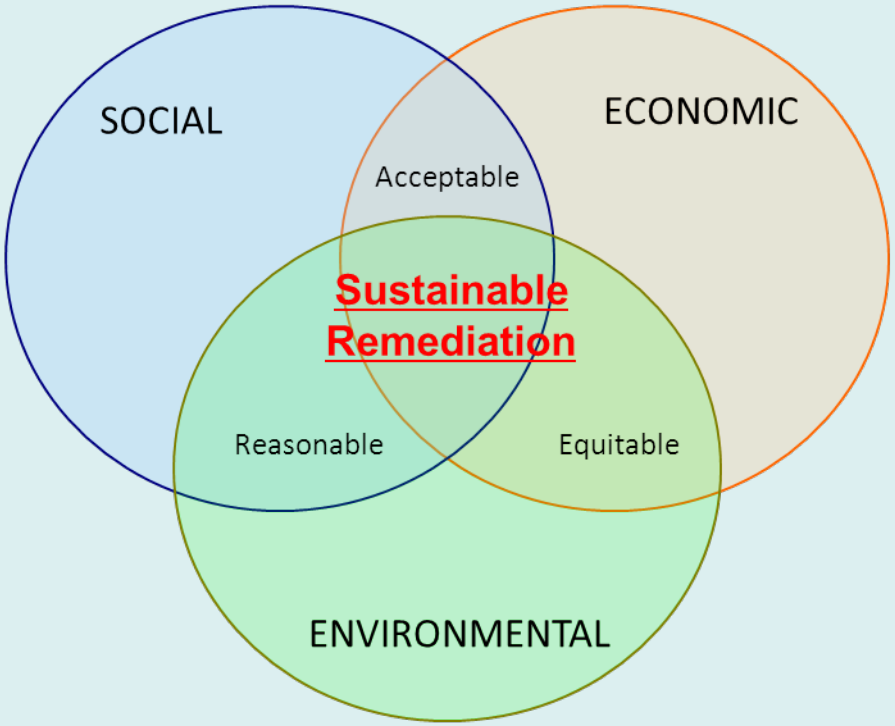
"Sustainable Remediation Framework" Haley et.al.,Spring 2011 Edition of Remediation Journal (June 2011)

APPLIED SUSTAINABLE REMEDIATION



"Sustainable Remediation Framework" Haley et.al.,Spring 2011 Edition of Remediation Journal (June 2011)

WHY SUSTAINABLE REMEDIATION ?



ENVIRONMENT
- Finite availability of resources
- Risk-based management
- Reducing emissions, waste, discharges

SOCIAL
- Risk management
- Regulatory compliance
- Positive corporate image
- Stakeholders' involvement & buy-in

ECONOMIC
- Cost Reduction / Savings
- Increasing land value
- Enhancing shareholder's value

CASE STUDIES

CASE STUDY
Former Burnaby Rifle Range

Challenges:

- Target & skeet range, 1950s to 70s
- Unused contaminated land; contamination ~ 2 hectares
- Lead, copper, zinc, antimony and PAHs
- Concentrations > hazardous waste standards

Sustainable Remediation:

- In-situ capping, and solidification and stabilization of metals
- Relocation of Haz Waste soil to new secured landfill within property
- Remedial plan incorporated creation of open green spaces, walking trails and improved stormwater management features

CASE STUDY
Former Burnaby Rifle Range

CASE STUDY
Former Burnaby Rifle Range

ENVIRONMENTAL	SOCIAL	ECONOMIC
Metal-contaminated soil was excavated, solidified & stabilized.	Sustainable solution that met all regulatory requirements and site re-development objectives	Cost effective solution
Soil placed in a nearby newly constructed secured landfill **Reduction of waste transported off-site and recycling of waste**	Avoided the impacts of soil transportation on the streets and neighbors Avoidance of noise and air emissions	>$1 M savings to the City Monitoring <$15 K/year
Ecological improvements that also managed surface runoff, reducing contaminants & peak flows to environment	Creation of municipal park and recreation areas from previously contaminated lands for use by the public / community	

CASE STUDY
Jordan River Engineered Wetlands

Challenges:

- Landfill leachate seeps discharging to Jordan River and its tributary
- Dissolved sulphides up to 50 times the BC WQG

- Pending sale of site for future park use
- Remote location

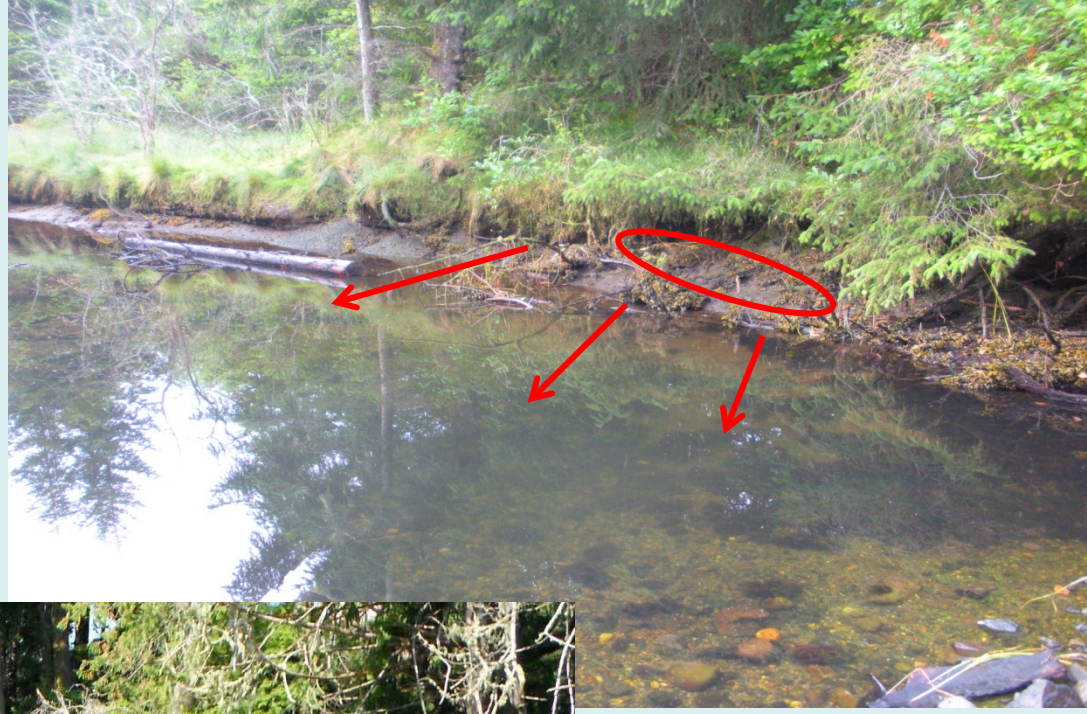
Sustainable Remediation:

- Engineered Wetlands
  - Minimal maintenance
  - No additional operator duties
  - No additional utility requirements
  - Re-using native vegetation for the replanting

Prior to remediation

After remediation

Prior to remediation



After remediation

CASE STUDY
Jordan River Engineered Wetlands

ENVIRONMENTAL	SOCIAL	ECONOMIC
Achieved remedial goals Mimic natural processes	Supported the reclamation of wood waste landfill as park land	Minimized capital cost by eliminating disposal cost of excavated material
Provide additional habitat for riparian and aquatic habitat	Accommodated neighboring First Nation operation	Minimized long term O&M costs (no energy use)
Low GHG emissions (hauled excavated material to on-Site landfill)	Minimized off-site traffic disruption	

CASE STUDY
Meadow Avenue Project

Challenges:

- Soil : Creosote NAPL => dissolved PAH plume
- Sediments : PAH in inter-tidal and sub-tidal, as high as 20,000 ug/g, 8 m deep
- Groundwater : dissolved PAH (shallow & deep Sand aquifers)

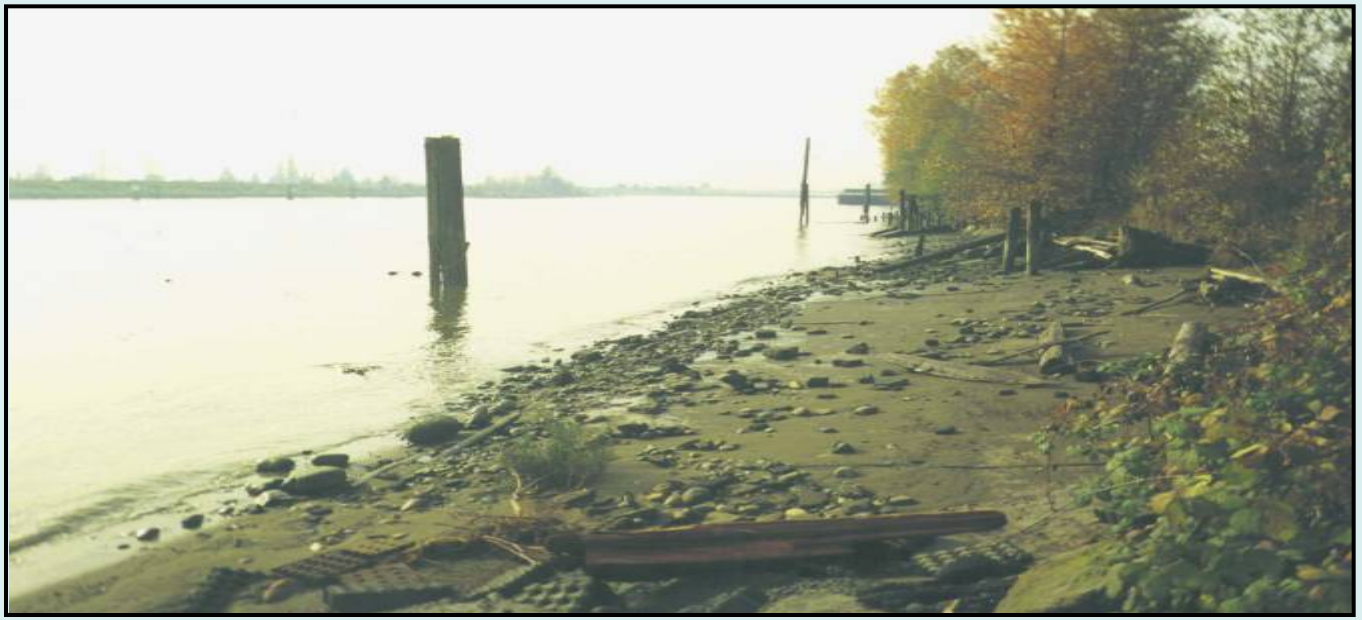
- Impacted sediments (50 m from shoreline; 3 different properties)
- Preventing development of adjacent properties
- Limiting use of main site

Sustainable Remediation:

- Dredging outside of containments using caissons
- Subsurface containment, barriers and caps

  => new industrial wharf & new engineered marshland / habitat restoration
- Avoidance of long-term Pump and Treat

Prior to remediation



After remediation

Prior to remediation

After remediation

CASE STUDY
Meadow Avenue Project

ENVIRONMENTAL	SOCIAL	ECONOMIC
Achieved remedial goals Enhanced fish habitat	Supported social / industrial re-uses in the remedy Improved site's navigational features	Allowed development of neighbouring lands resulting in economic development for the City and Region
Low GHG emissions (rail instead of trucking) and low energy consumption (no P&T)	Stakeholder engagement throughout the process	Optimized costs with contractor / consultant partnership through design and construction stages
Risk management of remaining sources	Implementation with minimal disturbance to Tenant & Neighbours	Saved >$35 M in capital costs Minimized long term O&M costs

LESSONS LEARNED

- Start with the end in mind (Preferred End Use / Future Use)
- Involve all stakeholders in developing your SR framework
- Set boundaries : any assessment will not be unlimited
- Avoid potential confusion over meanings and manage expectations
- Select the simplest approach first; assessment should be proportionate to project scale, complexity and sensitivity

  Qualitative ➔ ➔ ➔ ➔ ➔ ➔ Quantitative
- SR is a Holistic Approach / Process, not an off-the-shelf Technology

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