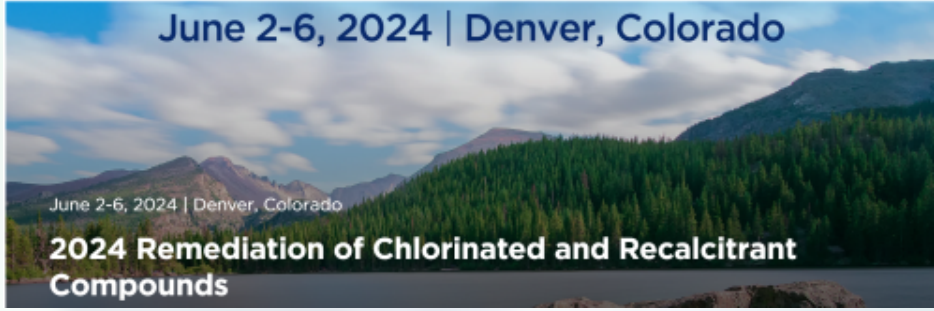


Novel Sustainability Scoring Method for Soil Remediation Technologies

***John Sankey**, P.Eng., Technical Sales – True Blue Technologies,*
Ysaline Depasse, M.Eng., R&D Engineer – Haemers Technologies
Aline Jordens, M.Eng., R&D Manager – Haemers Technologies,
Jan Haemers, M.Eng., Chief Executive Officer – Haemers Technologies

SUMMARY

CALEPA SCAP Program-Priorities

•Significant threat to human health or the environment
•Disadvantaged or small community impact
•Cost and environmental benefit of project
•Lack of availability of other sources of funds

Consistent with State Water Board Resolution No. 2021-0050 and the Racial Equity Action Plan, the **State Water Board considers environmental justice by evaluating the most recent CalEnviroScreen** score for the project location.

https://www.waterboards.ca.gov/water_issues/programs/grants_loans/scap/

EPA also has methods such as Environmental Justice Mapping and Screening Tool

01 Introduction

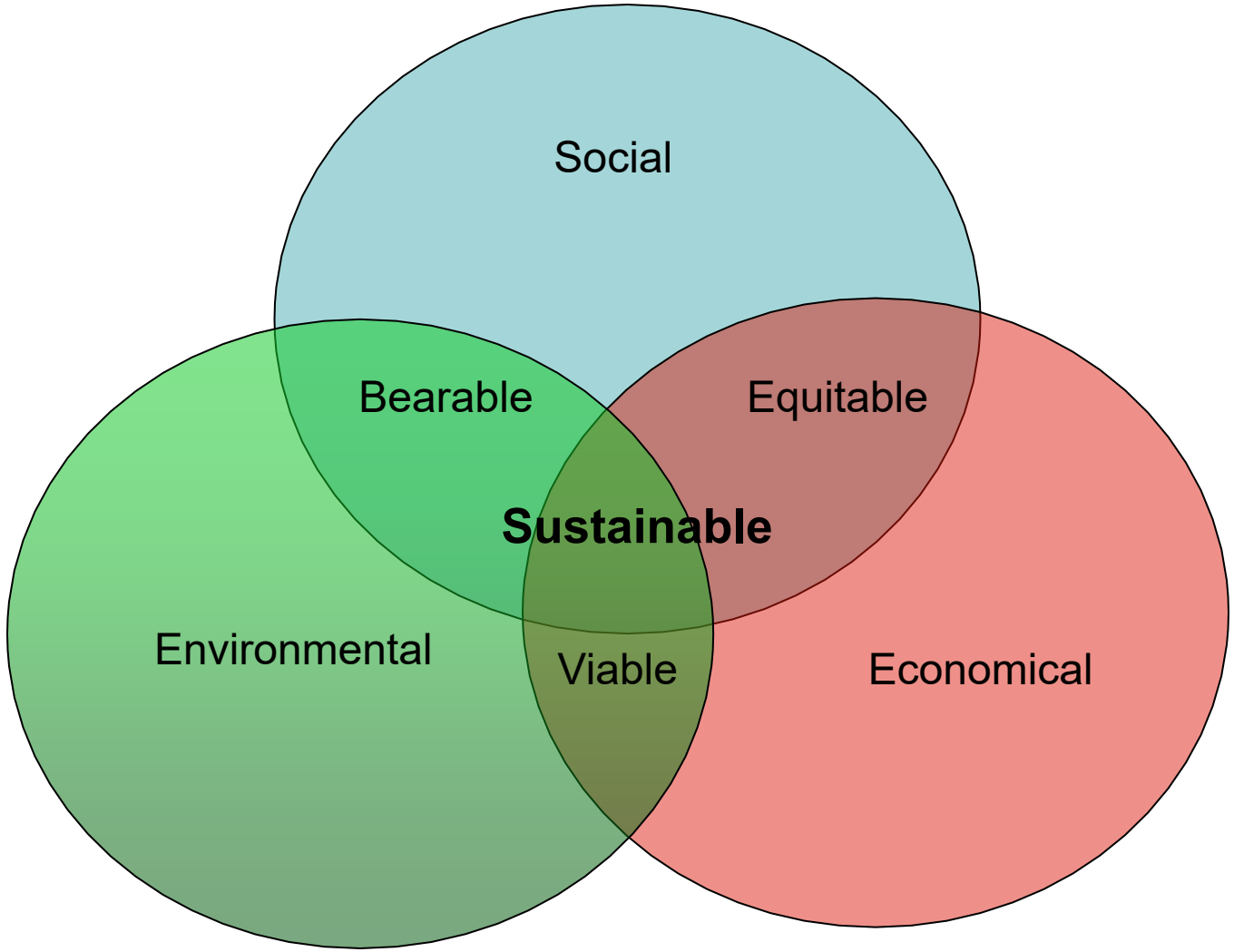
From Sustainable Development to Sustainable Remediation

Sustainable Development

- 1972 – Limits to growth (Club of Rome)
- 1980 – Sustainable Development as Global Priority (International Union Conservation of Nature)
- 1987 - Bruntland Report ‘Our Common Future’ (UN):

- **Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.**
  - 'needs', in particular, the essential needs of the world's poor, to which overriding priority should be given; and
  - limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs.

Sustainable Development



UN 8/17 Sustainable Development Goals (SDG)

Soil pollution and loss:

SDG1: no poverty
- Reduce crop yield and income, which jeopardizes health and cognitive potential

SDG2: zero hunger
- Lower food production per unit land
- Limit the available land for growing crops

SDG3: good health and well-being
- Reduce children's IQ due to lead exposure
- Cause kidney dysfunction, bone disease and cancers due to cadmium exposure
- Cause neurological damage due to mercury exposure

SDG6: clean water and sanitation
- Pollute groundwater
- Enter drinking-water sources via surface runoff

SDG15: life on land
- Threaten the health of plants and animals
- Reduce soil biodiversity

SDG13: climate action
- Reduce soil carbon storage potential
- Result in deforestation to obtain new farmland

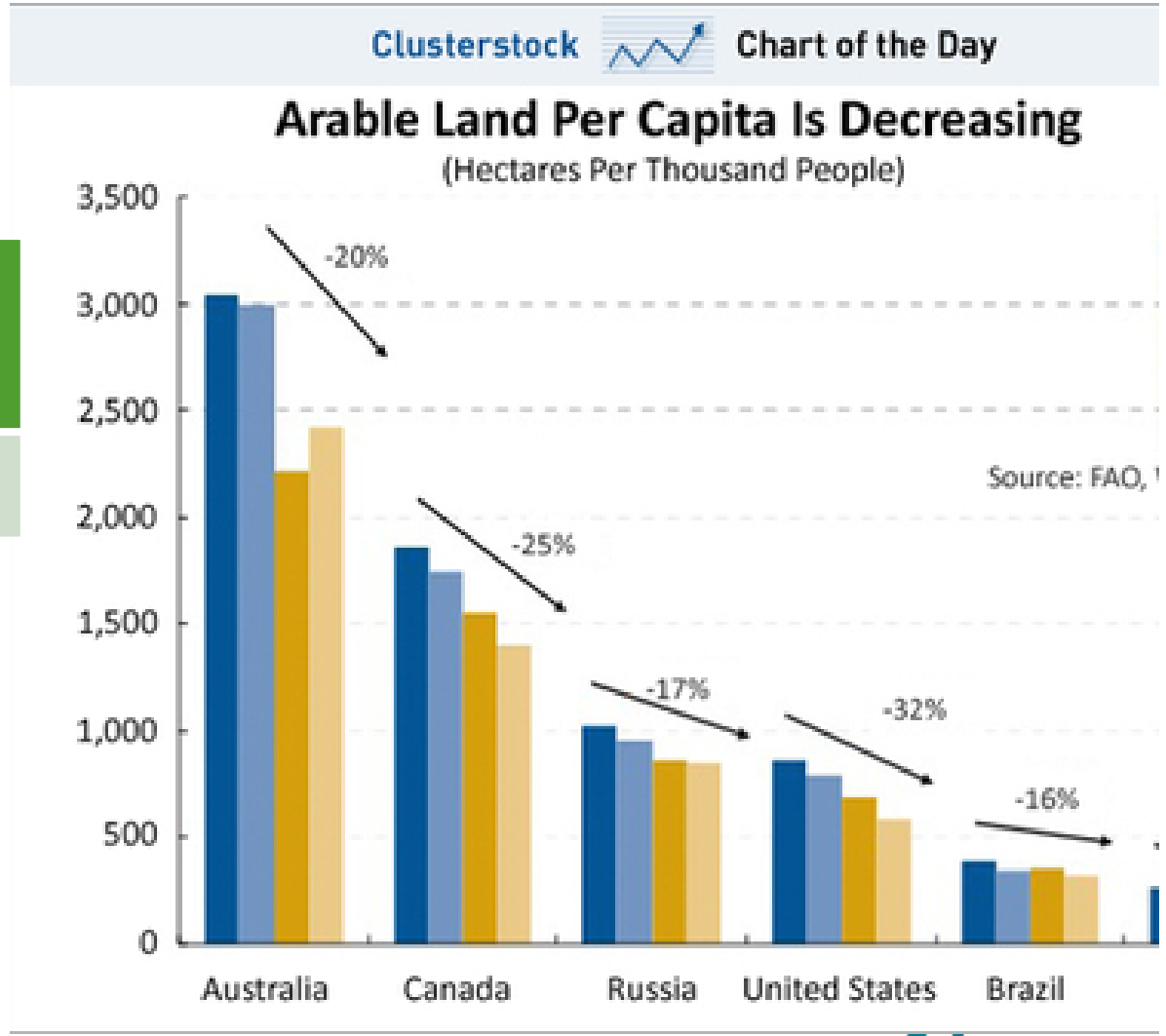
SDG12: responsible consumption and production
- Make sustainable production in agriculture difficult

SDG11: sustainable cities and communities
- Result in derelict land, environmental displacement and iniquitous exposure

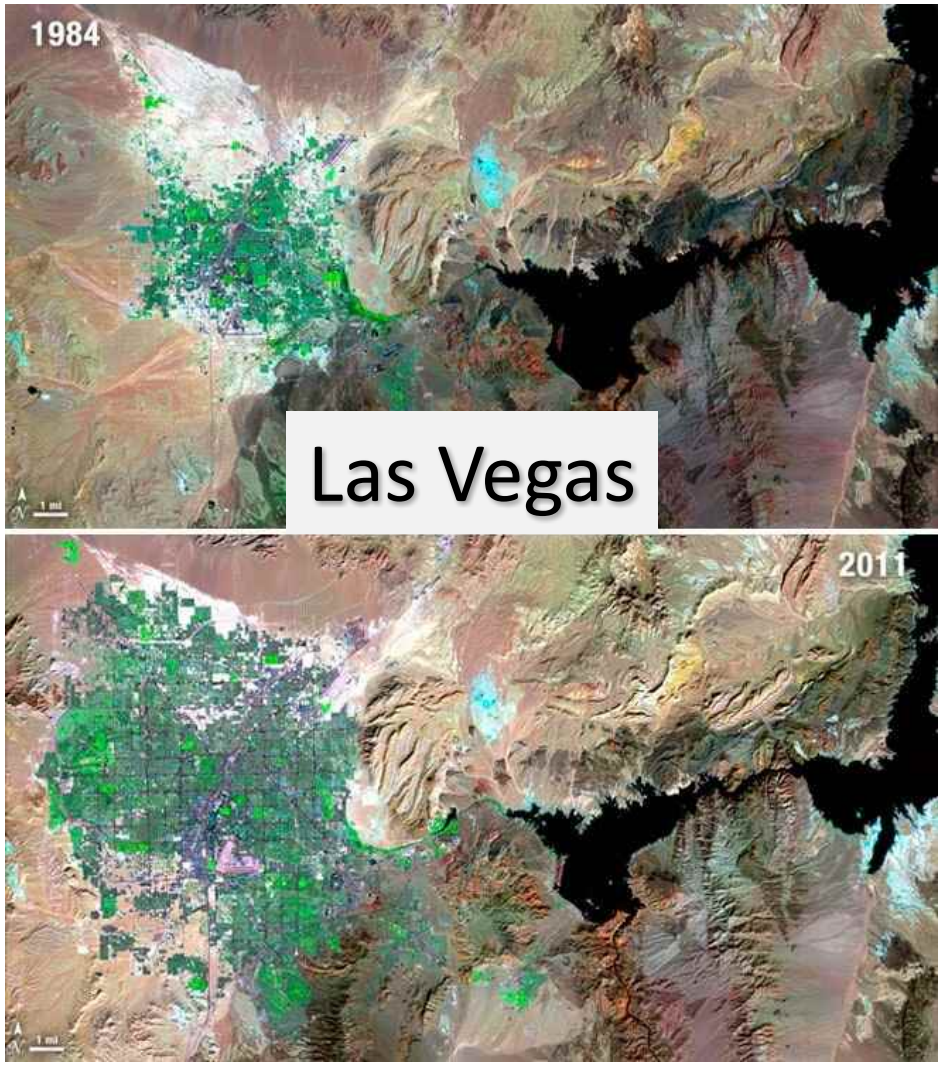
02 Sustainable Land Management

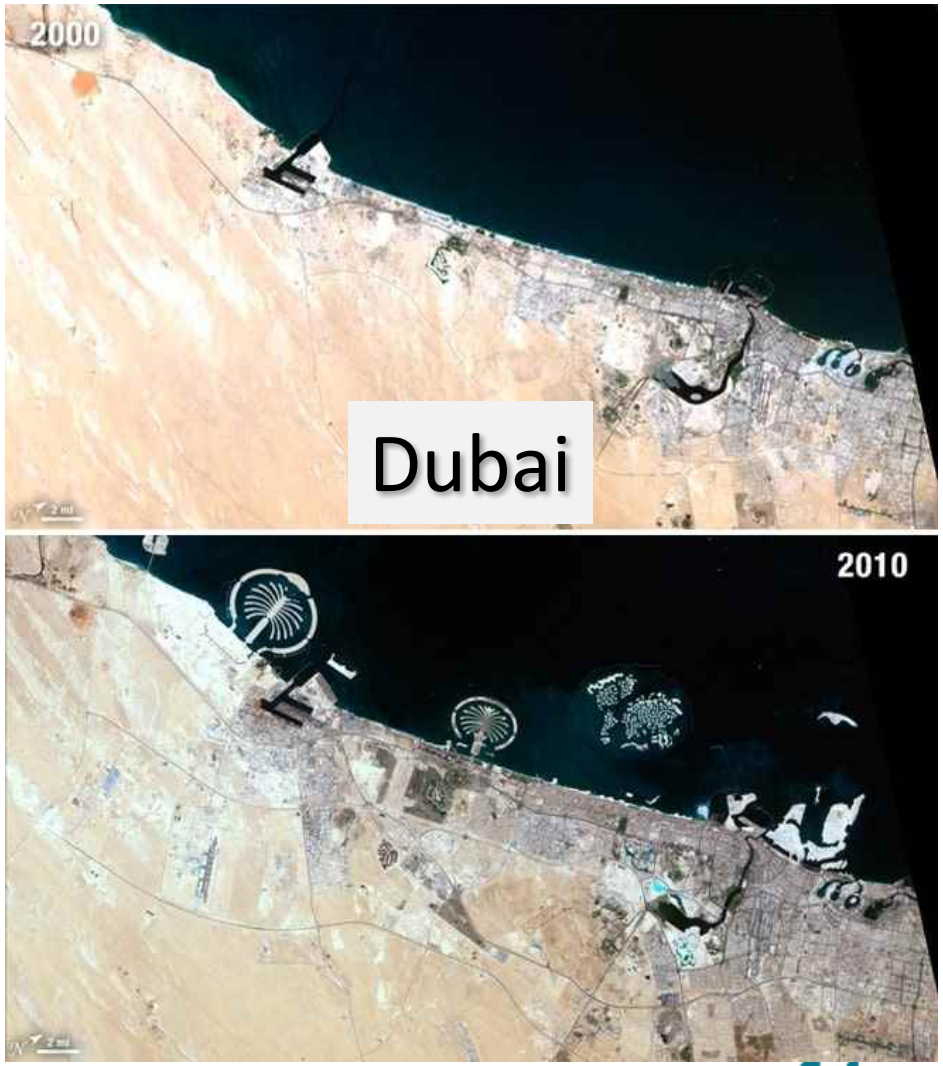
Arable Land Decrease

World	50 million acres/year	1+ acres/sec

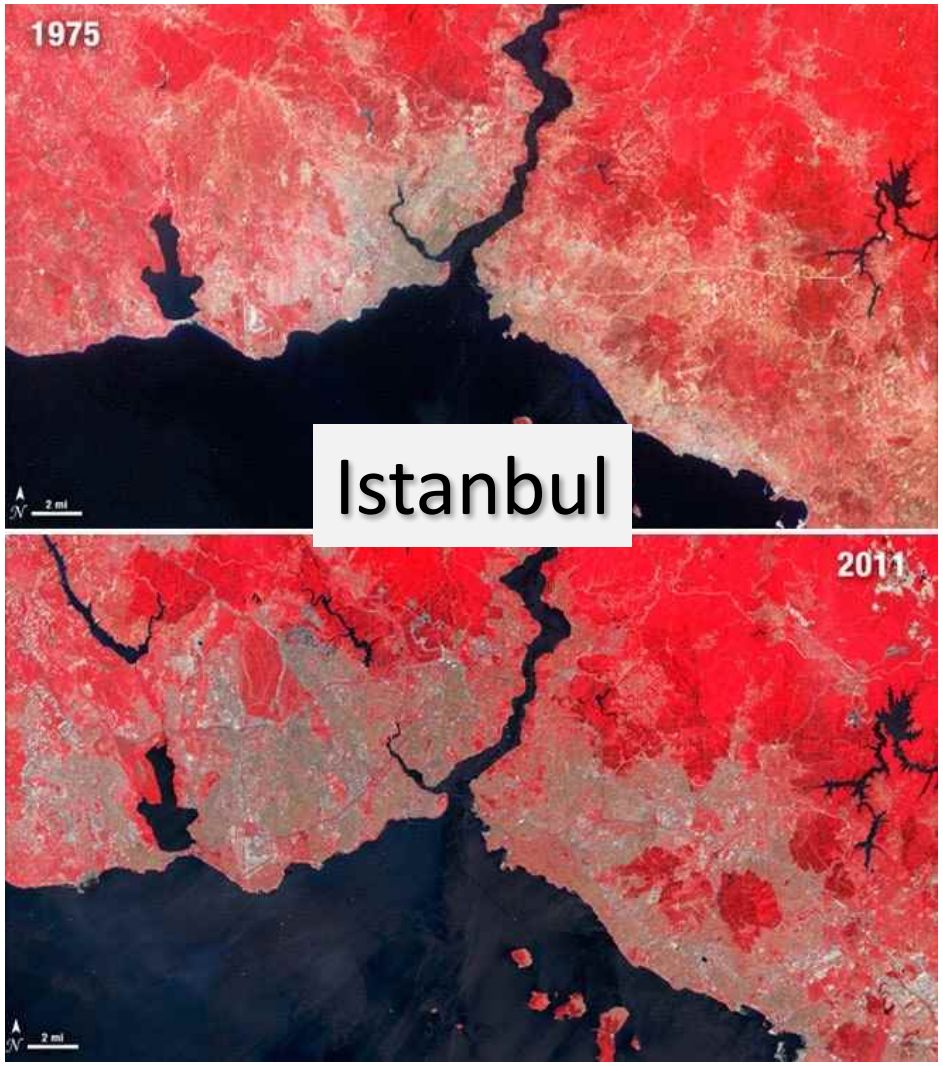


Urban Sprawl

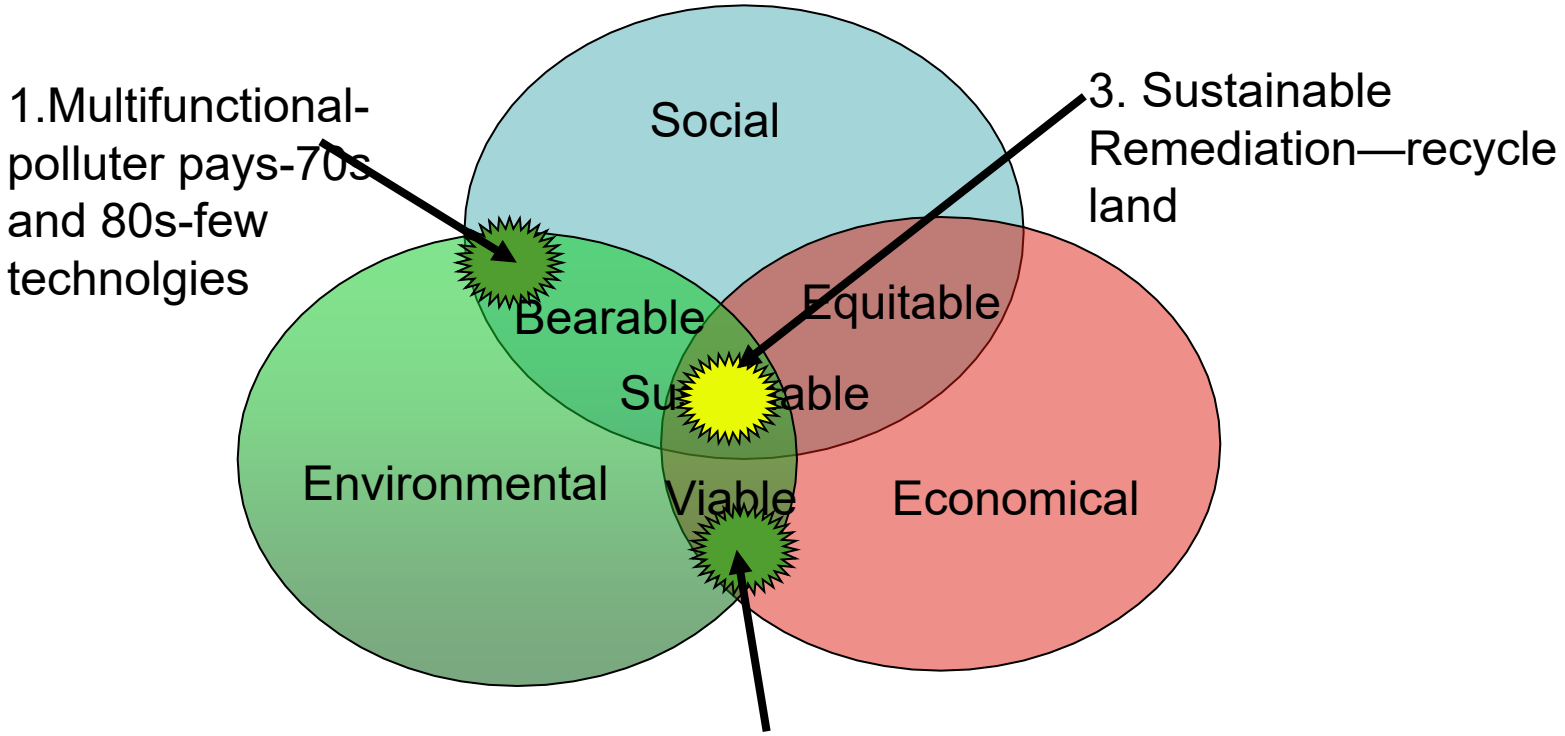




Urban Sprawl



Historical Evolution in Soil Remediation Policies



03 Sustainability Scoring

Introduction

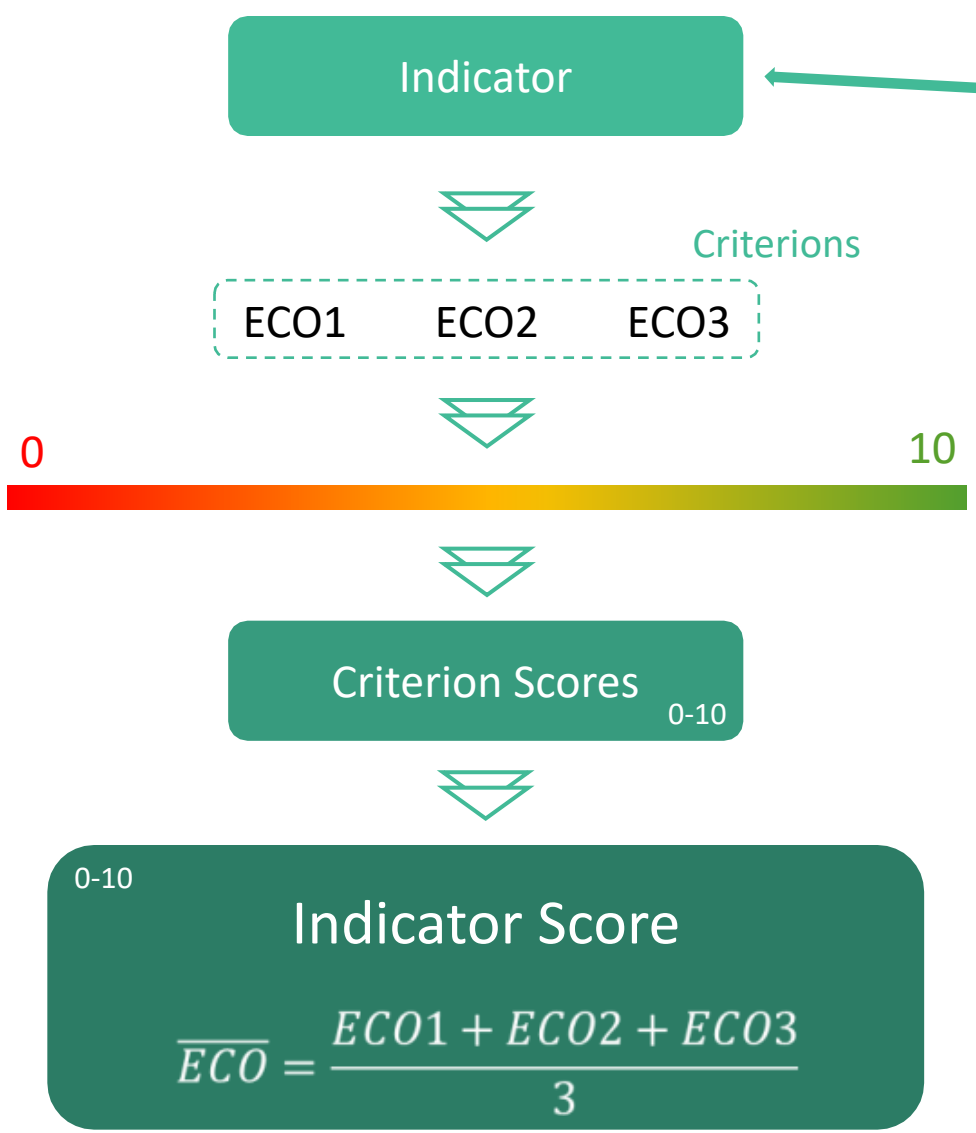
- 3 Major Branches:
  - **Economic**
  - **Social**
  - **Environmental**
- Goal
  - Scoring tool for project planning

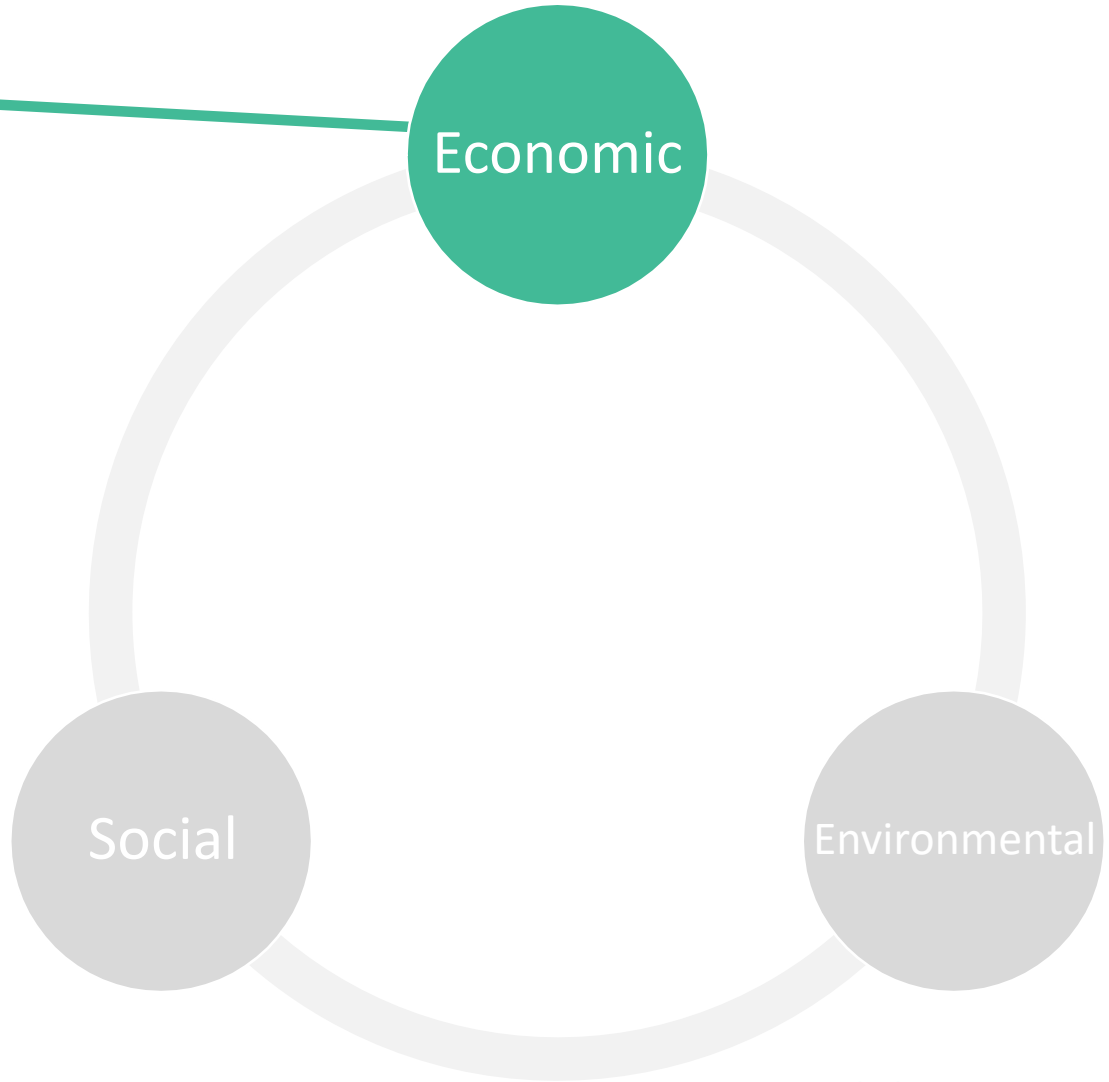
Scoring Remediation Technologies

- Remediation Technologies are scored/compared on a specific case
- A specific technology can score very high in one case and much lower in another

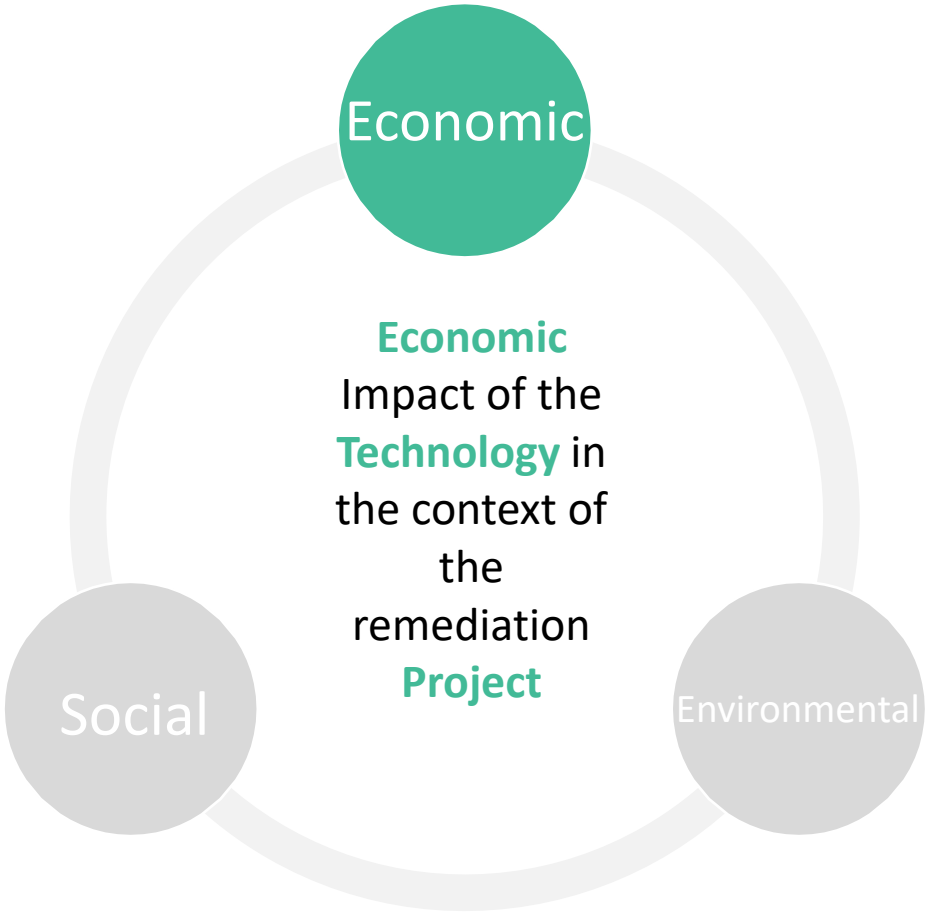
- NOT AN ABSOLUTE SCORE/RANKING

Scoring Methodology

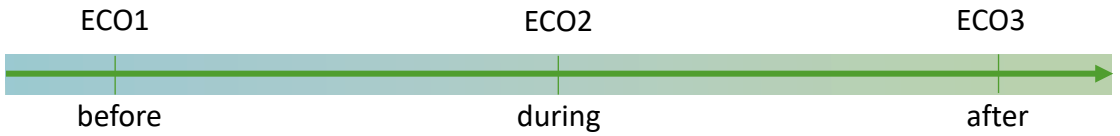




Economic Indicator



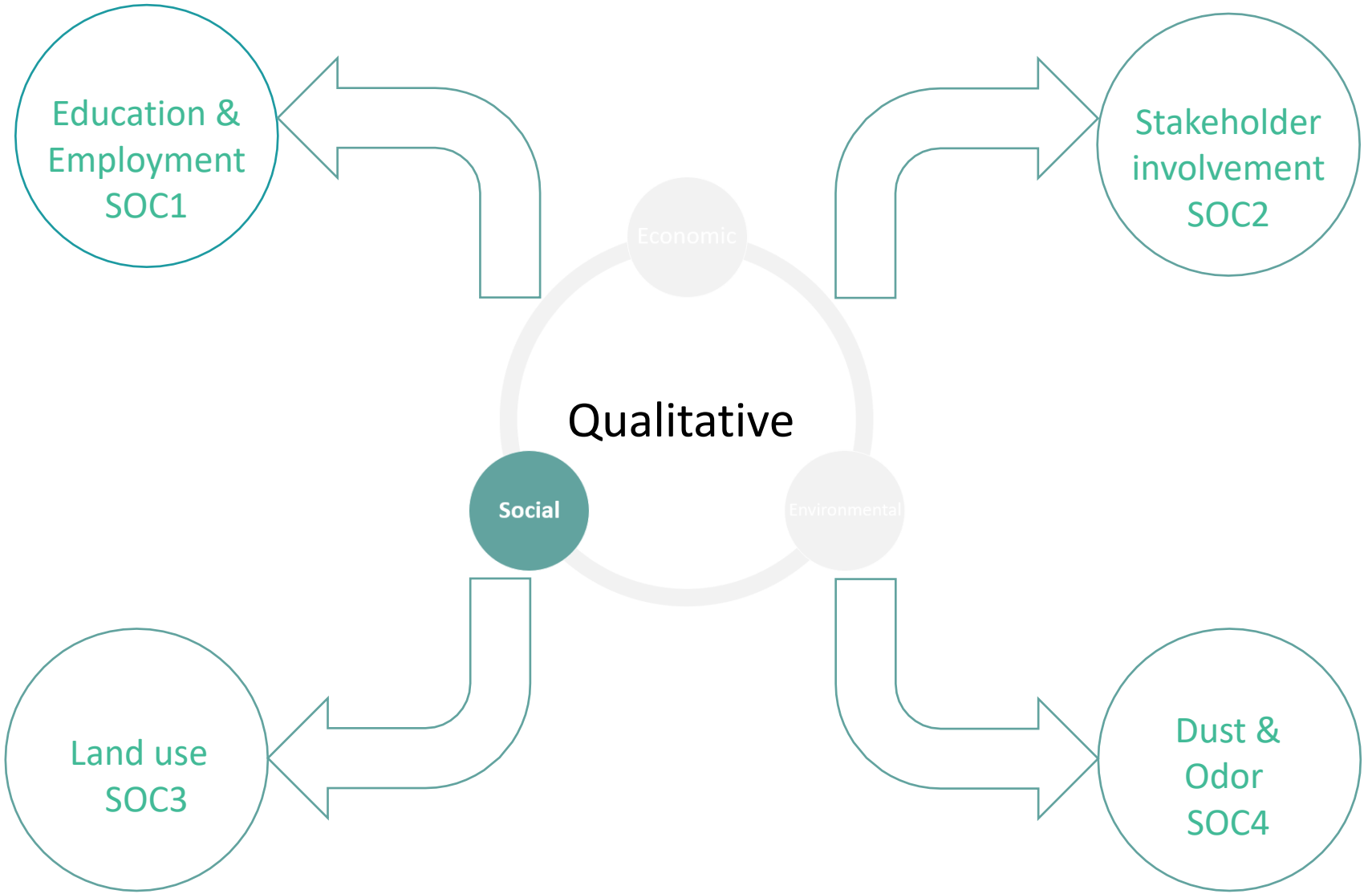
- ECO1 – Total Cost
  - Total cost predicted for the project (including hideen and own costs for Problem Owner)
- ECO2 – Degree of Uncertainty
  - Uncertainty on the predicted total cost
- ECO3 – Change in Land Value
  - Recuperated land value upon completion, if any



Project timeline

Social Indicator

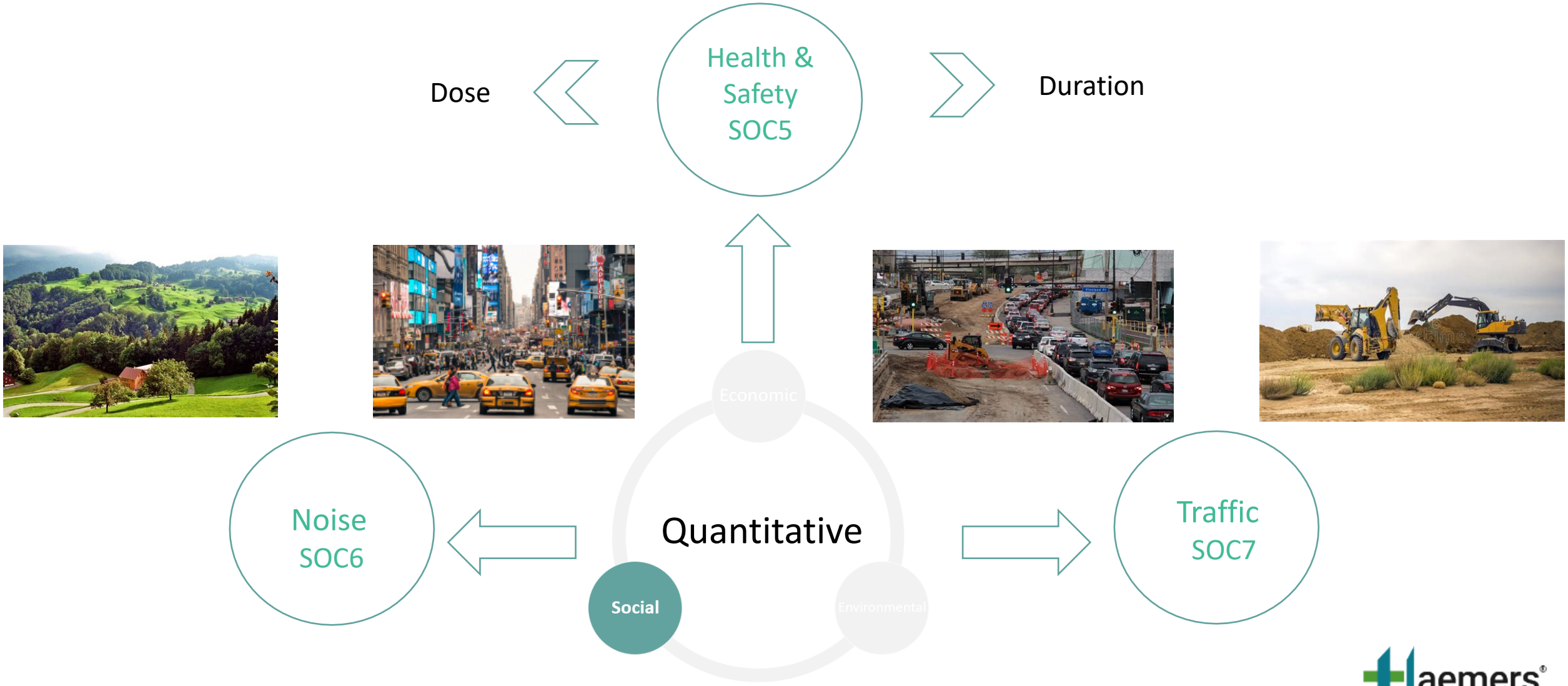
- Local businesses
- local vendors
- local partners
- Use of land



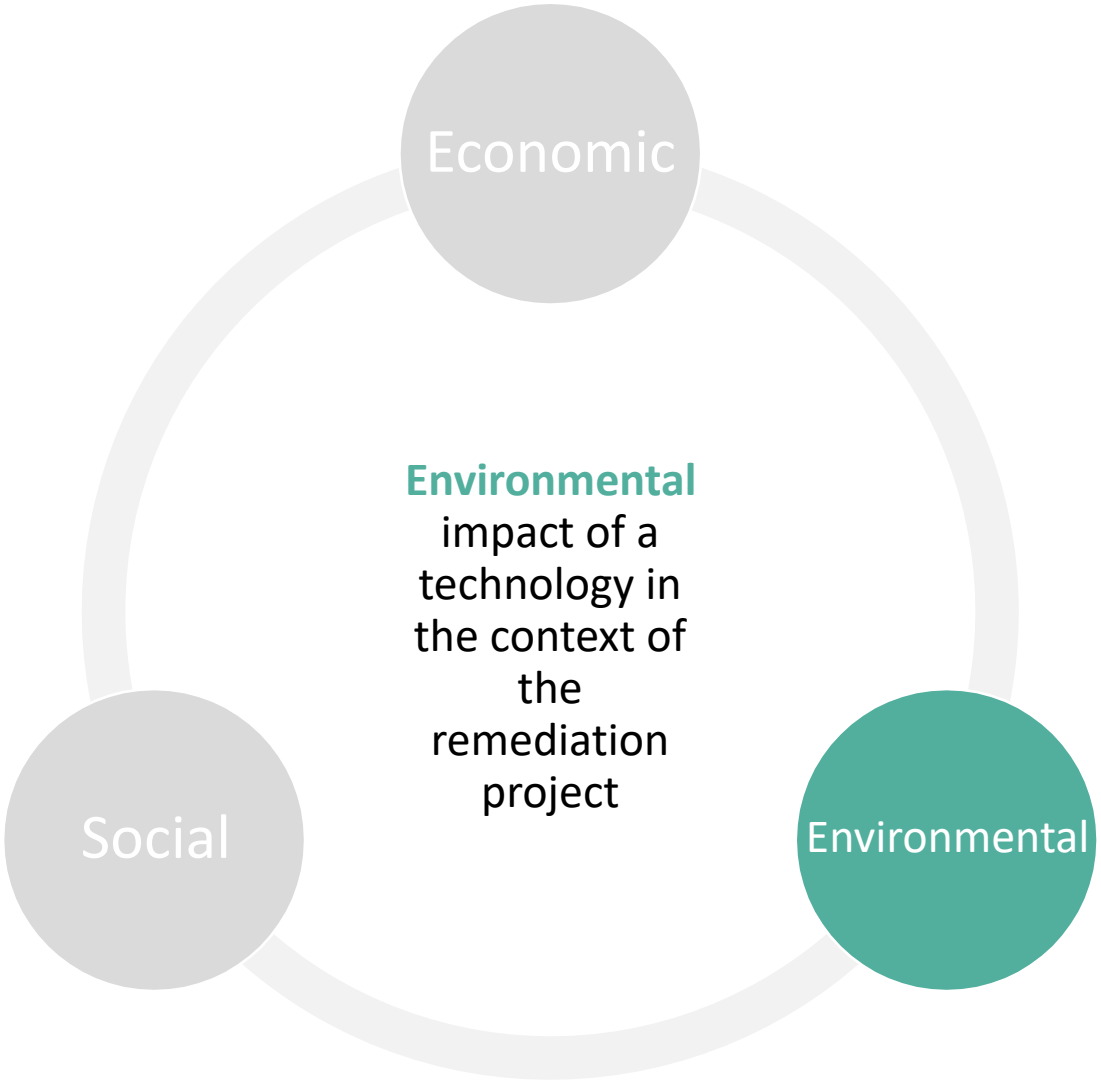
- Regulators
- Consultants
- Site owners
- First Nations

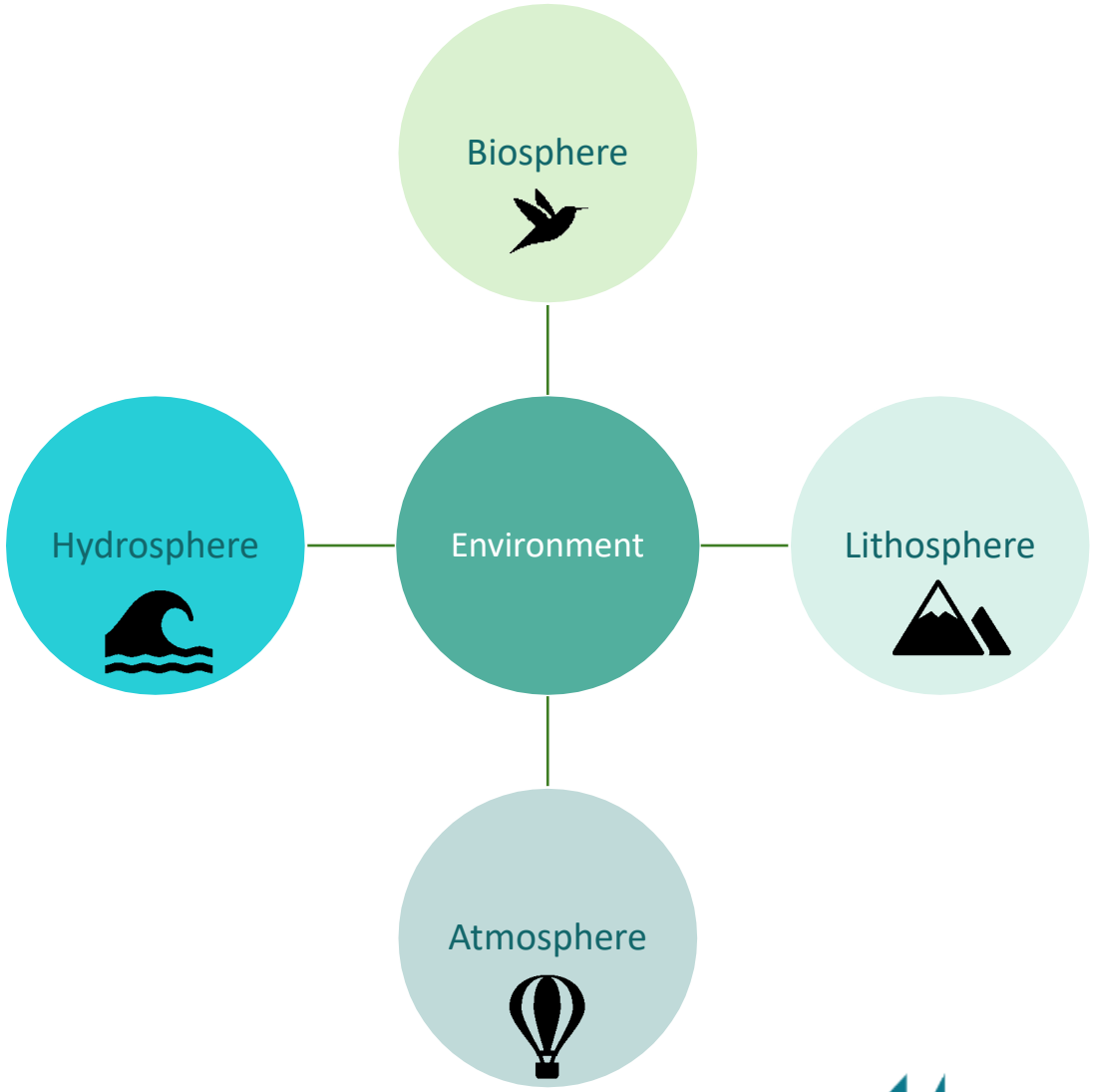
- Multifunctional
- Agriculture
- Housing
- Public space
- Industry
- No use

Social Indicator

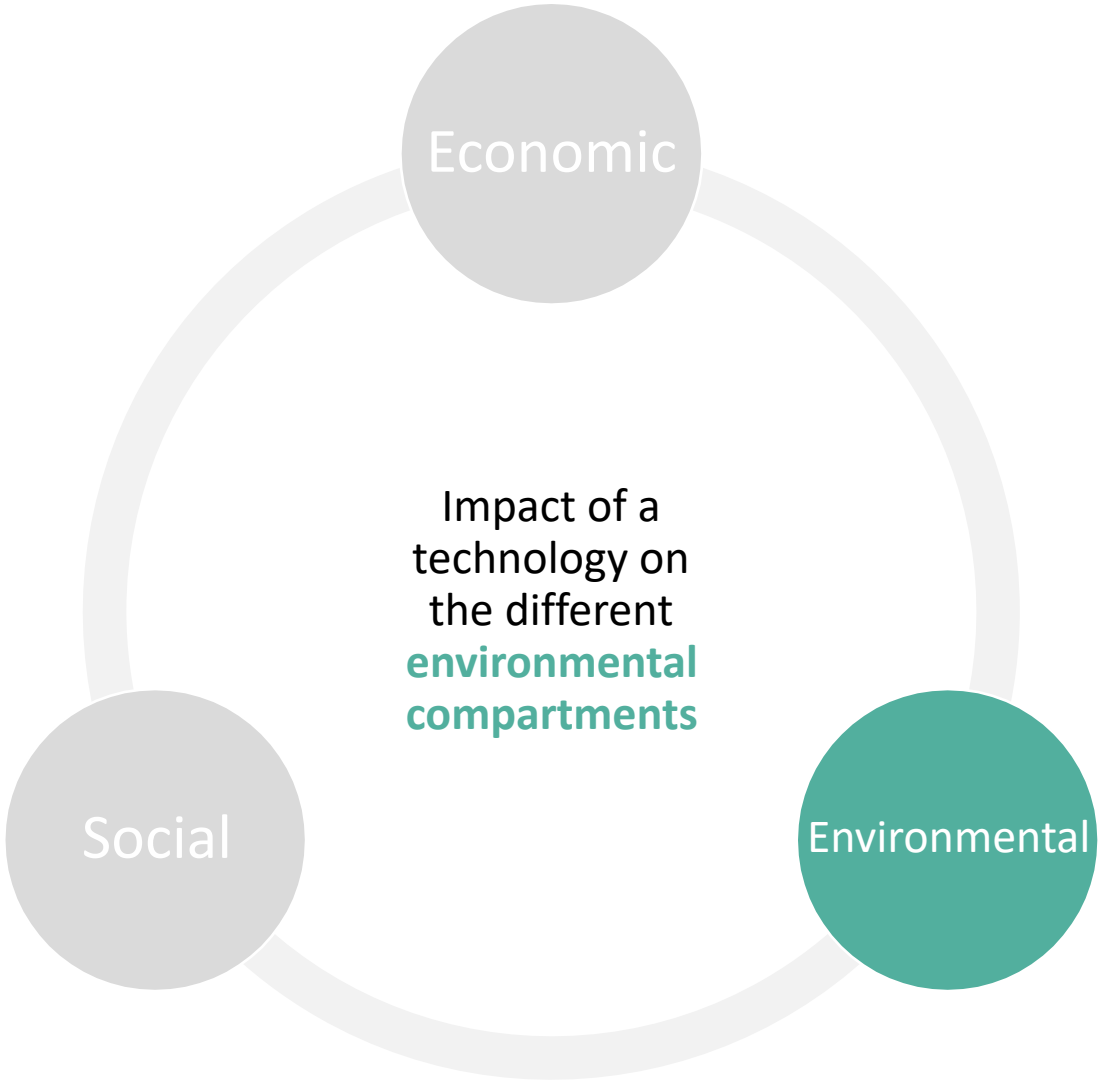


Environmental Indicator



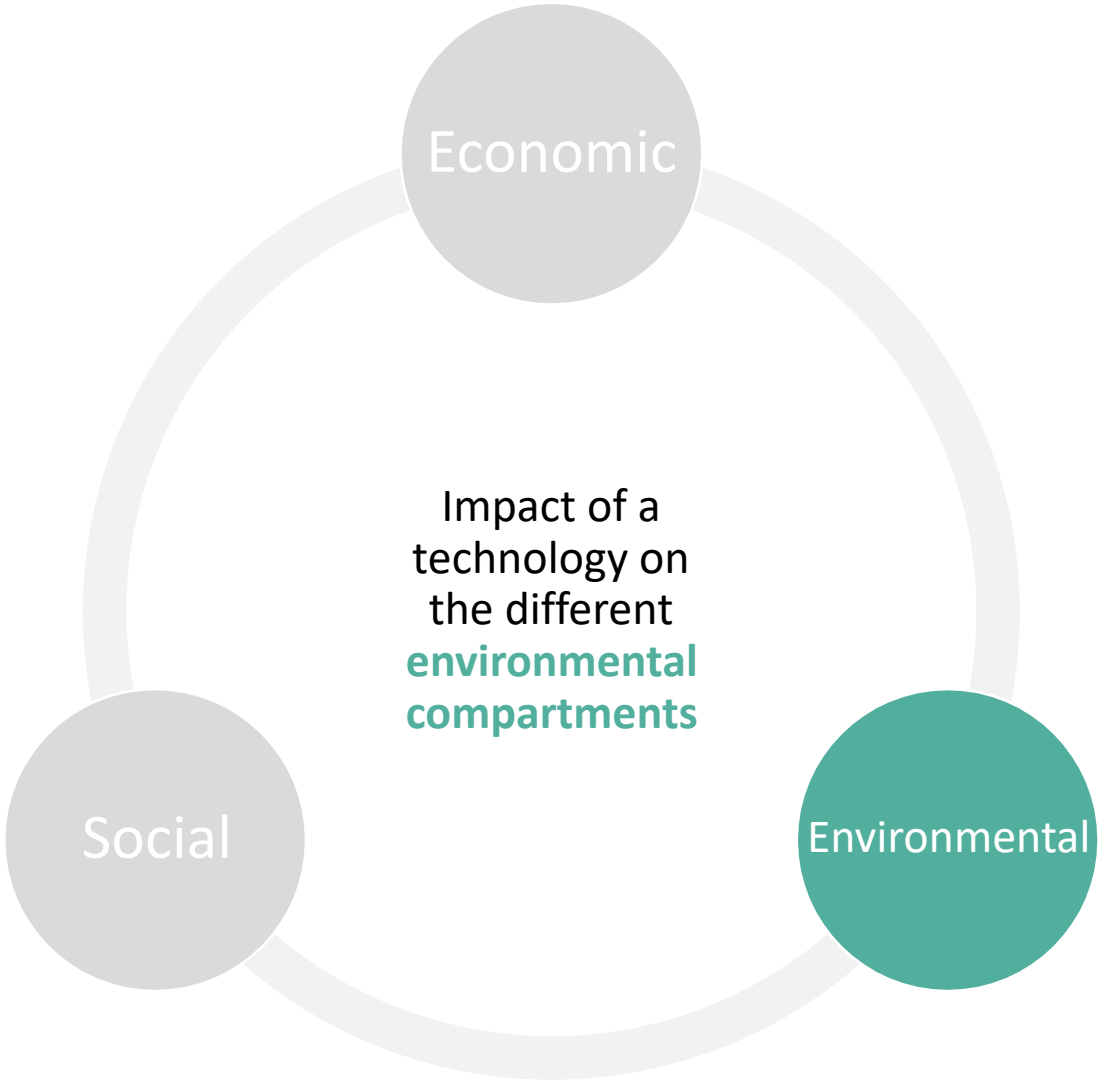


Environmental Indicator



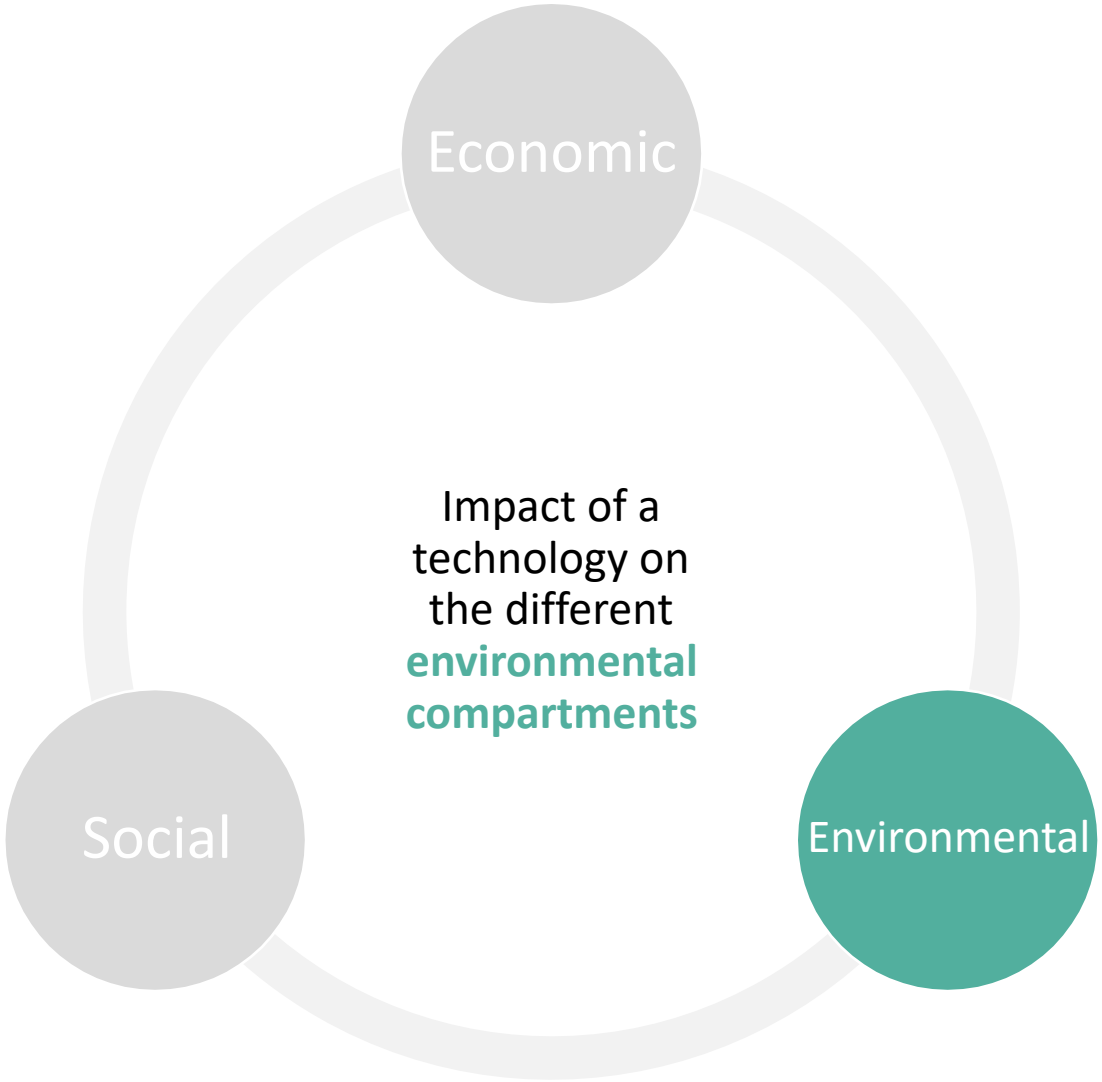
- ENV 1 – Efficiency on soil remediation
- ENV 2 – Efficiency on groundwater remediation
- ENV 3 – Risk of secondary contamination

Environmental Indicator



- ENV 4 – Gas emissions
  - CO2 emissions
  - Toxicity EQ
- ENV 5 – Impact on soil characteristics
- Is it better?
- ENV 6 – Solid waste

Environmental Indicator



- ENV 6 – Impact on surface waters
- ENV 7 – Noise

Method of Calculation

Indicator Scores

$\overline{ECO}$ $\overline{SOC}$ $\overline{ENV}$

$$\left(\prod_{i=1}^{n} a_i\right)^{\frac{1}{n}} = \sqrt[3]{\overline{ECO} \times \overline{SOC} \times \overline{ENV}}$$

Sustainability Score

Scoring Application (Geosyntec – CIMIC) – 2015

Scores - Outcome

Method	Eff.	Prac.	Subtotal E x P	ENV	SOC	ECON	Subtotal E+S+E	Total	Rank
ESDD – OCE & ECS	5	2.5	12.5	4.3	2	3.8	10.1	22.6	3.0
ISCC	1	3	3.0	3.0	2.5	1.2	6.7	9.7	13.0
ESEC – OCE & ECS	1	2	2.0	2.5	2.25	2.2	7.0	9.0	15.0
ESSS – OCE & ECS	1	2	2.0	2.3	2.75	2.9	8.0	10.0	12.0
ISSS – OCE & ECS	1	1	1.0	2.3	2.75	2.9	8.0	9.0	14.0
ESBR – OCE & ECS	3	2	6	4.2	3.75	4.1	12.0	18.0	7.0
ISBV	3	2.5	7.5	4.0	3.5	2.8	10.3	17.8	8.0
SVE	2	2.5	5.0	3.2	3.25	2.8	9.2	14.2	11.0
ESCO – OCE & ECS	4	1.5	6	3.8	3.25	3.5	10.6	16.6	9.0
ISCO	2	2.5	5.0	3.7	3	2.8	9.5	14.5	10.0
ISCT	5	3	15.0	3.2	4.625	4.3	12.1	27.1	1.0
ISRT	5	3	15.0	2.7	4.625	4.3	11.6	26.6	2.0
ESBT ETC – OCE & ECS	5	1.5	7.5	3.0	4.375	4	11.4	18.9	6.0
ESCT DTD – OCE & ECS	5	2	10.0	3.2	4.875	4.5	12.5	22.5	5.0
ESCT ITD - OCE & ECS	5	1.5	7.5	3.5	4.375	4.6	12.5	20.0	4.0

Conclusion

Sustainable Remediation

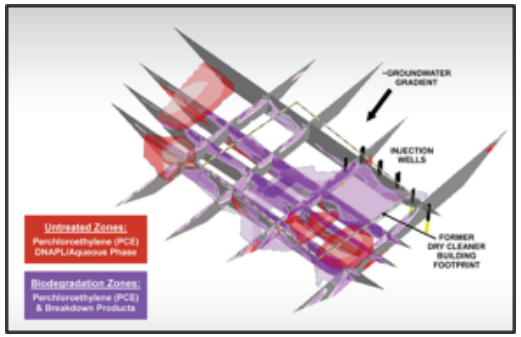
- Sustainability should become a main driver in selecting the appropriate solution
- It should also drive R&D efforts towards more sustainability
- Scoring is key – Many methods can be applied. Consistency when choosing a method

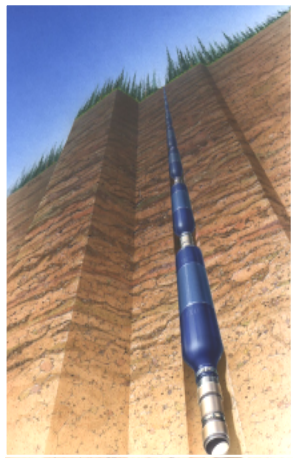
Thank You. Questions?

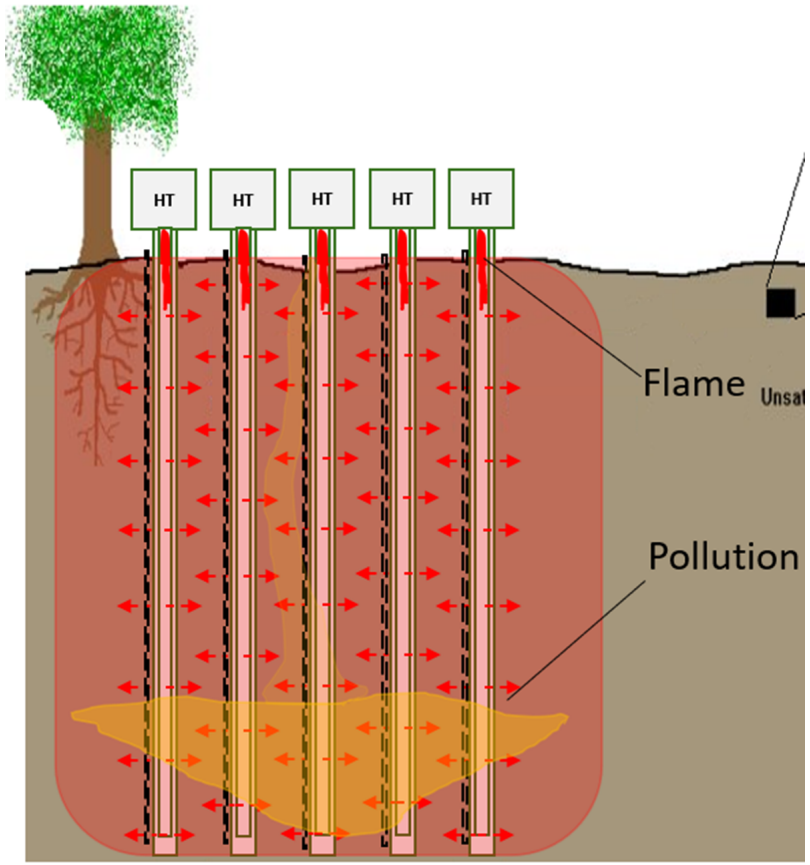
John Sankey, P.Eng., True Blue Technologies

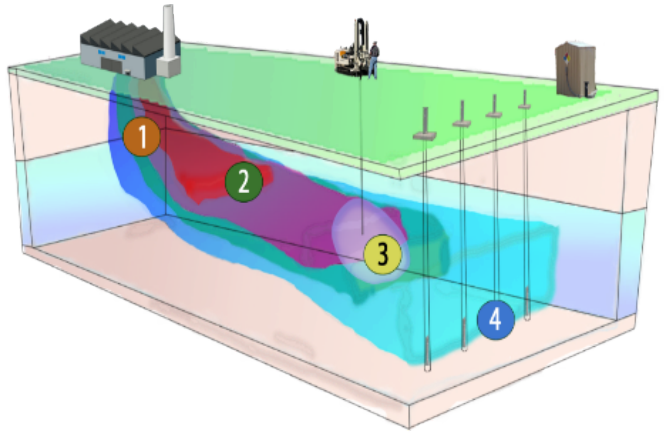
john.sankey@trueblueclean.com

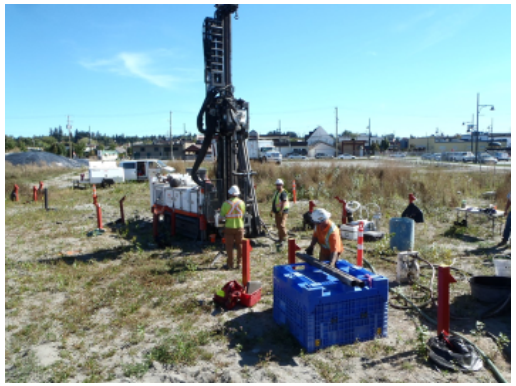
714.924.5483











True Blue Technologies

Remediation and Characterization Products and Support