April 18, 2017

Green and Sustainable Remediation (GSR) Overview

Lindsay Burton
Sustainable Remediation Forum (SURF) Secretary

secretary@sustainableremediation.org

Who is SURF?

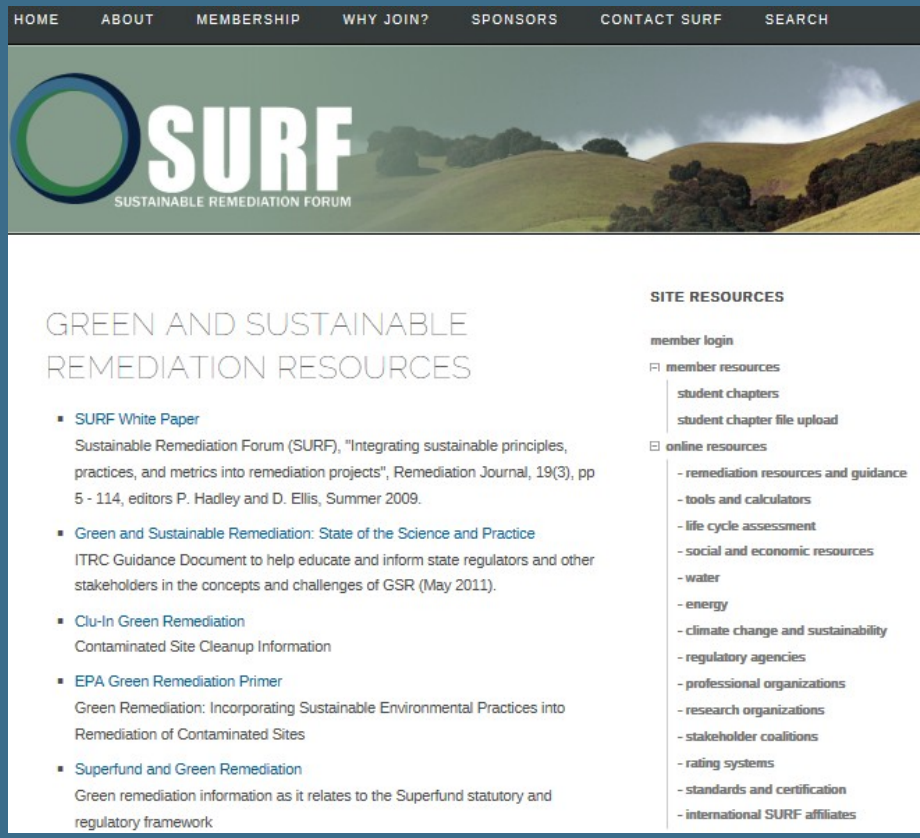
- The mission of SURF is to maximize the overall environmental, societal, and economic benefits from the site cleanup process by:
  - Advancing the science and application of sustainable remediation
  - Developing best practices
  - Exchanging professional knowledge
  - Providing education and outreach

What we will cover

- Introduction to GSR
  - Regulatory History
  - Definitions
  - Principles
- “Green” versus “Green and Sustainable”
- Three Pillar Approach
  - Environmental Aspects
  - Social Impact Categories
  - Economic Metrics
- Case for Action

GSR Resources

- SURF framework, guidance, and website
- ITRC GSR Overview and Framework
- ASTM Standard Guide for Incorporating Sustainable Objectives Into Cleanup



www.sustainableremediation.org/remediation-resources/

Regulatory History

- Executive Order 13423 (2007)
- US EPA- Green Remediation: Incorporating Sustainable Environmental Practices into Remediation of Contaminated Sites (2008)
- Executive Order 13514 (2009)
- Department of the Navy Guidance on Green and Sustainable Remediation [NAVFAC] (2012)
- Executive Order 13693 (2015)

Remediation

- **GOAL**: Reduce risks associated with site contamination
- **Footprint Effect Challenges**:
  - Uses natural resources
  - Generates emissions
  - Can generate waste materials
  - Introduces safety and health risks
- **Key Issue**: Remediation does not inherently benefit the environment, consequences of remedial actions must be considered when remediation considerations are made

Differentiating

Remedy implementation?

- **"Green" Remediation (US EPA; various documents)**
  - Practice of considering all environmental effects of remedy implementation and incorporating strategies to maximize net environmental benefit
  - The goal is not to change the remedy selection criteria but to incorporate sustainability into the process
  - Should not influence whether to remediate and may not influence technology selection but will influence how to implement remediation

Remedy Selection?

- **"Green and Sustainable" Remediation**
  - Goes beyond Green Remediation…incorporates socio-economic considerations
  - The goal is to incorporate all 3 pillars of sustainability (environmental, social, economic) into the entire remedial action process in order to minimize impact and maximize value

Definition

Green and Sustainable Remediation (GSR)**:**

- 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 (Sustainable Remediation Forum - United Kingdom).
- Goes beyond traditional remediation…
  - Incorporates environmental, social and economic factors
  - Enhances benefits to human health and the environment
  - Improves stakeholder engagement
  - Identifies and prioritizes stakeholder values, focusing on the most critical for remedial alternative evaluations
  - Results in remedial actions that are comprehensive, implementable and effective

Three Pillar Approach

Environmental	Social	Economic
• Energy Use • Emissions (including climate change) • Impacts on Water • Use of natural resources and generation of wastes • Impacts on land and ecosystems • Final Use	• Impacts on human healthy and safety • Ethical and equity considerations • Impacts on neighborhoods or regions • Community involvement and satisfaction • Accident risk to site workers	• Project costs or benefits • Employment and capital gain • Other benefits (tax base, infrastructure development)

Environmental Aspects

- Emissions to air
- Releases to water
- Releases to land
- Use of materials and resources
- Use of energy
- Energy emitted
- Generation of waste and/or by products
- Use of space

Source: ISO 14001

Societal Impact Categories

- Stakeholder engagement
- Health and Safety
- Benefits Community at Large
- Alleviate Undesirable Community Im
- Economic Vitality
- Social Justice
- Regional and Global Societal Impacts
- Value of Ecosystem Services & Natural Resources Capital
- Risk-Based Land Management & Remedial Solutions
- Contribution to Local and Regional Sustainability Policies & Initiatives

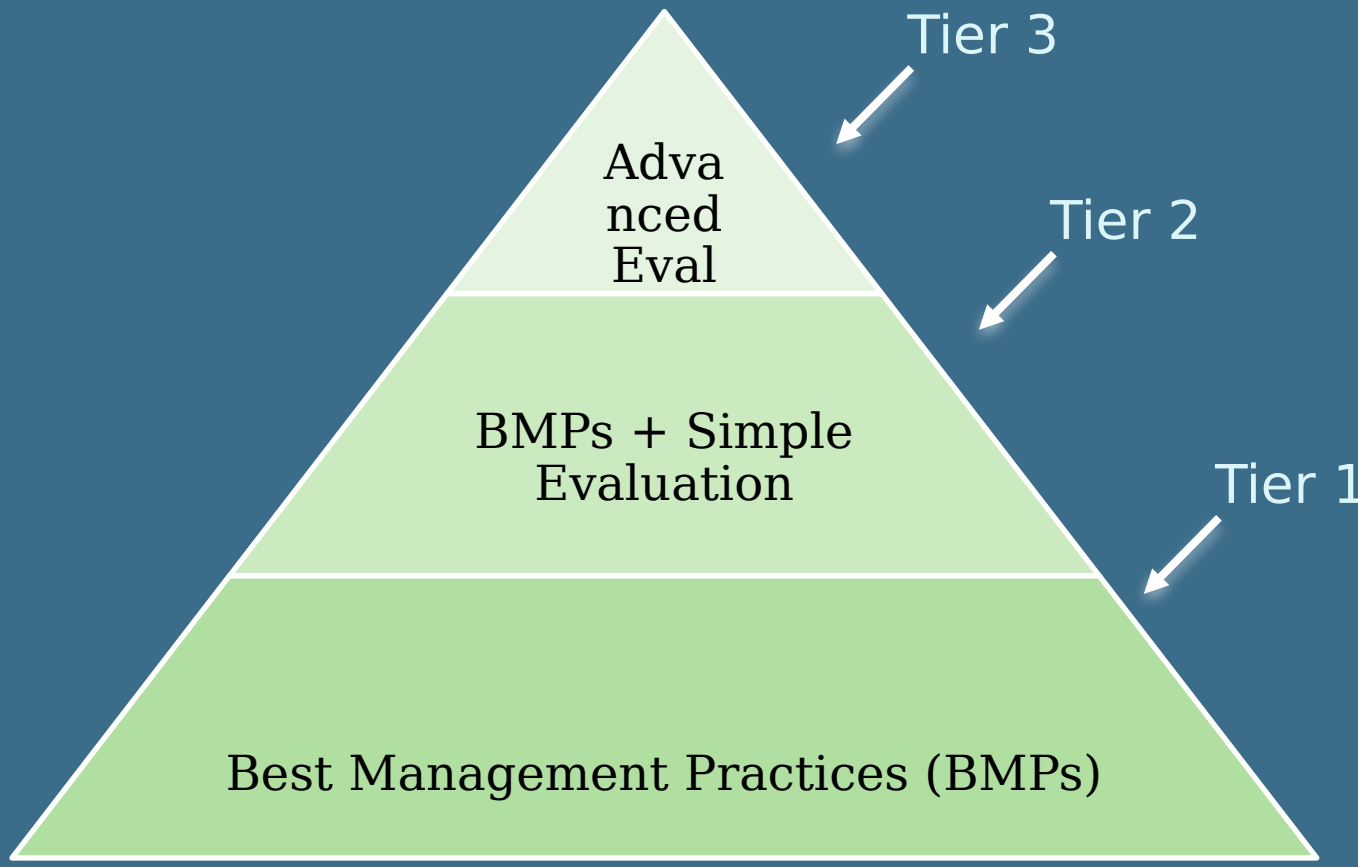
Economic Metrics

- Local job generation/ preservation
- Increased local community prosperity
- Poverty Reduction
- Creation of Community Assets
- Cost Effectiveness

Application

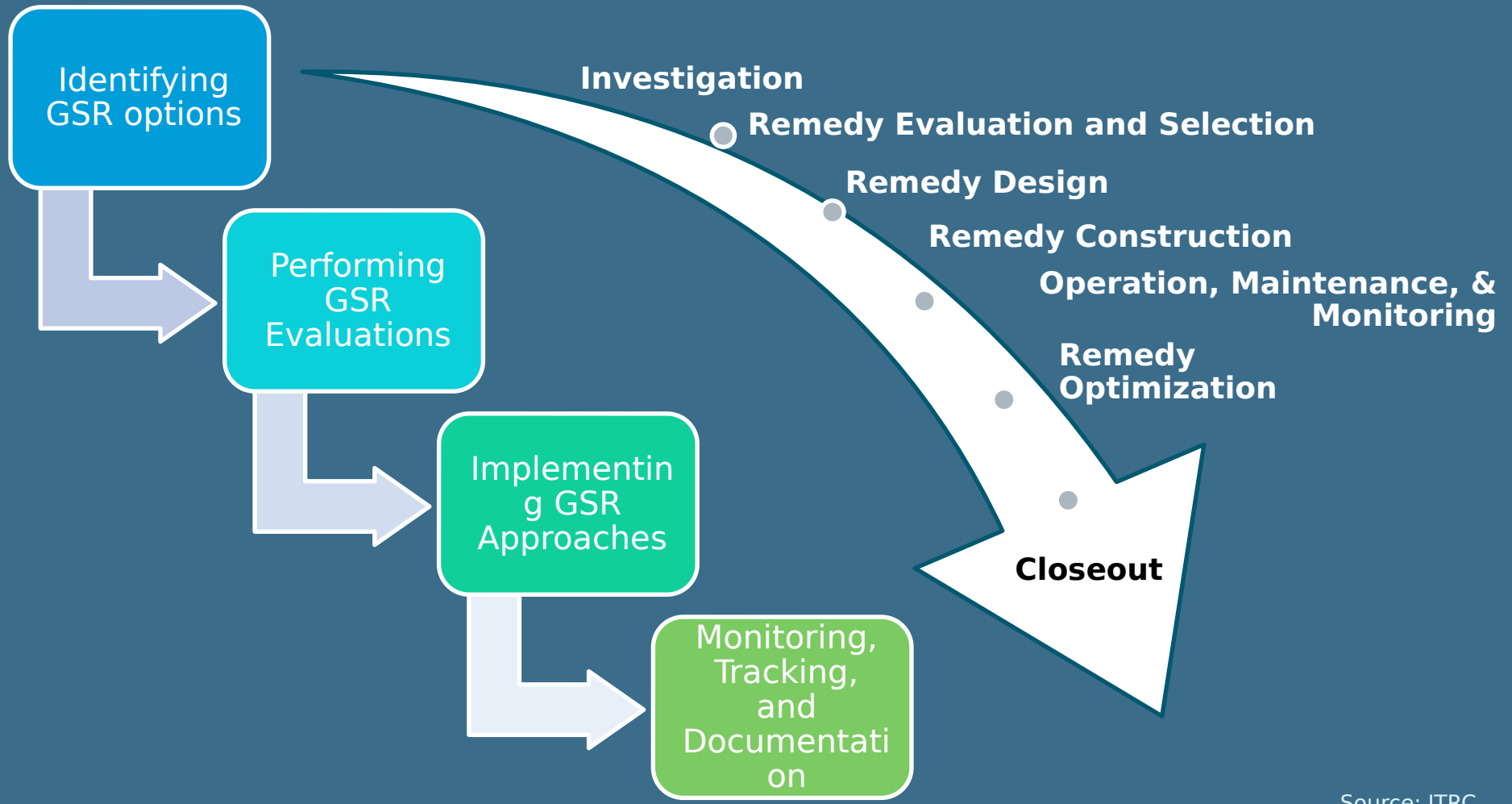
Planning

- Evaluate/Update Conceptual Site Model
- Establish GSR Goals
- Stakeholder Involvement
- Select Metrics, Evaluation Level, Boundaries
- Document GSR Efforts



Source: ITRC 2011

GSR Implementation

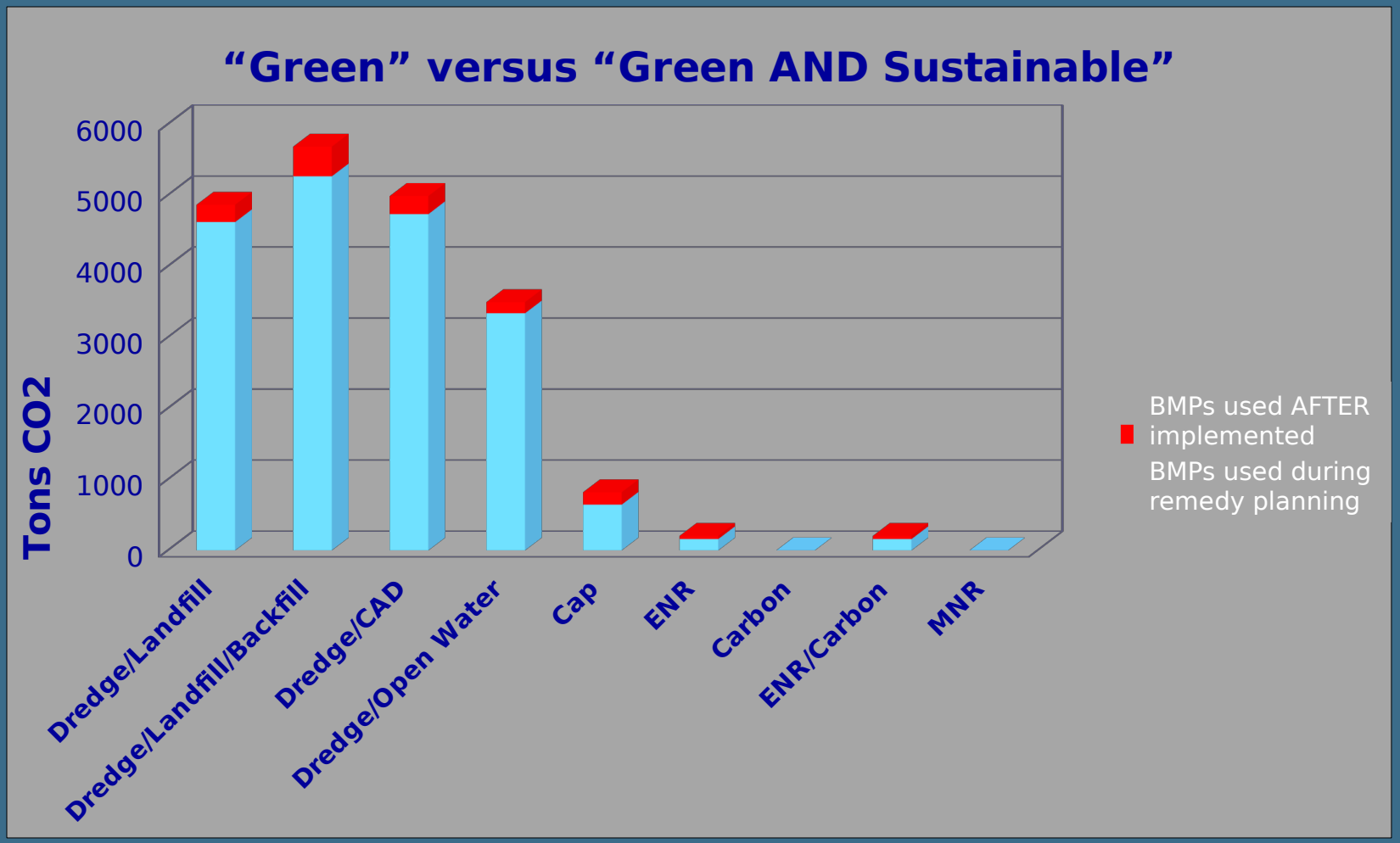


Source: ITRC 2011

BMP Implementation

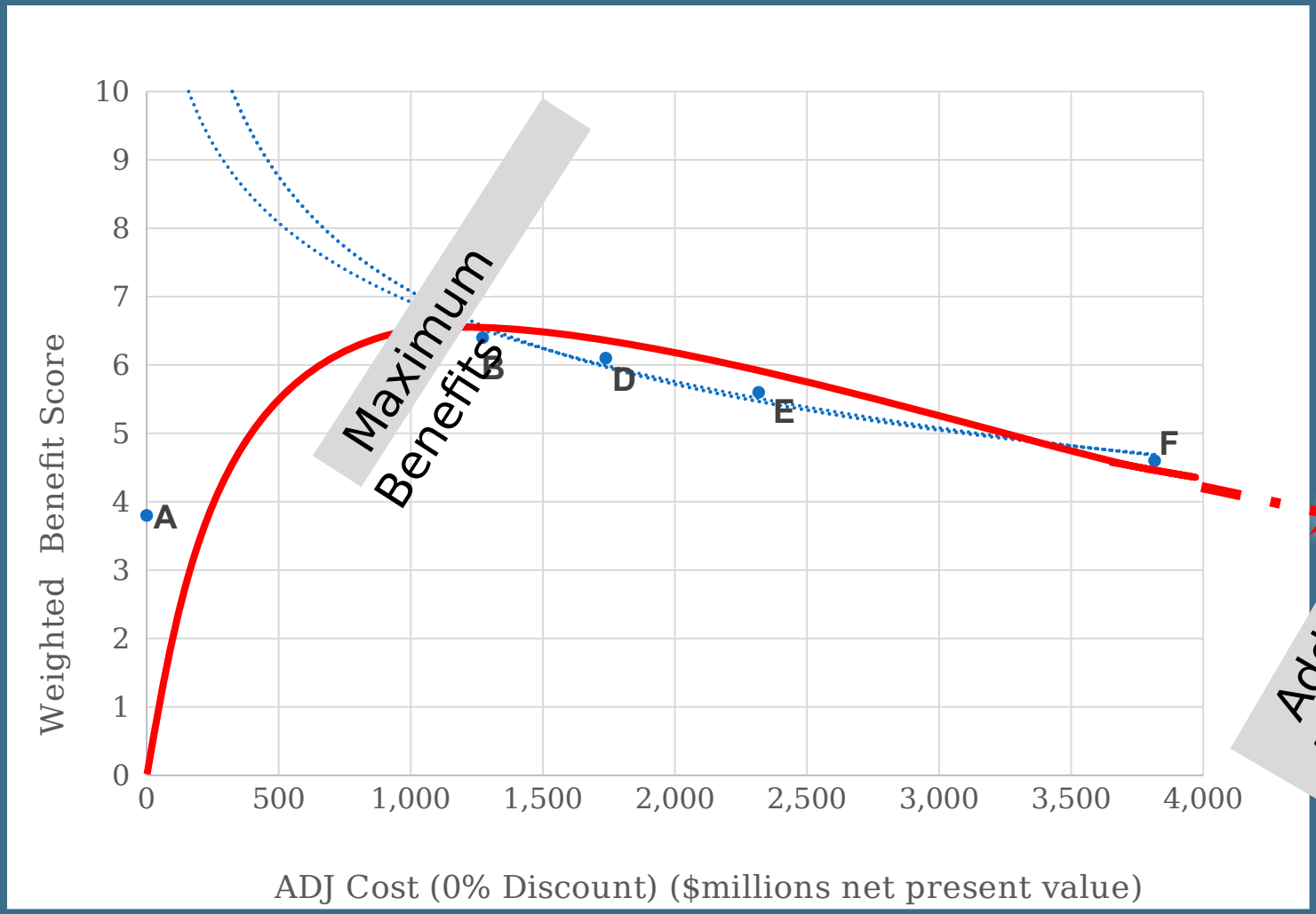
Primary Sustainability Pillar	BMP GSR Metric	Project Stage				
		Investigation	Remedy Evaluation and Selection	Remedial Design and Construction	Operations and Maintenance	Closure
Environmental	Implement a telemetry system to reduce frequency of site visits.			X	X	
	Implement an idle reduction plan to reduce the amount of vehicle idling.	X	X	X	X	X
	Consider use of field screening methods (eg. Field test kits for contaminant screening) and on-site mobile laboratories to reduce resources and minimize laboratory analysis.	X	X		X	
Social	Develop templates of communication strategies for Project Manager use.	X	X	X	X	X
	Use a neutral party convener or facilitator for community engagement activities.	X	X	X		
	Consider selecting service providers, product supplies (e.g. cleanup products, safety supplies, work equipment, fuels/lubricants) and analytical laboratories from the local area and consolidate service and delivery schedules.	X	X	X	X	X
Economic	Determine short term and long term cost of site remediation alternatives contrasting with environmental and community benefits.	X	X	X		
	Consider providing the public training on sustainability (eg. implementing a local education program about site impacts and remediation impacts).	X	X	X	X	X
	Consider specific decision points for transition from one technology to another to limit the extent of remediation.		X	X		

Case for Action



Reference: Lower Duwamish Waterway Feasibility Study (AECOM, 2012)
Note: Unit emissions are given for a 10 acre site with 5 feet contamination depth, 50% volume creep, transportation to and disposal at Roosevelt Landfill, 50% open water disposal, and 50% beneficial reuse. BMPs include finer tolerances, maximize rail use,

Comparison of Environmental Benefits to Cost



Source: AECOM (2016)

Questions?

Thank you!

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