



Sustainable Remediation 2011: State of the Practice
June 2011

Incorporating Sustainability Considerations in Sediment Remedy Selection

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Outline

- Site Overview (Sediment component)
- Feasibility Study –Alternatives Considered and Selection
- Develop another Alternative from a Sustainability Perspective
- Evaluation of Alternatives using Sustainability Metrics
- Conclusion



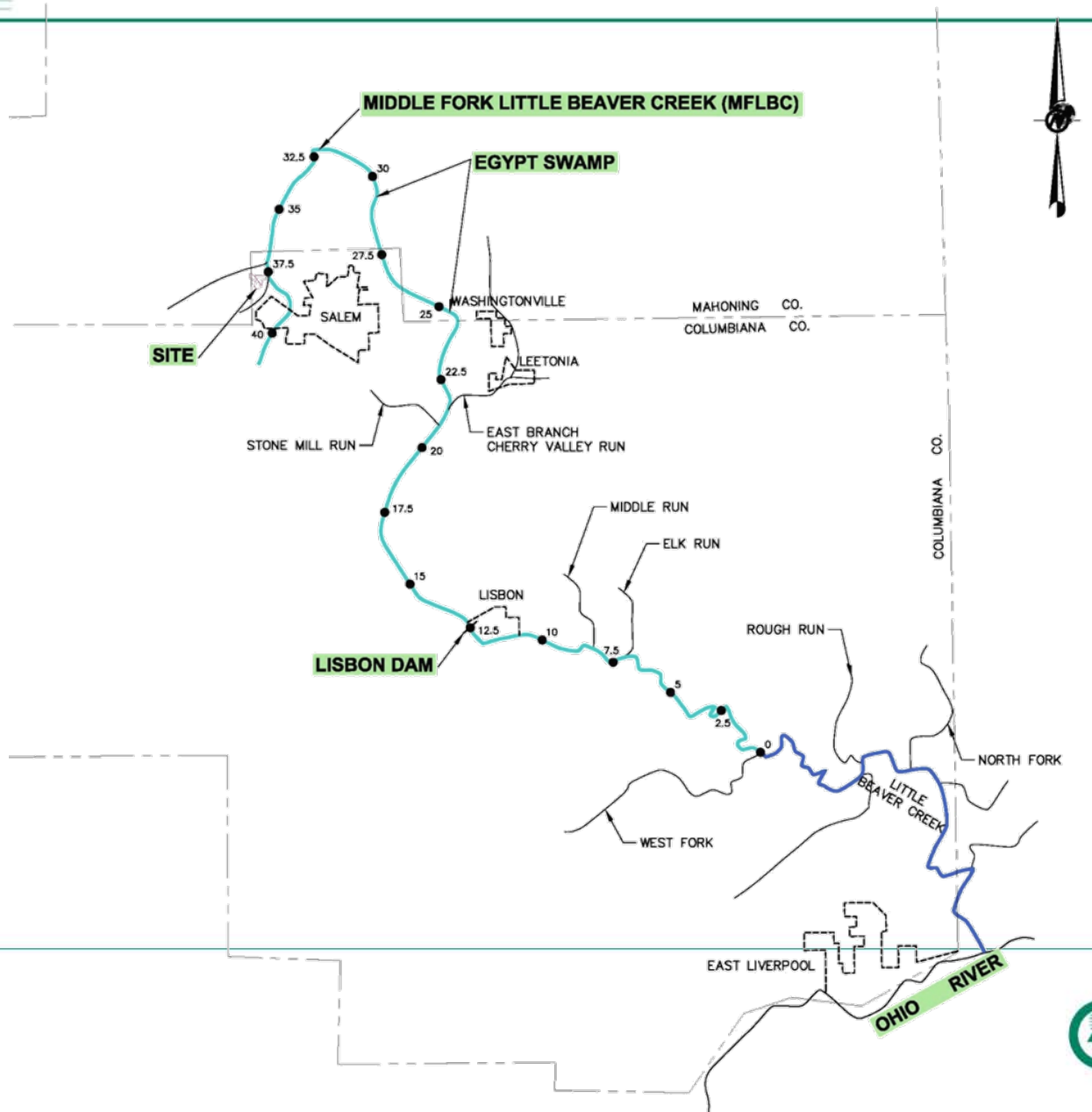
Retrospective Case Study

- Nease Chemical CERCLA site, Ohio
- Former pesticide manufacturer
- Primary COC mirex (C₁₀Cl₁₂):
 - Hydrophobic (log K_{ow}= 6.89)/lipophilic
 - Persistent, bioaccumulative
- Impacts detected in 40 river miles of sediment and floodplain
- Documented impacts to fish tissue, beef and milk of cattle raised in floodplain

- On-site source control IRM
- Off-site Engineering and Institutional Controls
 - Fencing to exclude cattle from creek and low lying floodplain areas
 - Catch and Release Order for fish
 - Direct contact restriction on Creek

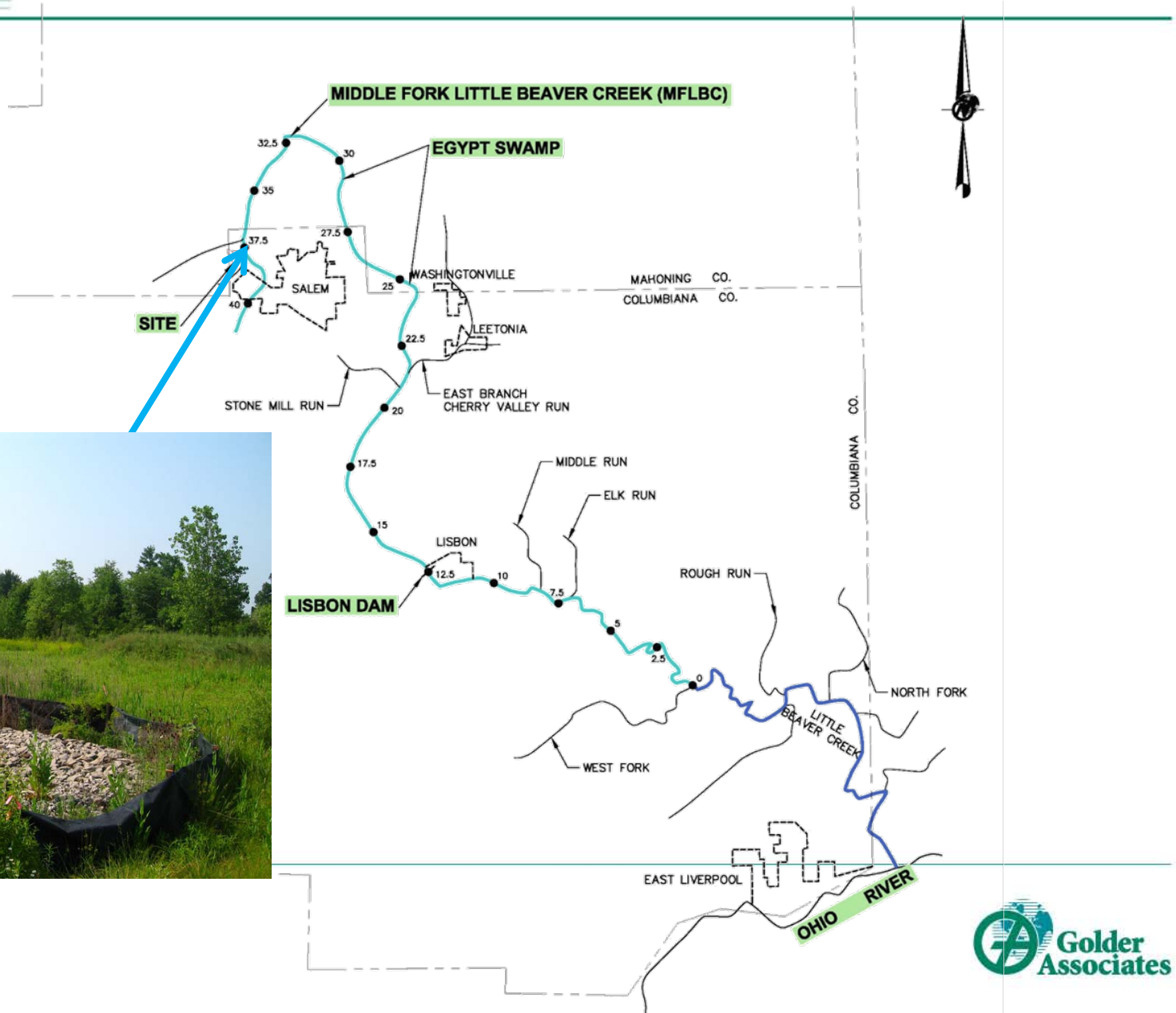


Site Overview



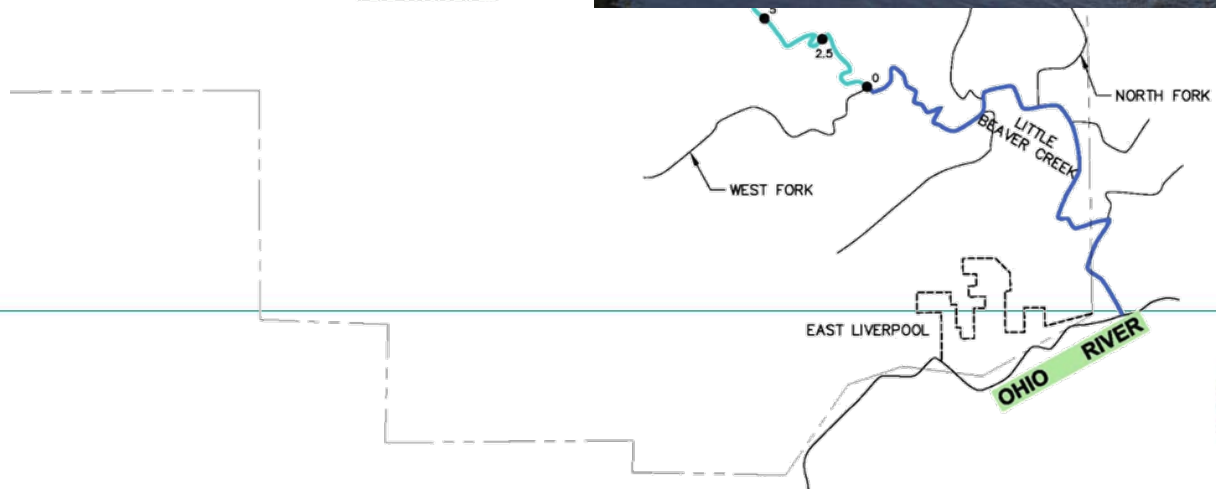
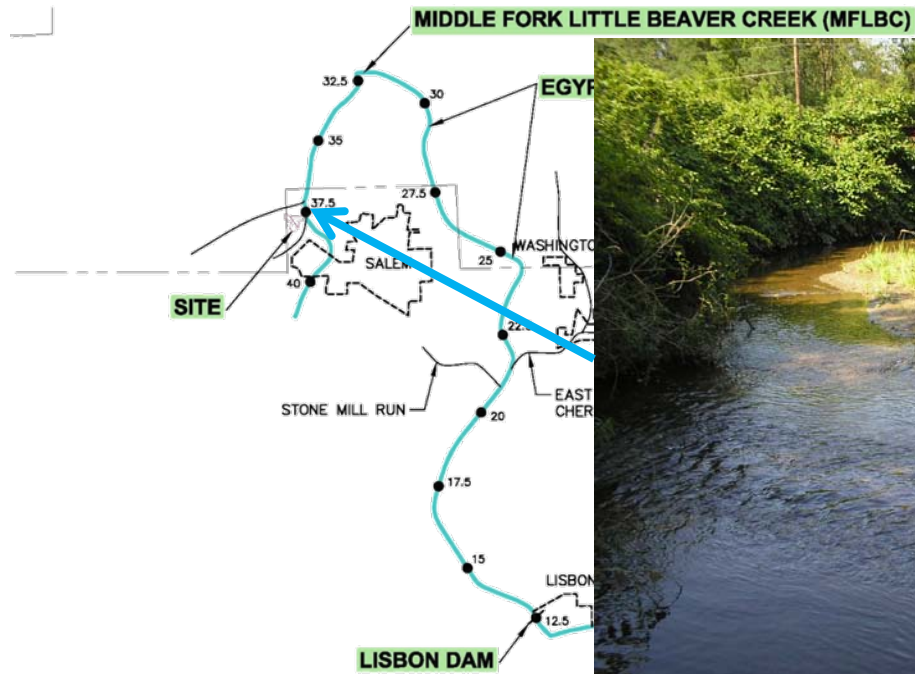


Site Overview



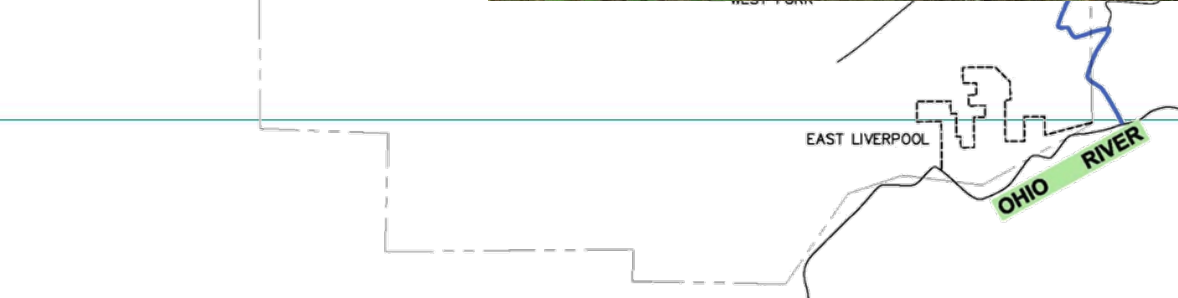
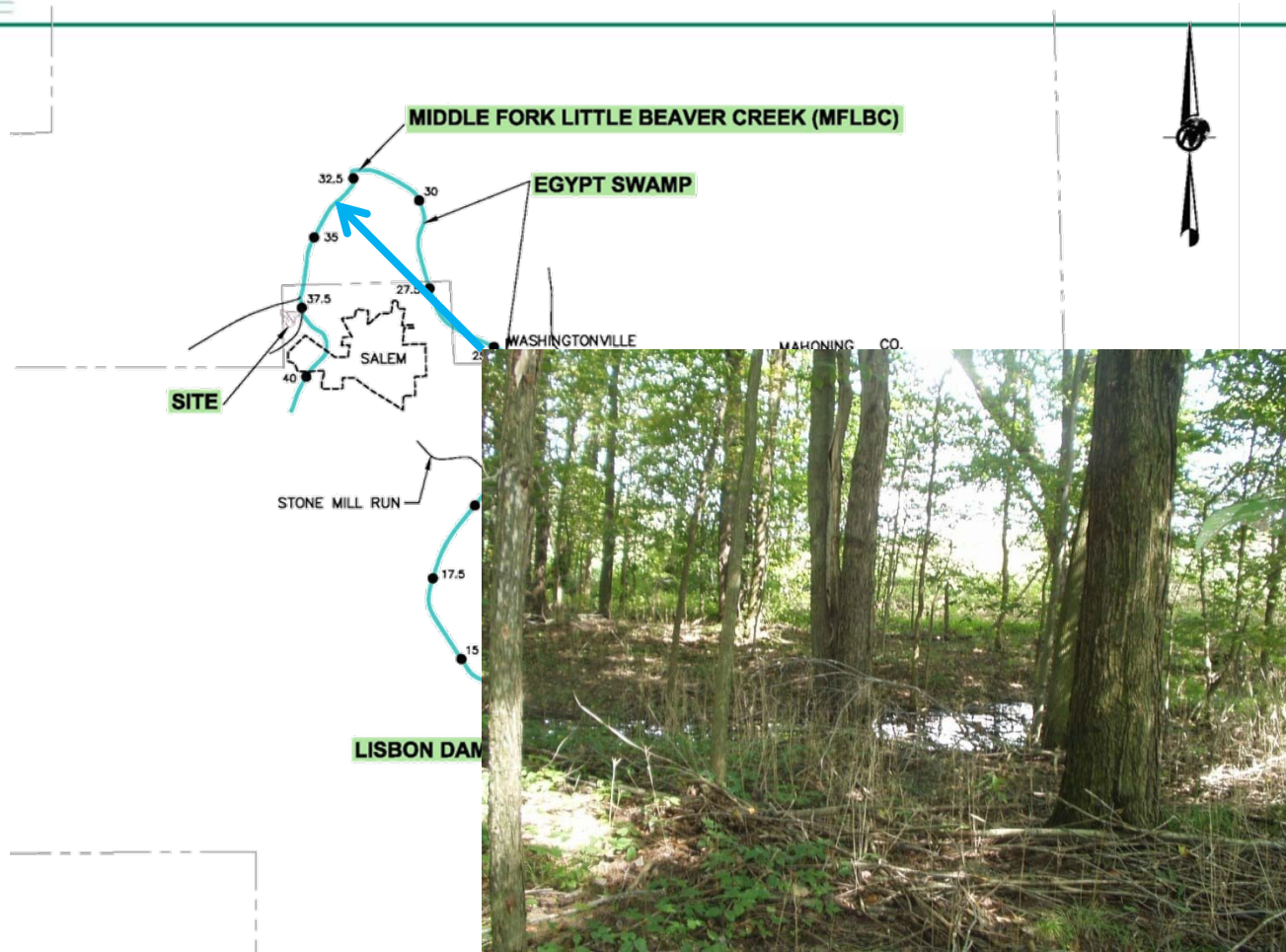


Site Overview



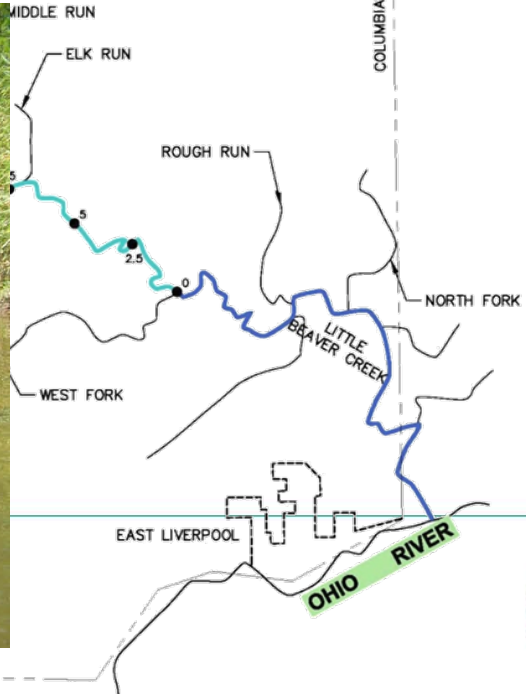
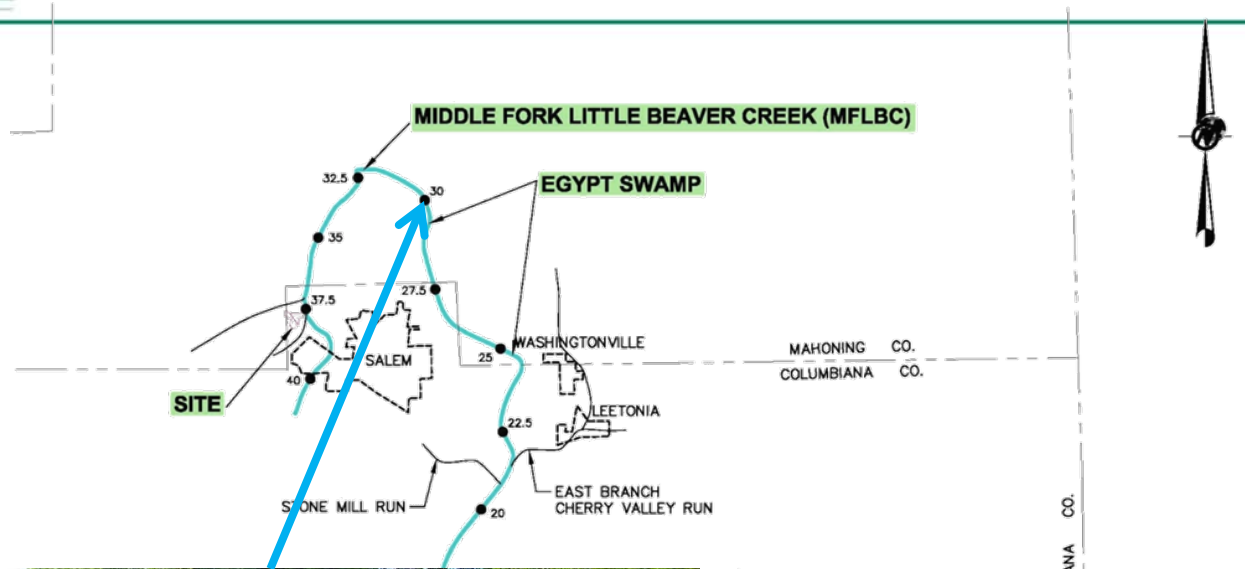


Site Overview



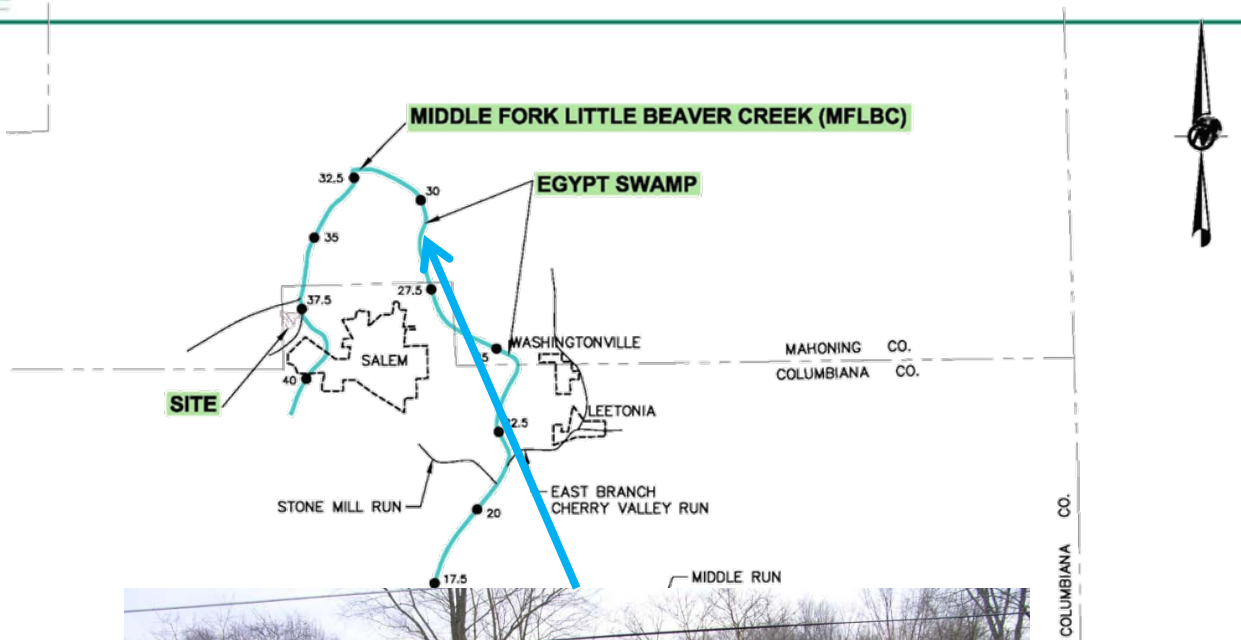


Site Overview



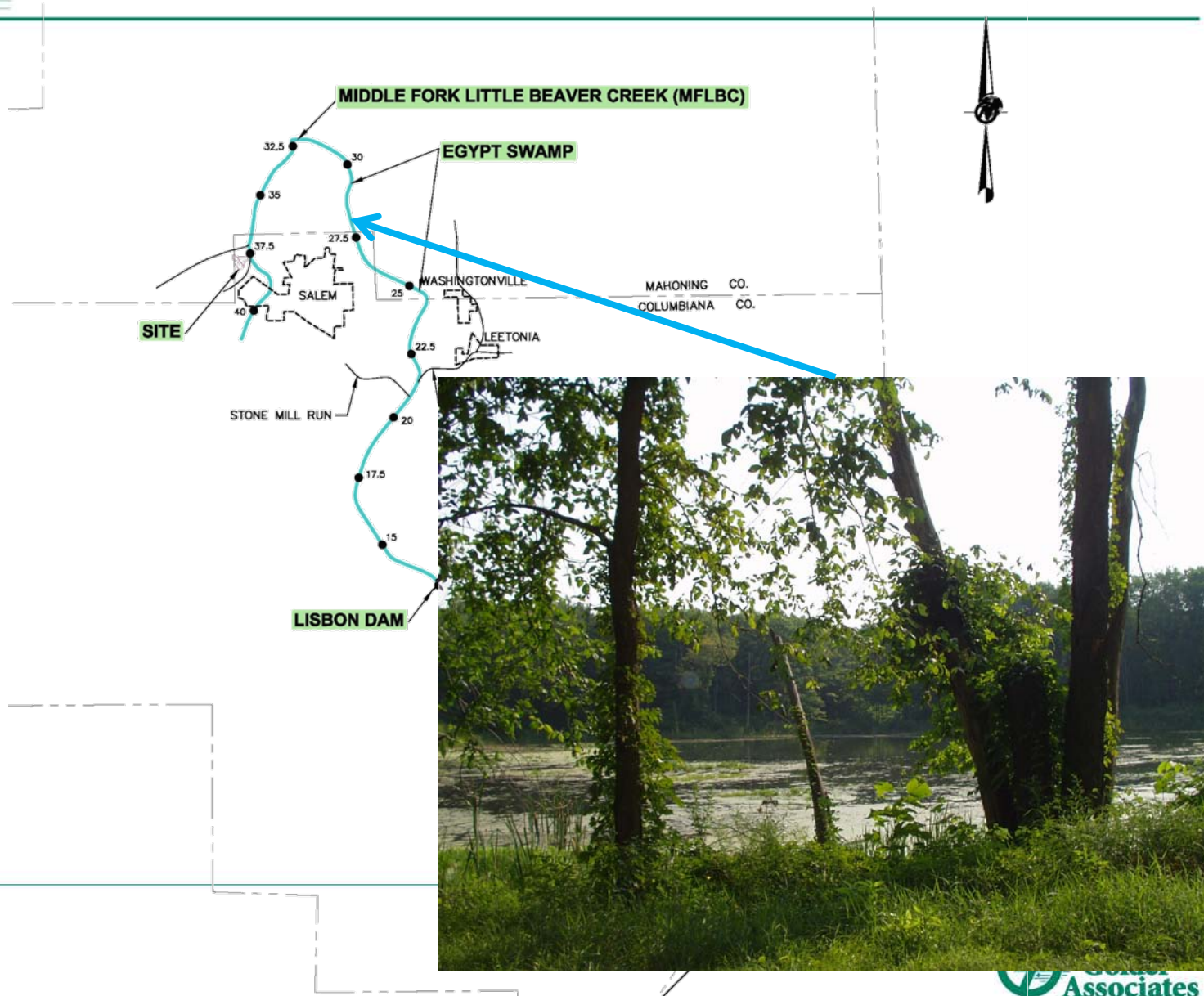


Site Overview



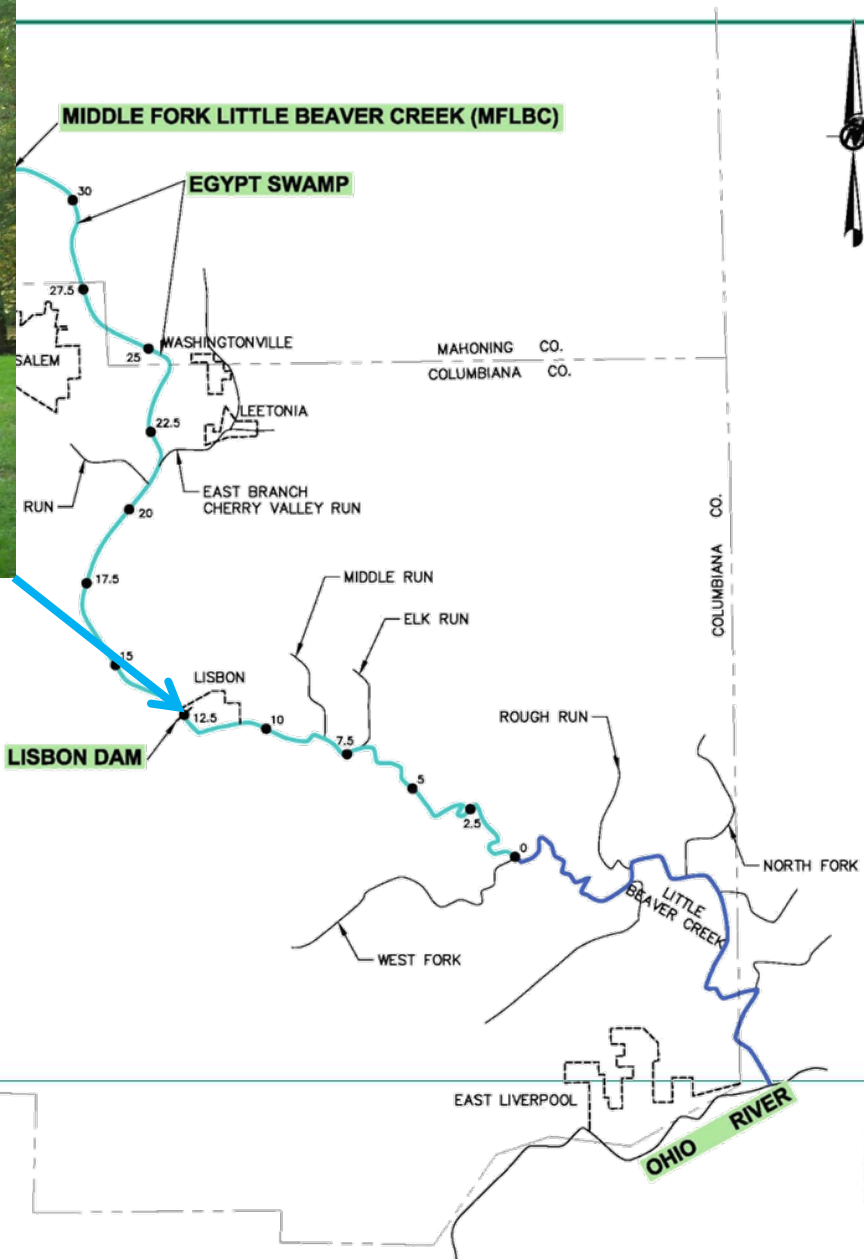


Site Overview





Site Overview





Remedial Action Objectives

■ Sediment

- Mitigate unacceptable levels of mirex uptake in fish from sediment
- Mitigate additional mirex contamination of floodplain soil from sediment

■ Floodplain Soil

- Mitigate ecological exposures to unacceptable levels of mirex in floodplain soil
- Mitigate unacceptable levels of mirex uptake in cattle from floodplain soil



CERCLA Remedial Alternatives (simplified)

Alternative	Sediment	Floodplain Soil
Alternative 1	No Further Action	No Further Action
Alternative 2	Monitored Natural Recovery	Targeted removal
Alternative 3	Targeted removal (Dredging)	Targeted removal



CERCLA Alternative Evaluation

Relative Ranking	Protection of Human Health and Environment	Compliance With ARARs	Short-Term Effectiveness		Long-Term Effectiveness	Reduction of Toxicity, Mobility, Volume	Implementability	Cost
			Potential Short-Term Impacts	Remediation Time Frame				
<i>First</i>	Alt. 2, 3	Alt. 2, 3	Alt. 2	Alt. 3	Alt. 3	Alt. 3	Alt. 2	Alt. 2
<i>Second</i>			Alt. 3	Alt. 2	Alt. 2	Alt. 2	Alt. 3	Alt. 3

- Resulted in selection of Alternative 3 (targeted removal of sediment and floodplain soil)

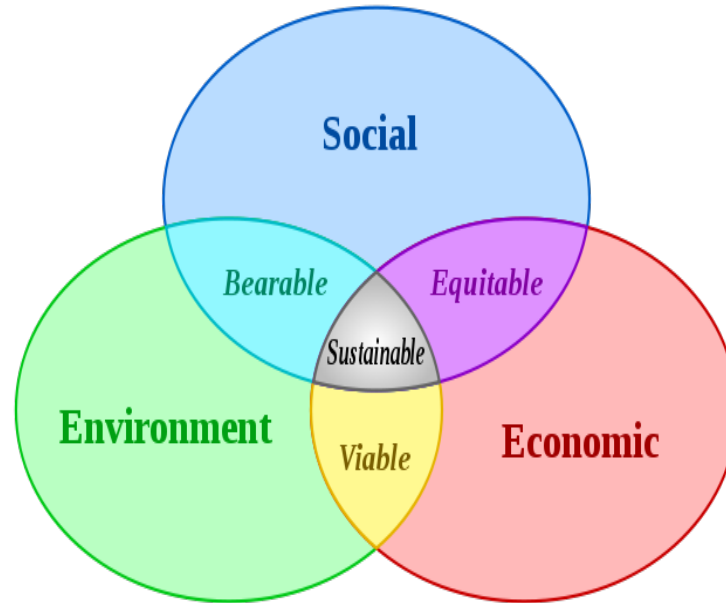


Additional Remedy Considerations

- The aquatic community is healthy/improving
- Remaining aquatic community impacts are not site-related (physical habitat and sewage stressors)
- Institutional and engineering controls have effectively mitigated human health risks
- Removing riparian engineering controls will have a negative effect on aquatic system
- Even if mirex in fish tissue is reduced, unlimited human use of the resource still cannot be achieved due to background contamination
- Dredging/removal will adversely impact aquatic and riparian zone habitats



Sustainability Dimensions



The Sustainability Challenge:

Finding an acceptable balance among the three dimensions of sustainability so as to best meet the present needs and goals without compromising the ability of future generations to meet their own goals and needs

Sustainability Resources



Sustainable Remediation White Paper—Integrating Sustainable Principles, Practices, and Metrics Into Remediation Projects

David E. Ellis
Paul W. Hatley

1.0 INTRODUCTION

The remediation industry was born in the late 1970s, following a steady stream of highly publicized discoveries of toxic chemicals in landfills, drinking water, and even neighborhoods. The government responded to these discoveries of environmental contamination. Environmental laws were passed at the state and national level, and programs were created within environmental regulatory agencies to oversee and sometimes fund the cleanups. Industry and consultants kept pace by hiring staff, building programs, and initiating cleanups. The remediation industry was off at a sprint before it had learned to crawl.

With the public demand for swift and sometimes immediate cleanups, responsible parties and the remediation industry invested heavily in energy intensive engineered projects, such as groundwater pump-and-treat systems, soil excavation and off-site disposal, incineration, and thermal treatment. The public's attitude was that no cleanup could be initiated soon enough or implemented fast enough.

While such energy intensive remediation systems are well intended, they generally have not achieved acceptable cleanup levels (National Research Council [NRC], 2005). These energy intensive engineered remedies frequently cannot overcome the basic technical limitations encountered when recovering contaminants from the environment once the contaminants are widespread and dilute. As a result, most engineered groundwater remediation systems reach a certain concentration and go no further regardless of the energy expended. The concentration that can be reached is often far higher than the cleanup level.

Within the last ten years, a growing body of information suggests that global climate change can be correlated with fossil fuel use and carbon dioxide releases into the atmosphere. As members of the broader environmental industry, remediation experts are well aware of this concern and have firsthand knowledge of the potential contribution of energy intensive remediation systems to global climate change. For example, at one remediation project in New Jersey, it was estimated that the difference between two proposed remedies could be as high as 2 percent of the annual greenhouse gas emissions



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Sustainable Remediation

- Sustainable remediation:
 - “...a remedy or combinations of remedies whose net benefit on human health and the environment is maximized through the judicious use of limited resources”
 - *Sustainable Remediation Forum (SURF)*

- A Sustainable Remedial Action is one that:
 - Protects human health and the environment
 - Minimizes energy/resource consumption
 - Reduces/eliminates releases to the environment from remediation
 - Harnesses or mimics a natural process
 - Results in the reuse or recycling of land or other resources
 - Encourages the use of remedial technologies that permanently destroy contaminants

Ellis & Hadley, 2009



A Sustainable Alternative

- Environmental Controls
 - Restrict activities in riparian zone (environmental covenant)
 - Avoids cattle exposure
 - Enhances habitat (riparian and aquatic)
 - Maintain fishing advisory (catch and release)
 - Protects fish population
 - Protects human health
 - Manages background risk

- Environmental Enhancements
 - Restore physical habitat (sinuosity, substrate and bank enhancement)
 - Enhance wetland functions and values
 - Concrete dam removal

- *No (or more limited) sediment/soil removal*



Alternative Evaluation based on Sustainability

- Compare alternatives based on combination of *environmental*, *social* and *economic* dimensions of sustainability
- Individual metrics include, but expand upon, the conventional NCP criteria
- Weighting of metrics is transparent and site-specific
- Calculation tools for new metrics such as GHG emissions, energy consumption

GoldSET® : Environmental Indicators

Environmental Aspect						
Code	Indicator	No Action	Monitored Natural Recovery	Targeted Removal (Dredging)	Environmental Controls and Enhancement	Weight
ENV-1	Soil Quality	0	50	90	50	3
ENV-2	Sediment Quality	0	50	90	50	3
ENV-3	Surface Water Quality	0	50	50	90	3
ENV-4	Water Usage	100	82	0	43	1
ENV-5	Short-Term Impacts on Biodiversity and Species Sta	100	100	0	50	1
ENV-6	Long-Term Impacts on Biodiversity and Species Stat	50	50	50	150	3
ENV-7	Greenhouse Gas Emissions	100	99	0	28	1
ENV-8	Energy Consumption					1
ENV-9	Wastes					1
ENV-10	Short term Impacts to Land Use					1
ENV-11	Long-Term Impacts to Land Use					1
ENV-12	Short-Term Impacts to Habitat	100	100	0	0	1
ENV-13	Long-Term Impacts to Habitat	50	100	50	100	2
ENV-14	Contamination Removal	0	20	100	20	3

Greenhouse Gas Emissions

Compares the estimated quantity of GHG emitted by the various options.

Ok

GoldSET® : Social Indicators

Social Aspect						
Code	Indicator	No Action	Monitored Natural Recovery	Targeted Removal (Dredging)	Environmental Controls and Enhancement	Weight
SOC-1	Public Safety	100	100	50	50	2
SOC-2	Worker's Safety	100	50	0	0	2
SOC-3	Duration of Work	100	0	33	33	1
SOC-4	Quality of Life (During the Project)	<p>Quality of Life (During the Project)</p> <p>Evaluates the impact of each option on the quality of life associated with the execution of the option.</p> <p>Scoring Scheme :</p> <p>0 = Significant impact anticipated</p> <p>50 = Some impacts anticipated</p> <p>100 = No anticipated impact</p>				1
SOC-5	Use for the Public					3
SOC-6	Local Job Creation and Diversity					1
SOC-7	Response to Social Sensitivity					2
SOC-8	Standards, Laws and Regulations					1
SOC-9	Impact on the Landscape	1				



GoldSET© : Economic Indicators

Economic Aspect						
Code	Indicator	No Action	Monitored Natural Recovery	Targeted Removal (Dredging)	Environmental Controls and Enhancement	Weight
ECONO-1	Net Present Value of Options' Costs	100	77	0	33	3
ECONO-2	Environmental Reserve	0	0	50	0	1
ECONO-3	Economic Advantages for the Local Community	<div data-bbox="838 634 1673 919" style="border: 1px solid gray; padding: 5px;"> <p>Net Present Value of Options' Costs</p> <p>Measures the present value of the costs (including initial capital expenditure and O&M expenses) over the life of the project.</p> <p style="text-align: right;"><input type="button" value="Ok"/></p> </div>				2
ECONO-4	Reliability (Maintenance and Repair)					1
ECONO-5	Technological Uncertainty					3
ECONO-6	Logistics					1



Comparison of Alternatives

Monitored Natural Recovery

ENVIRONMENT	64%
SOCIETY	46%
ECONOMICS	30%

Environment



Economics Society

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Project Cost : \$ 1,800,000.00

Project Duration : 60 years

Targeted Removal (Dredging)

ENVIRONMENT	56%
SOCIETY	49%
ECONOMICS	36%

Environment



Economics Society

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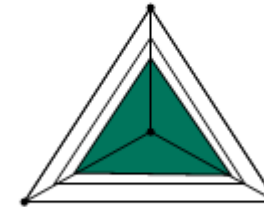
Project Cost : \$ 3,000,000.00

Project Duration : 30 years

Environmental Controls and Enhancement

ENVIRONMENT	59%
SOCIETY	62%
ECONOMICS	59%

Environment



Economics Society

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Project Cost : \$ 1,500,000.00

Project Duration : 30 years



In Conclusion...

- Introducing sustainability considerations provides a framework for:
 - Evaluating a broader range of alternatives
 - Considering net environmental benefit
 - Considering extra-local interests
 - Integrating remediation and restoration goals
 - Supports corporate sustainability reporting
 - Developing *better* remedies
- Depending on the regulatory environment for a given site, the acceptance of this approach may vary.



Thank You

www.GOLD-SET.com