An Equation that Enhances the Chances of Success of Mine Waste Mitigation by Stakeholders – Driven Projects

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"One of the landmark environmental protection laws enacted by Congress in the late 1960s and early 1970s, the Clean Water Act of 1971, now stands as one of the principal obstacles for the treatment of acid mine drainage.

When a third party—a nonprofit organization, community group, government agency, or corporation—attempts to clean up acid mine drainage coming from an abandoned mine, that third party legally assumes liability for the mine's discharge. An environmental Good Samaritan may want to decrease the acid mine drainage, but perhaps because of cost limitations, cannot undertake a comprehensive remediation project that would satisfy Clean Water Act water quality standards."
Cleaning Up Abandoned Hardrock Mines in the West: Prospecting for a Better Future. 2005. Limerick, et al.

Stake holder

The Equation

Probability of Success F(x) = (Federal + State + Local) Governments +

(Private Concerns) + (Owners) +

(Non-Profit Organizations) + (NGO's) +

(Realistic Expectations + Specialist Level In-depth Knowledge) + (Experience) +

(Sound sampling design with quality assurance and quality control)

(Preparation of Project Plan) + (Vetting of Project by Experts)

Why have I added these components to the equation?

(Sound sampling design with quality assurance and quality control)

(Specialist Level In-depth Knowledge) +
(Experience) +

(Preparation of Project Plan) +

(Vetting of Project by Experts) +

(Realistic expectations)

There have been many well-intentioned attempts to remediate mine sites and treat mine wastes that have failed.

Some have failed because the design and construction team had a superficial knowledge and little experience with the applied technologies.

Some have failed because the expectations were overly ambitious.

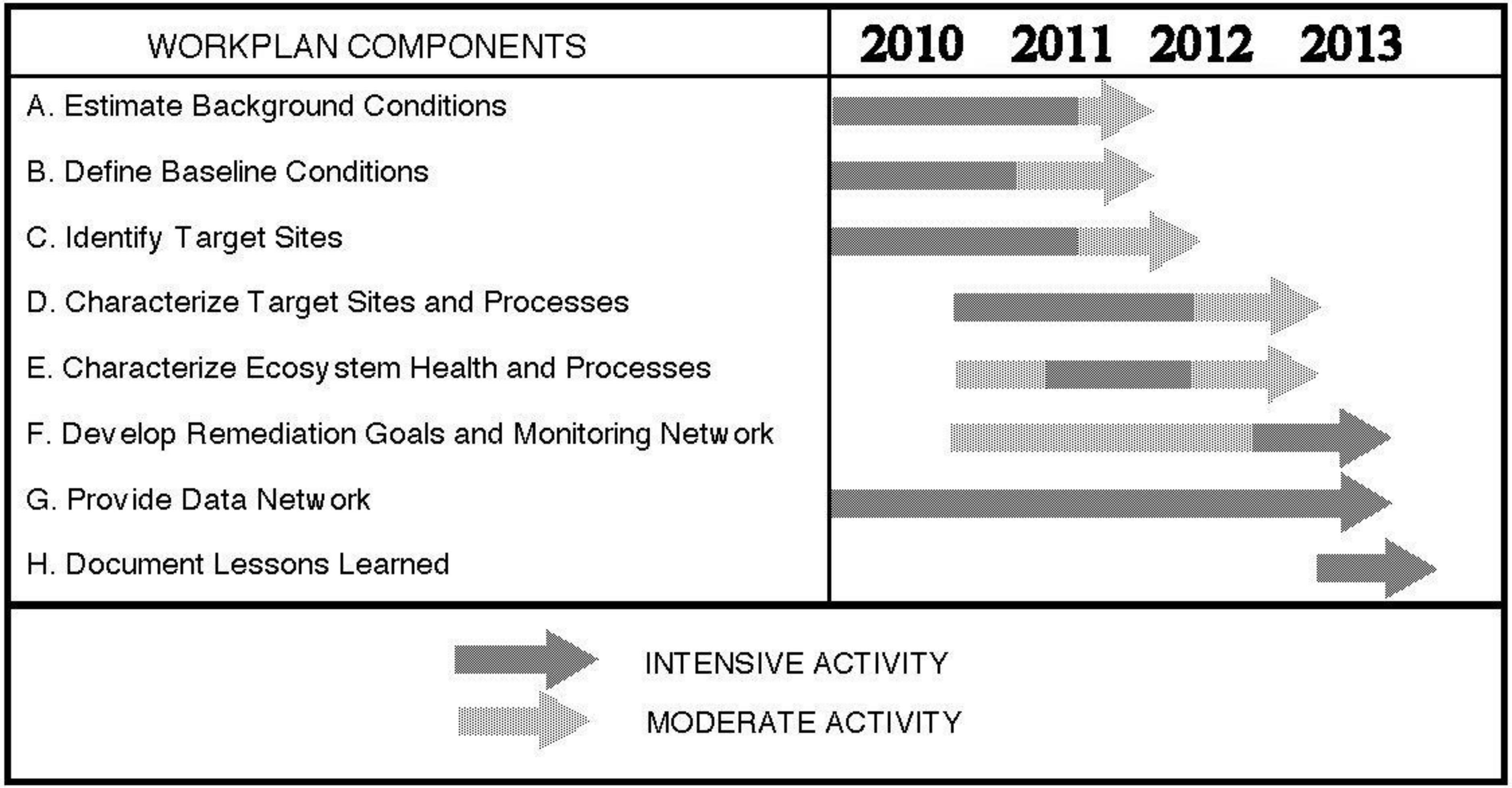
Inadequate sampling design.

What does the USGS recommend for Acceptable Sampling?:
Estimate Background (pre-mining) Conditions

- Define Baseline (current) Conditions
- Identify Target Sites (major contaminant sources)
- Characterize Target Sites and Processes Affecting Contaminant Dispersal
- Characterize Ecosystem Health and Controlling Processes at Target Sites
- **Develop Remediation Goals** and Monitoring Network
- **Provide an Integrated, Quality-Assured**, and Accessible Data Network
- Document Lessons Learned (for future applications of watershed approach)

A Science-Based, Watershed Strategy to Support Effective Remediation of Abandoned Mine Lands. Buxton, et al.1997. USGS.

There must be a thoughtful and well documented plan



Schedule for accomplishment of workplan components.

A Good Example: Trout Unlimited.

Trout Unlimited, Jason Willis, 2017 presentation: A Collaborative Approach to Mine Reclamation

Trout Unlimited lists several collaborative efforts and offers before-after photos.

Lion Creek Project – TU, CCWF, NFF, USFS, CSM, USGS, Mtn. Pine Mfg.

Leavenworth Watershed – TU, USFS, Freeport, NFF, DRMS, CDPHE, USGS, EPA

Tiger Mine Project – TU, BLM, DRMS, CMC, Freeport

These projects fulfilled all of the components of the equation!

Examples: King Solomon Mine in Mineral (Creede District), CO

Community representatives and NGO's had read about "Wetland Treatment Systems" for treating Acid Rock Drainage. The system did not treat the water from the adit successfully. An inspection of the system revealed many deficiencies that were a result of lack of in-depth knowledge of the state-of-the-art design and function.

Example: Pennsylvania Department of Environmental Protection and the Bureau of Abandoned Mine Reclamation (BAMR) Projects

Constructed facilities have run the gamut of available passive treatment options, including limestone beds, aerobic wetlands, anoxic limestone drains, vertical flow systems of different variations and semi-active lime dosing systems.

Unforeseen problems have been encountered in both construction and operation of the various systems. The most common construction related problems have included encountering additional flows during excavation, leaking ponds and difficulties attempting to manipulate mine pool elevations.

Significant plugging at the entrance to a limestone bed has been a problem at one site. Finally, an evolving issue is the need for more frequent and significant maintenance than was initially envisioned with these systems.

Example: Acid mine drainage (AMD) from abandoned underground mines significantly impairs water quality in the Jones Branch watershed in McCreary Co., Kentucky, USA.

A 1022-m^2 surface-flow wetland was constructed in 1989 to reduce the AMD effects, however, the system failed after six months due to insufficient utilization of the treatment area, inadequate alkalinity production and metal overloading.

Realistic Expectations: Expect treatment to meet cold water stream standards.

Removing 50% of the metals or even 70% of the metals typically won't meet stream standards. Improved water quality – yes. Meets stream standards – No

Example: A small VFW system constructed in Butler County, PA at an abandoned surface mine site, is operating very effectively with minimal problems. Currently, the system is removing about 50 percent of the manganese and is discharging net alkaline water.