

Lecture 22 overview

1. Overview
2. Types of mitigation
3. Developing a program
4. Guidelines

Mitigation

- Avoidance of activities or areas
- Limits on actions or effects
- Repair or replacement of resources: on or off site

Mitigation

Two major uses:

- 1) Incorporate measures to reduce effects below 'significance':
 - *mitigated FONSI*
- 2) Reduced significant severe effects in an EIS:
 - incorporated into *ROD*

Mitigation

Mitigated FONSI

- Measures must be considered before proposed action
- Action must be conditioned on measure:
 - Contractual obligations
 - Condition requirements
 - Design modifications/measures

Mitigation requirements

- Must be site specific
- Must be independently analyzed
- Cannot be added during EA process without restarting
- Measures must be available to public
- Measures not based on planned studies
- Requires analysis of measures and effectiveness

EIS Process

Goals of NEPA: protect environment by considering environmental effects at International, Federal, State & local levels:

- Alternate course of actions
- Increasing use of mitigation
- Efficacy of mitigation very important

Methow Valley

*Robertson v.
Methow Valley Citizens Council*
Supreme Court, 1989

- Plaintiffs challenged the Forest Service's approval of a major downhill ski resort after an EIS study
- The EIS proposed on- and off-site mitigation measures which were not fully adopted by the agency building the resort

Methow Valley

Findings:

1. NEPA *does not impose* a substantive duty on agencies to mitigate adverse environmental effects or to include in each EIS a fully developed mitigation plan
2. NEPA itself does not impose substantive duties mandating particular results, but simply *prescribes the necessary process* for preventing uninformed -- rather than unwise -- agency action

Methow Valley

Findings:

3. While discussion of mitigation measures is important, there is a distinction between a *requirement of discussion* and a requirement that a mitigation plan be adopted
4. It would be inconsistent with NEPA's *reliance on procedural mechanisms* -- as opposed to substantive, result-based standards -- to demand the presence of a fully developed plan

10 Types of Mitigation

- | | |
|-------------------|---------------------|
| 1. Avoidance | 6. Restoration |
| 2. Preservation | 7. Replacement |
| 3. Minimization | 8. Augmentation |
| 4. Improvement | 9. Development |
| 5. Rehabilitation | 10. Diversification |

Avoidance

Avoid certain resources or areas of that are environmentally sensitive

Must be considered early in planning

Examples:

- Considering alternatives under NEPA
- Project management like staging or timing of activities

Preservation

Prevention of future actions by acquiring land or protecting it

Examples:

- Greenbelts
- Reserves & refuges, Land Trusts
- *Nature Conservancy*

Land Trusts

Nonprofit organizations involved in helping protect natural, scenic, recreational, agricultural, historic, or cultural property

About 900 independent land trusts in America:

- protect 2.7 million acres
- own 437,000 acres
- conservation easements on 450,000 acres
- used methods to protect 1,159,000 acres

- Columbia Land Trust

Minimization

Limiting the degree, extent, magnitude or duration of adverse effects

Examples:

- Biological/Civil engineering
- Project management
- Silt curtains, oil booms



Improvement

Enhance capability of an existing resource

Example:

- Artificial reefs



Rehabilitation



Repairing or enhancing affected resources, often from previous damage

Examples:

- Improve wildlife habitat
- Tree planting on stream banks

Restoration



Restoring affected resources to an earlier state

End point of process:

- improvement < rehabilitation < restoration

Typically requires extensive engineering

Examples:

- Wetland restoration
- Stream restoration

Stream Restoration



Common Procedure:

1. Remove invasive plants
2. Plant native trees
3. Stabilize soil
4. Lower sedimentation
5. Enhance fish survival

- ✓ Question
- ✓ Hypotheses
- ✓ Design experiment
- ✓ Conduct experiment
- X Analyze results
- X Interpret results

Stream Restoration



Questions:

1. How many plants
 2. What species?
 3. Location?
 4. Spacing?
- Solutions
- ```
graph LR; Q1[1. How many plants] --> S[Solutions]; Q2[2. What species?] --> S; Q3[3. Location?] --> S; Q4[4. Spacing?] --> S;
```

---

---

---

---

---

---

---

---

## Adaptive Approach

1. Try six different planting methods
2. Monitor water quality
3. Monitor fish abundance
4. Based on results, use best method, continue to monitor
5. Refine design and monitor in new areas

---

---

---

---

---

---

---

---

## Adaptive Approach

### Key components:

1. Approach allow us to learn from our impacts
2. Progress towards a low impact relationship with our environment

---

---

---

---

---

---

---

---

## Replacement

Compensation for loss of resources at one location with creation and/or protection at another location

May involve legal transfer of land

Example:

- Wetland Mitigation Banking

---

---

---

---

---

---

---

---

## Augmentation

Increasing size or area of an existing resource

Example:

- Increasing size of previous wetland or forest

---

---

---

---

---

---

---

---

## Development

Creating new resources

Required appropriate conditions & habitats

Example:

- Stormwater basins as 'wetlands' for groundwater recharge

---

---

---

---

---

---

---

---

## Diversification

Increase the mixture or diversity of habitats, species or resources

Example:

- Housing developments with greenways, forests and wetlands areas

---

---

---

---

---

---

---

---

## Wetland Banks

Mitigation projects where the loss of wetlands are offset by paying into a "wetland mitigation bank"

Rationale:

1. Replacement of numerous, small wetlands does not replace functions
2. Restoration of larger, functioning wetland more efficient

---

---

---

---

---

---

---

---

## Wetland Banks

"Bank" must be previously functioning wetland

Areas of the bank are sold (\$ per ft<sup>2</sup>) to developers to offset project impacts at varying ratios (e.g., 2:1)

Purchased areas held in permanent trust

Funds used to restore wetland

---

---

---

---

---

---

---

---

# Wetland Banks

## Issues:

- Replacement of functions
- Habitat fragmentation
- Social & Environmental justice

---

---

---

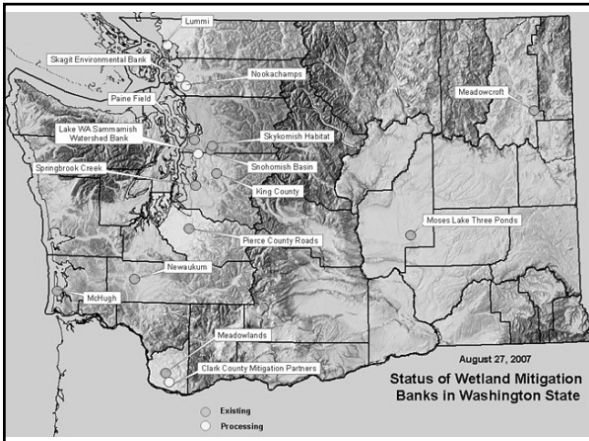
---

---

---

---

---



---

---

---

---

---

---

---

---

# Wetland Mitigation Standards

## Vegetation

- Species richness and diversity
- Survival & cover of native & invasive vegetation

## Hydrology

- Soil saturation, flow, depth & duration

## Substrates

- Soil color & texture

## Water Quality

- pH, temperature, BOD, nutrients, conductivity



---

---

---

---

---

---

---

---

## Wetland Mitigation Standards

Ossinger, Mary. 1998.  
*Standards for Wetland Mitigation Projects, A Guideline. Third Review Draft.* Washington Department of Transportation, Olympia.



---

---

---

---

---

---

---

---

## Mitigation Programs

Conducted by teams trained in engineering and natural sciences:

- Need to understand mechanics of project
- Need knowledge of biological systems
- But also need knowledge of social systems (human behavior & psychology)

Multi-step process

---

---

---

---

---

---

---

---

## Mitigation Program

A. What impacts can and should be mitigated?

- Not all impacts are significant
- Focus on significant ones
  - Most efficient
  - Avoid unforeseen consequences
- "Net zero impact" not the only criteria

---

---

---

---

---

---

---

---

## Mitigation Program

### B. Understand cause/effect relationships

Impacts may have several contributing causes which must be separated

Example: Effects of development on stream fishery

- Remove trees
- Build houses and roads/driveways nearby
- Divert runoff into stream

---

---

---

---

---

---

---

---

## Mitigation Program

### Direct effects:

- *Increase:*
  - temperature, sediments, organic matter, chemicals, flow rate
- *Decrease:*
  - oxygen content, detritus

---

---

---

---

---

---

---

---

## Mitigation Program

### Indirect effects:

- Organic matter cause algal bloom
- Sediment abrades fish gills
- Sediment smothers fish gills
- Reduction in detrital supply changes invertebrate community structure
- Storm flows scour gravel, remove debris
- Toxic runoff kills fish

---

---

---

---

---

---

---

---

## Mitigation Program



What is relative role of each factor?  
Eliminate all impacts or just a few?

Example:

- Is loss of fishery significant?
- If so, mitigate effects through:
  - Controlling of suspended particles
  - Avoiding storm flow increases
  - Treating runoff
  - Replanting trees
- If not, let project proceed, then restock

---

---

---

---

---

---

---

---

## Mitigation Program

C. Consider structural vs. non-structural methods

Non-structural methods:

Project management options that minimize or avoid impacts

Examples:

- Project staging
- silt guards
- soil storage

---

---

---

---

---

---

---

---

## Mitigation Program



Structural methods:

Major investments of funds to design, construct and maintain features of a project

Example:

- Wildlife under- and over-passes



---

---

---

---

---

---

---

---

## Mitigation Program

### D. Evaluate potential side effects

Implementation may result in unforeseen consequences

- Often due to lack of precise knowledge & understanding of environment
- Failure to conduct an adequate assessment

---

---

---

---

---

---

---

---

## Mitigation Program

### Examples:

1. Create wildlife underpass
  - Hunters flock to area to kill deer
2. Create deeper, larger wetland
  - People begin swimming in pond
3. Plant trees along a roadway
  - Street lights stimulate foliage in winter, causing frost damage

---

---

---

---

---

---

---

---

## Guidelines

1. Each proposed mitigation measure:
  - Must be evaluated as a potential impact
  - Should be assessed for unintended consequences

---

---

---

---

---

---

---

---

## Guidelines

2. Consider mitigation very early in process as significant impacts are identified:
  - Helps to identify non-structural methods
  - Allows time to develop more costly structural approaches

---

---

---

---

---

---

---

---

## Guidelines

3. Evaluate physical and social factors that may influence implementation:
  - Achieve a consensus among all agencies on appropriateness
  - Use previous mitigation measures whenever possible

---

---

---

---

---

---

---

---

## Guidelines

4. Monitor measures for success with respect to their objectives:
  - Insures long-term achievement of objectives
  - Helps develop widely-useable, tested and proven methods

---

---

---

---

---

---

---

---