

Ecological Restoration Following a Sediment and Soil Removal Action

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Introduction

- Overview of tonight's presentation
- Ecological Restoration
 - Restoration Goals and Objectives
 - Existing Conditions
 - Integration of Restoration with Remedial Action(s)
 - Restoration Implementation
- Case Studies
 - Loring AFB - East Branch Greenlaw Brook
 - Sudbury River
 - East Branch Housatonic River
- Q & A

Defining Ecological Restoration Goals and Objectives



Ecological Restoration Goals and Objectives



- Goals and Objectives:
 - provide the foundation for defining project characterization and design parameters;
 - identify potential project challenges;
 - guide project implementation (methods); and
 - establish framework for defining measures of success.
- Need to be well thought out
- Use the process of establishing goals and objectives to communicate with interested parties

Ecological Restoration Goals and Objectives



- Goals
 - Statements of purpose for conducting the project
 - Broad - Restore wetland functions and values
 - Specific - Reestablish a cold water fishery
- Objectives
 - Provide basis for design criteria and performance standards
 - Flow regime
 - Water temperature
 - Habitat structure
 - Breeding success of target species

Defining Restoration Goals

- Can the project be successfully completed in place or does mitigation have to be considered?
- What is the desired outcome of the restoration (what should the river/floodplain look like) and the time period (by when)?
- Would functions and values be reproduced or enhanced?
- How do proposed future conditions relate to preexisting features?
- Define restoration goals with measurable objectives

Defining Restoration Goals (examples)

- Primary restoration goals
 - Restore wetland functions and values
 - Provide fish and wildlife habitat
 - Maintain flood storage
 - Insure sediment/bank stabilization
- Secondary restoration goals
 - Habitat enhancement
 - Increased recreational use

Defining Restoration Objectives

Objectives should:

1. Be realistic (budget, science, engineering, space, time)
 - Ensure that hydrology will support desired habitat type (e.g. lower water table will not support scrub/shrub habitat without further excavation)
 - Consider habitat limitations (e.g. need cold, oxygenated water to support trout)
 - Insure necessary materials are available
 - Timeframe (e.g. a mature forested floodplain will not grow in 5 years but will establish over a longer duration)

Defining Restoration Objectives

Objectives should:

2. Translate to specific measures

– Examples:

- The river/stream will contain a self-sustaining trout population.
 - Count redds, numbers of adults/juveniles, age class distribution
- The wetland will provide waterfowl brood-rearing habitat.
 - Count numbers of broods, young per brood

A photograph of a natural wetland area. In the foreground, there is a dense field of tall, green grasses. A small stream or pond flows through the middle ground, with several fallen logs partially submerged. The background consists of a dense forest of tall trees under a clear blue sky. The text "Existing and Proposed Conditions" is overlaid in the lower center of the image.

Existing and Proposed Conditions

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Development of Existing and Proposed Conditions Plans

- Existing Conditions – detailed baseline ecological characterization
 - Describe system functions and values
 - Narrative reports, maps, plan sheets, cross-sections
- Post-Remediation Conditions – status of the site following contaminated sediment/soil removal
 - Physical parameters
 - Maps, plan sheets, cross-sections
- Proposed Conditions – conceptual and construction plans
 - Conceptual or % design for review
 - Detailed construction plans & specs (construction bid package)



Baseline Ecological Characterization: Hydrology



Hydrologic and fluvial processes

- Verify sources of hydrology
- Establish channel type and morphological classification and evolution
- Determine patterns of erosion and accretion



1952

1972

1990

2000

Baseline Ecological Characterization: Soil Characterization

Existing Soils

- Organic Soils
 - Percent organic carbon
 - Organic horizon thickness
- Mineral Soils
 - Soil Texture
 - Oxidation
- Substrate type

Proposed Soils

- Mimic existing soil conditions
- Suitable for desired plant community
- Available in sufficient quantities

Baseline Ecological Characterization: Natural Communities/Wetland Classification

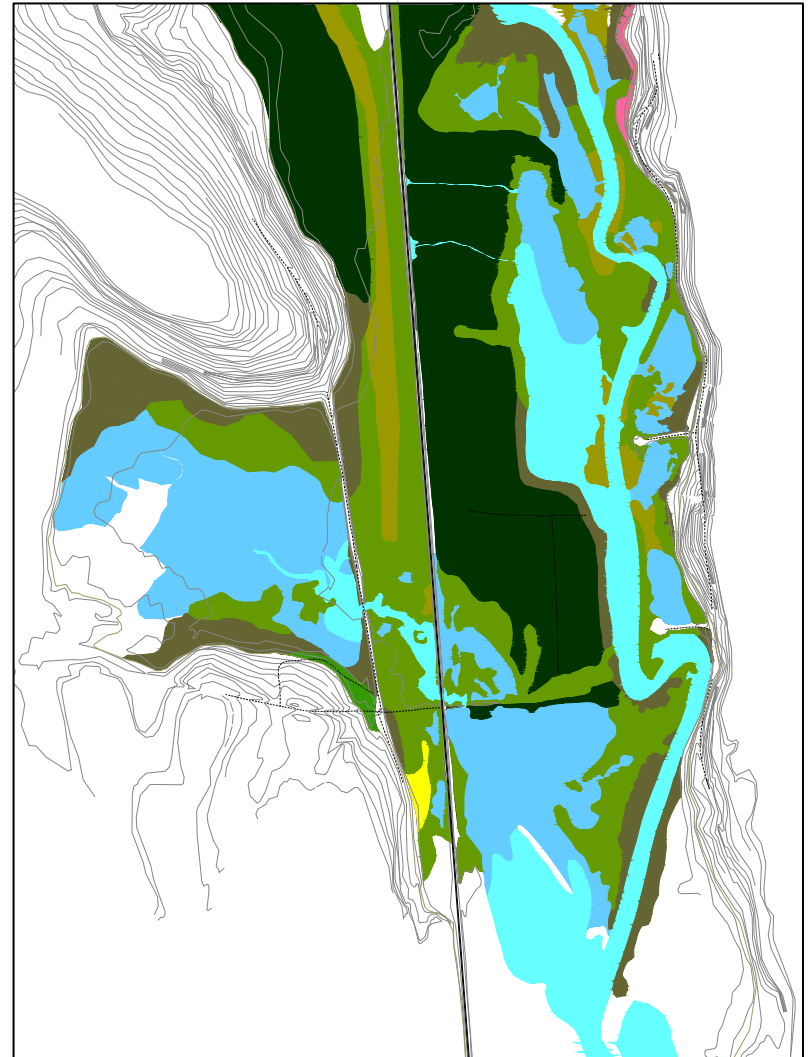


- Map using aerial photos
- Perform field surveys to ground-truth photo-interpretation
- GPS boundaries
- Develop layer for GIS data base

Develop Existing Conditions Plan Plan View

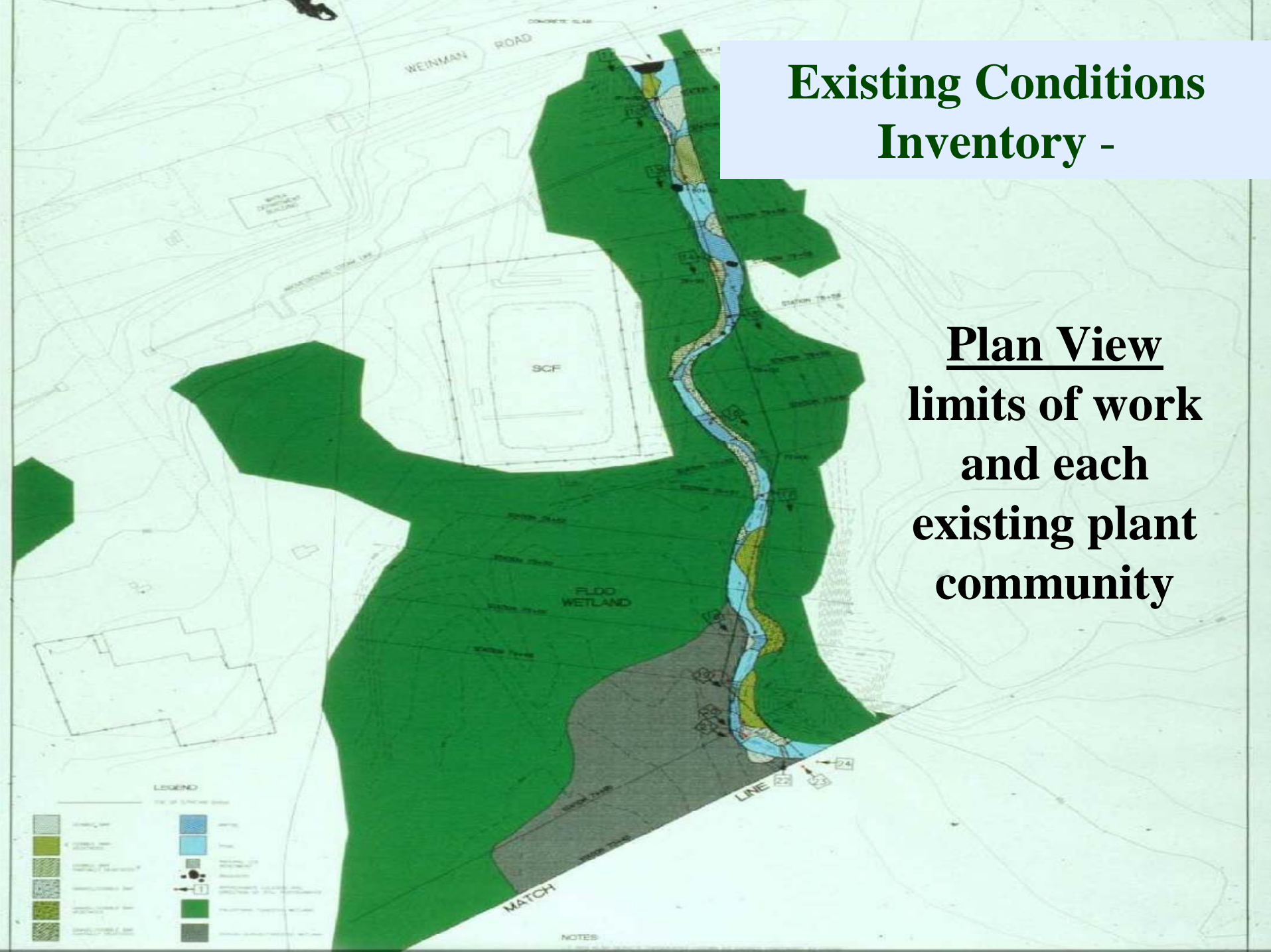
Mapping layers:

- Wetland & natural community boundaries
- In-stream structures
- Significant wildlife habitat
- Topography
- Infrastructure (roads, bridges)
- Removal area and restoration area boundaries
- Property boundaries
- Survey control locations



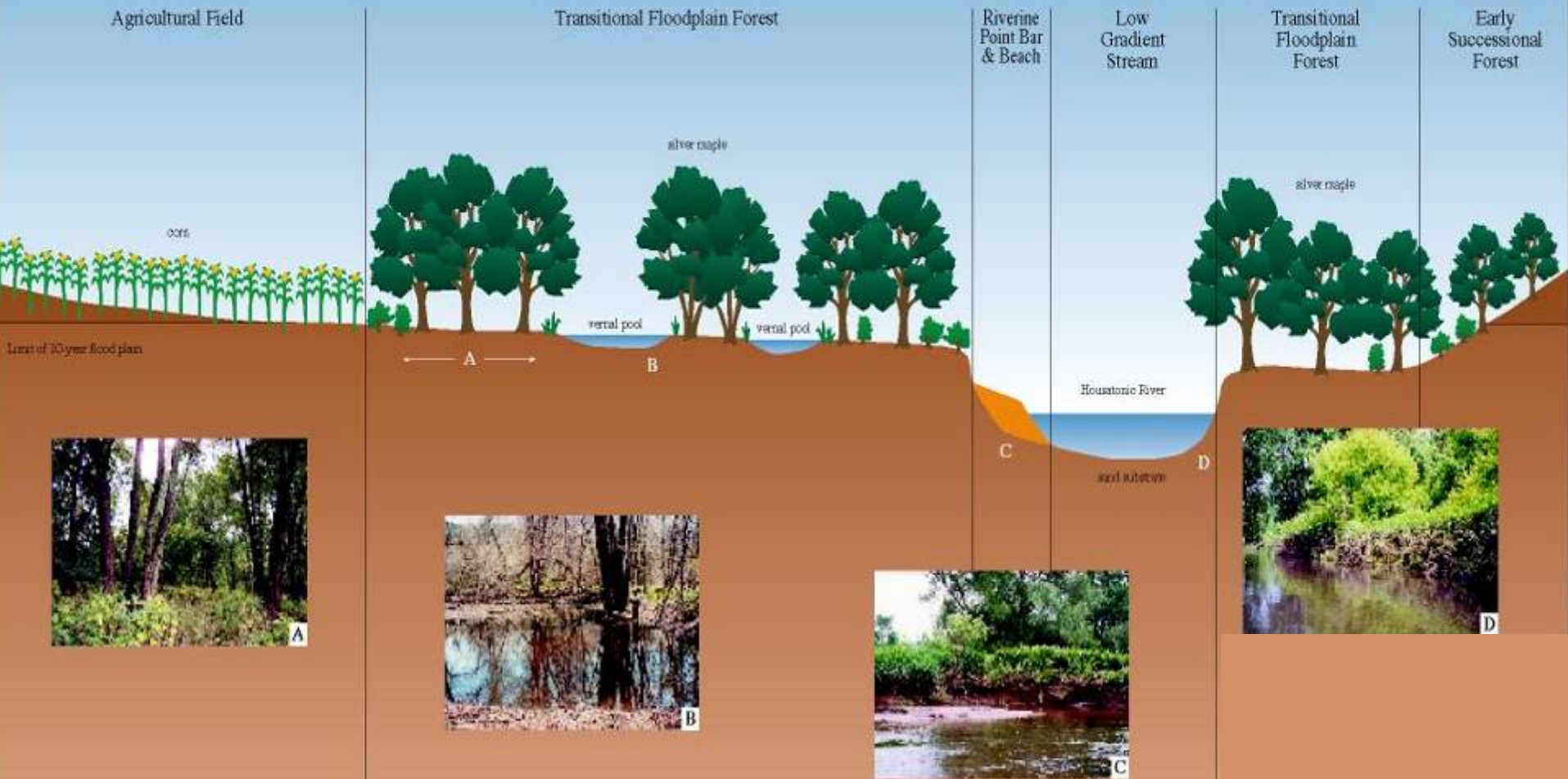
Existing Conditions Inventory -

Plan View
limits of work
and each
existing plant
community

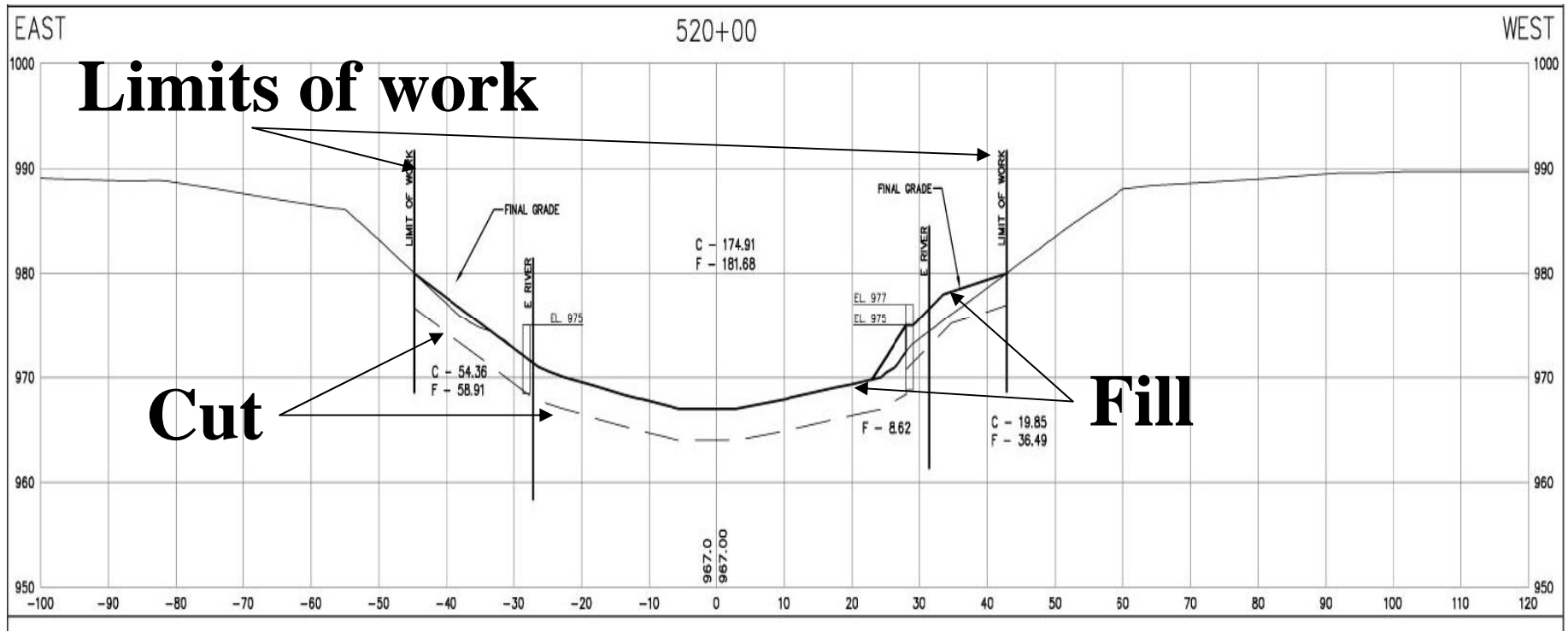


Develop Existing Conditions Plan

Example Cross Section



Develop Existing Conditions Plan (example cross-section)



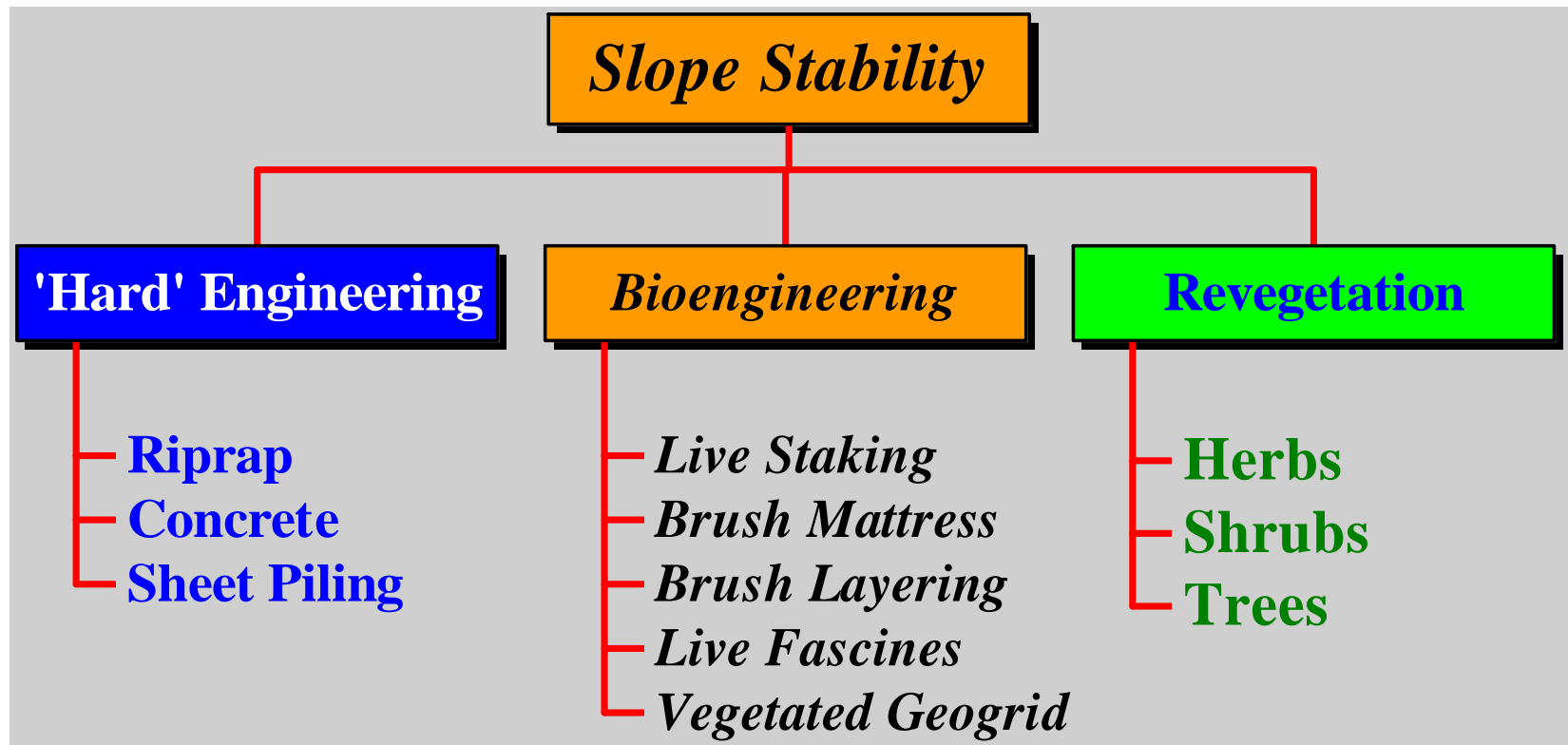
Develop Proposed Conditions Plan

Grading Plan

- Following removal of contaminated sediment/soil
 - reestablish survey control (profile & cross-sections)
 - check post removal grades & compare to proposed grades
- Develop final grading & resoiling plan (plan view and cross-sections)
 - resoil to final grade with suitable growth medium
 - use 6 to 8 inches minimum of soil
- Verify required hydrology is present

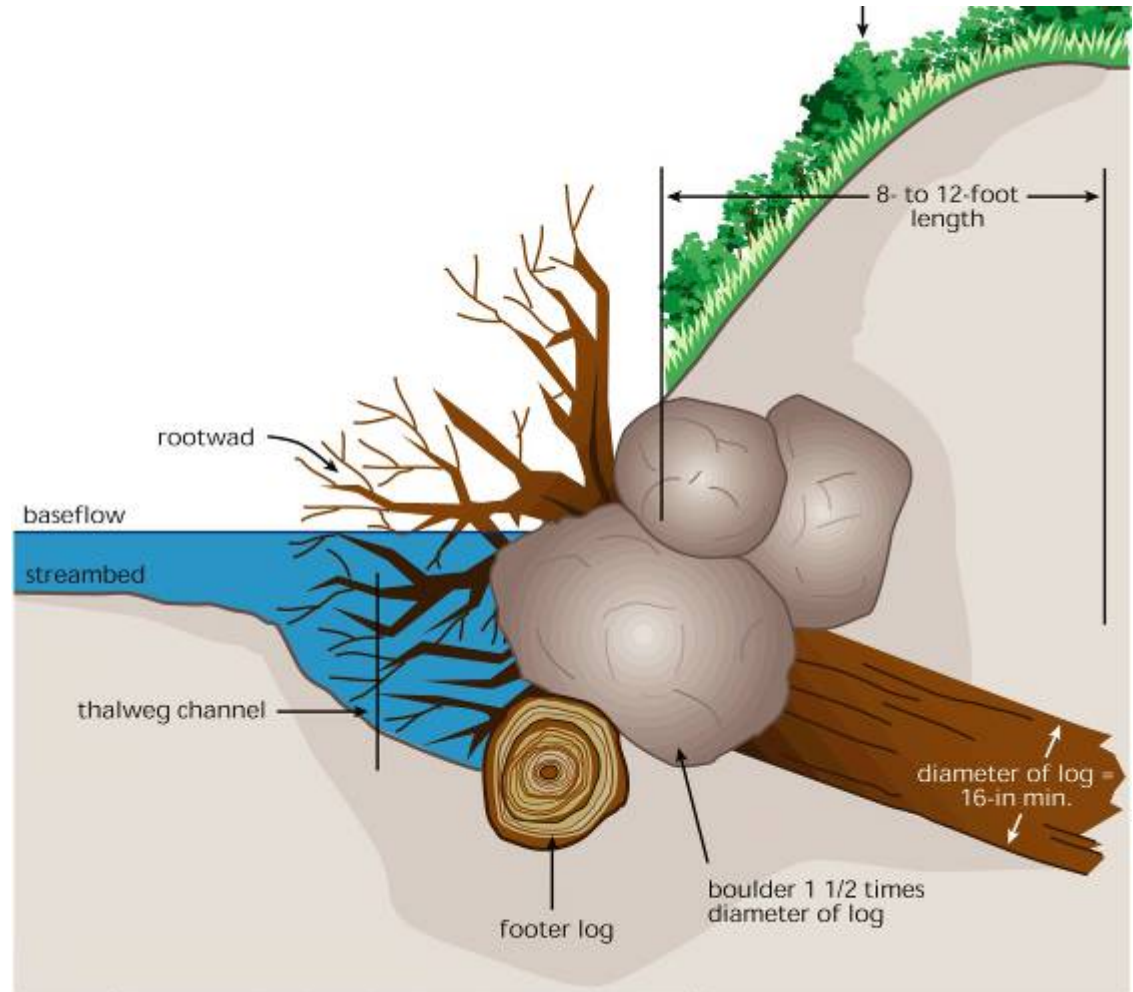


Develop Proposed Conditions Plan: Approaches to Bank Stabilization



Bioengineering of River Banks and Slopes

- Engineered analysis of proposed design
- Design criteria include:
 - Slope stability
 - Constructability
 - Cost
 - Ecological/biological Value



Source: Chapter 16 Engineering Handbook, USDA-NRCS, 1997.

Develop Proposed Conditions Plan

Planting Plan

- Show locations of each natural community (plan view)
- Provide diagram and explanation of planting density and spacing per habitat (herbs, shrubs, & trees)
- Provide diagram, text and field training on how to plant each species



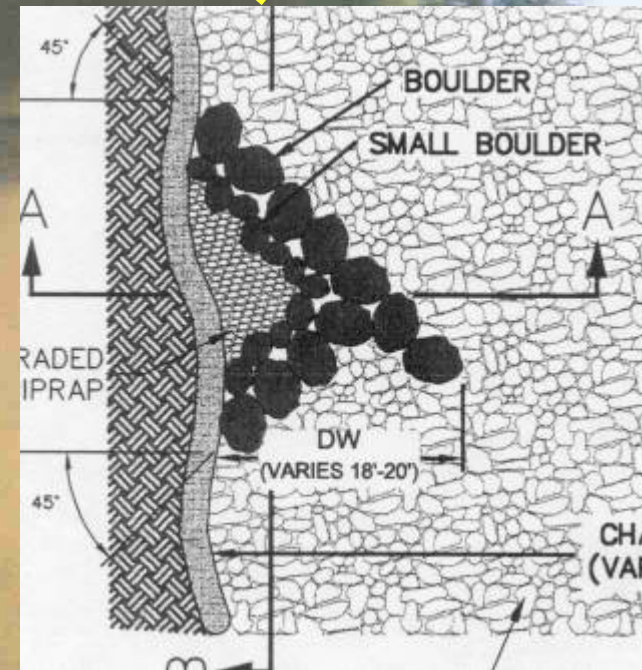
Develop Proposed Conditions Plan: Grade Control and In-Stream Structures

- Types of structures (boulders, rock weirs, and single wing deflector)
- Dimensions
- Locations
- Orientation



Develop Proposed Conditions Plan: In-Stream Habitat Enhancements

- Define purpose of in-stream structures
 - Habitat
 - Fluvial Control
- Design target structures
 - Habitat structures (e.g., vortex weirs, boulders)
 - Fluvial control (e.g., check dams)



Restoration Implementation/Integration with Remedial Action



Restoration Construction

- Perform construction oversight using restoration specialist
- Establish/maintain erosion controls and water management system
- Restoration of:
 - Hydrology
 - Vegetation
 - Soils
 - Habitat



Restoration Construction

Relationship with contaminated sediment/soil removal

- Reuse structural materials if possible (trees, rocks)
- Sequence removal of removal/remedial infrastructure (roads, water control) to benefit restoration construction



River and Stream Construction

Riverbanks -

- Erosion Control Installation
- Clearing and Grubbing
- Resoiling
- Replanting
- Invasive Control



River and Stream Construction



River bed

- Native materials
- In-stream Structures

Rock "w" weir

Wetland Construction

- Grading and Resoiling
 - Establish hydrology
 - Establish micro-topography
 - Soil
 - Appropriate organic content and matter
 - Free of invasives



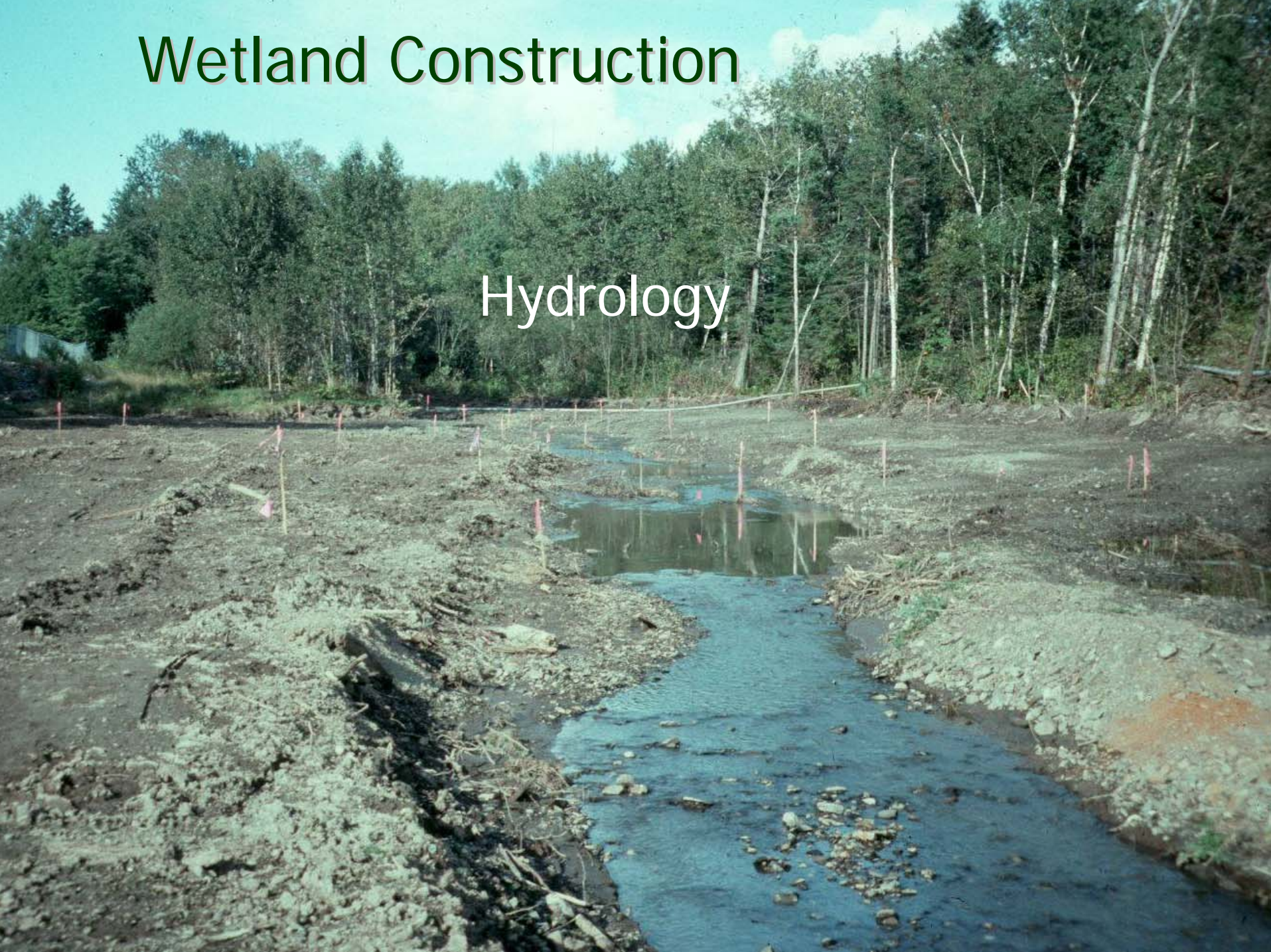
- Revegetation
 - Procure plants
 - Plant installation and inspection
 - Seeding and mulching



Watering

Wetland Construction

Hydrology



Wetland Construction

Microtopography, pit & mound



Long-Term Monitoring

A person wearing a blue jacket, orange safety vest, and a light-colored cap is standing in a field of tall grasses and wildflowers. They are holding a clipboard and looking at it. The background shows a dense forest of trees under a cloudy sky.

Collect data to determine if Performance Standards (developed as measures of project goals and objectives) have been achieved

Monitoring Plan specifies:

- Physical, chemical, biological measures
- Engineering measures
- Frequency and duration of monitoring
- Methods