

Draft Phase II Comprehensive
Site Assessment and
Draft Phase III Remedial Action
Plan

*Former Raytheon Wayland Laboratory
430 Boston Post Road, Wayland, Massachusetts*

Draft Phase II Comprehensive Site Assessment

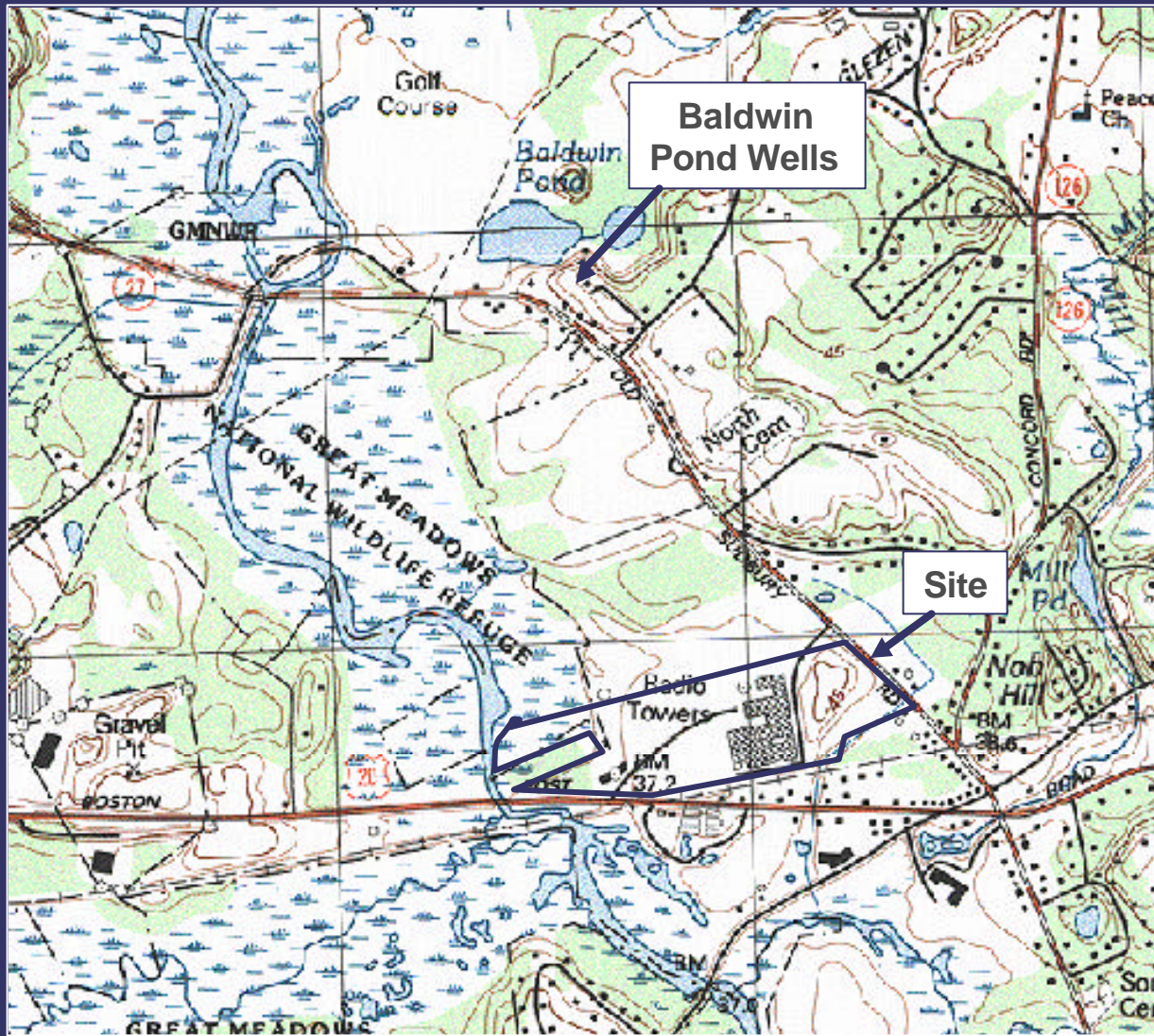
- **Purpose**

- Site History
- Site Hydrogeological Characteristics
- Environmental Fate and Transport of OHM
- Nature and Extent of Impact
- Exposure Assessment
- Risk Characterization

Site History

- **1955 - Previously undeveloped land**
- **1955-97 - Raytheon leased property (never owned)**
- **1957-95 - Raytheon operations**
- **Located in Water Supply Protection Zone II**
- **Wetlands located on property**
 - Adjacent to Sudbury River
 - Contiguous with Great Meadows NWR
 - Outfall





Raytheon Operations History

- **Research and Development facility for defense electronics**
- **Radar development and testing**
 - Test radars on roof
 - Targets on towers
- **Prototype electronic equipment**
 - Antennae and transmitters
 - Design and test of manufacturing processes
- **Retrofit of defense electronic field equipment**

Site Regulatory History

- **1995-96 - Site closure activities**
 - RTN # 1783 CERCLIS review 1987 (C)
 - RTN # ERBn92-1340 UST Removal 1992 (C)
- **May 1995 - Initiated a Phase I Investigation**
 - Identified several areas of concern
 - RTN # 3-13302 Fuel Oil Release 1996 (C)
 - RTN # 3-13574 VOCs in groundwater 1996
 - RTN # 3-14042 PCBs in Soil 1996
- **May 1996 - Phase I submitted to MA Department of Environmental Protection (DEP)**
- **1997 - MCP Tier 1B Classification**

Site Regulatory History (cont.)

- **1998 – 2000** **Continued Site Investigation**
- **April 2000 - Raytheon notified DEP of potential Imminent Hazard Condition (Ecological)**
- **May 2000 - Immediate Response Action (IRA) submitted to DEP**
- **September 2000 - Public Involvement Plan (PIP) submitted to DEP**
- **November 2000 - New Tier IB Permit issued with conditions**
- **September 2001 - Release Abatement Measure (RAM) Plan submitted for Groundwater Pilot Study**

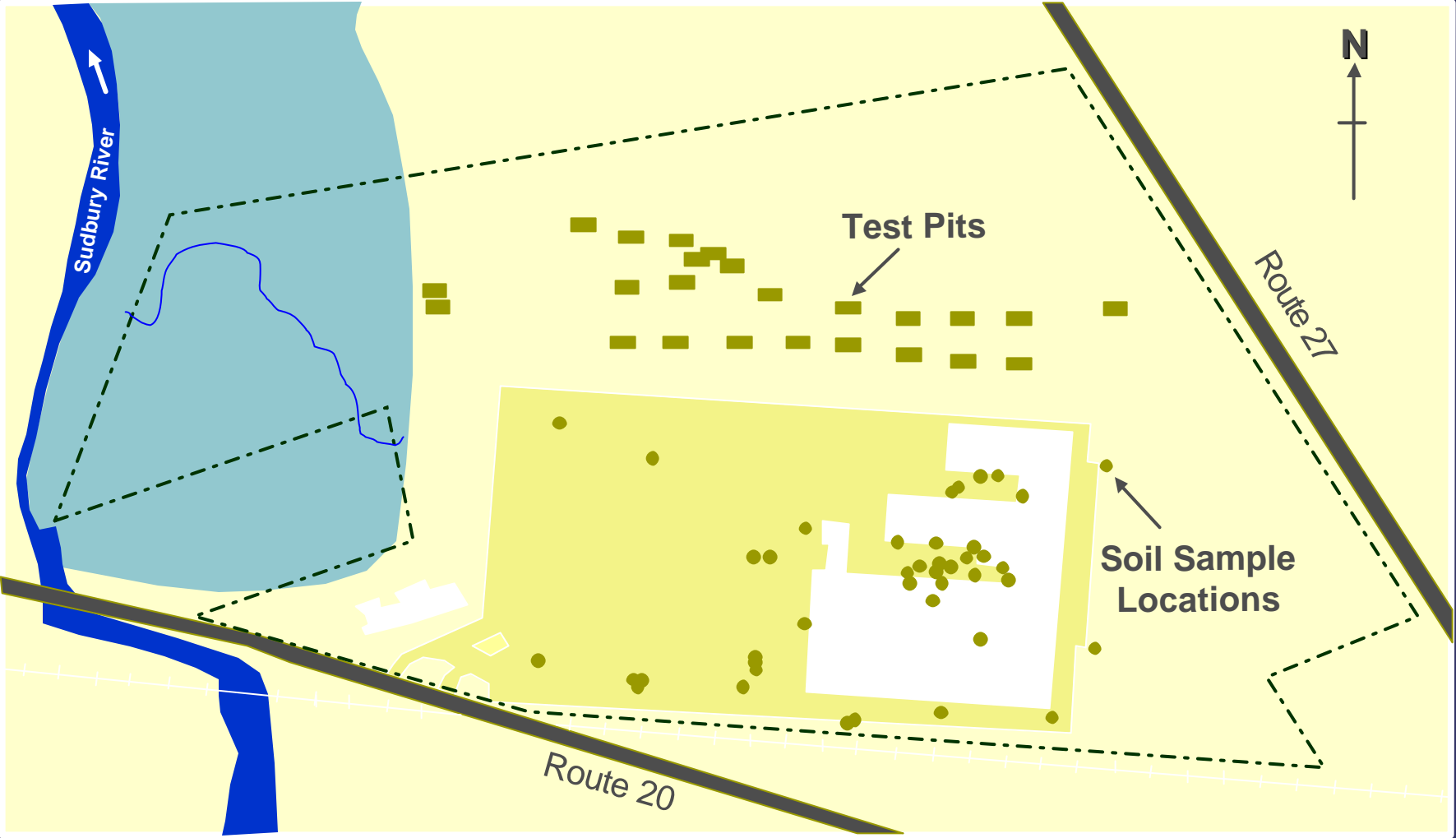
Site Evaluation

- **Investigation activities included:**
 - soil evaluations and removal actions
 - groundwater sampling
 - surface water sampling
 - wetland sediment sampling
 - aquifer testing

Soil Investigations

- **67 samples analyzed for metals, VOCs, PAHs, and PCBs**
- **24 test pits completed in northern portion**
- **4 Limited Removal Actions (“LRAs”) performed**
- **Two RAMs performed**
 - tank removal and Activity and Use Limitation (“AUL”) by new owner, Wayland Business Center (“WBC”) RTN 3-13302
 - soil removal at TP-3 for RTN 3-14042
- **Soil concentrations are below MCP standards with exception of the restricted areas (Wayland Business Center, Activity and Use Limitation)**

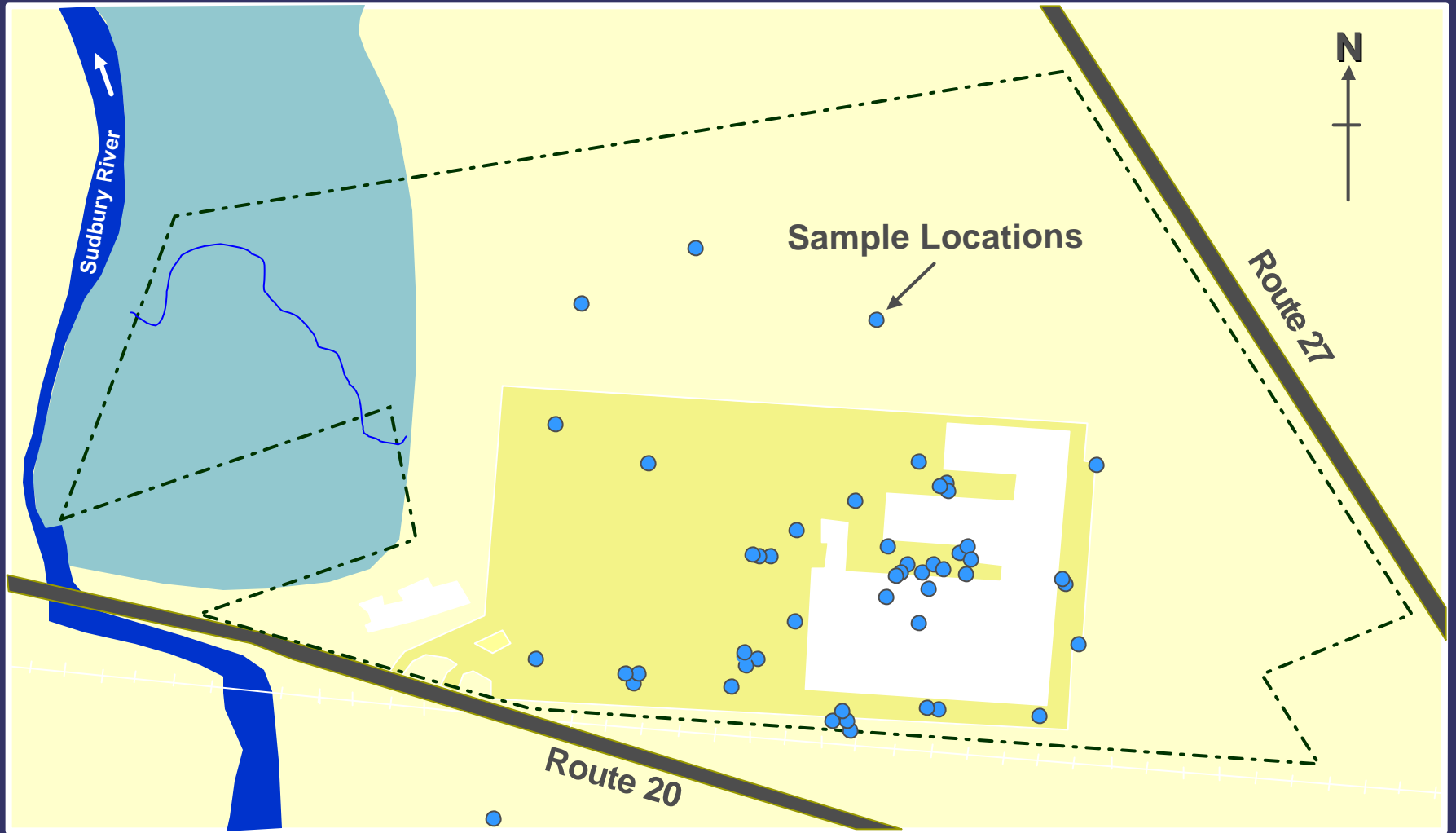
Soil Sampling



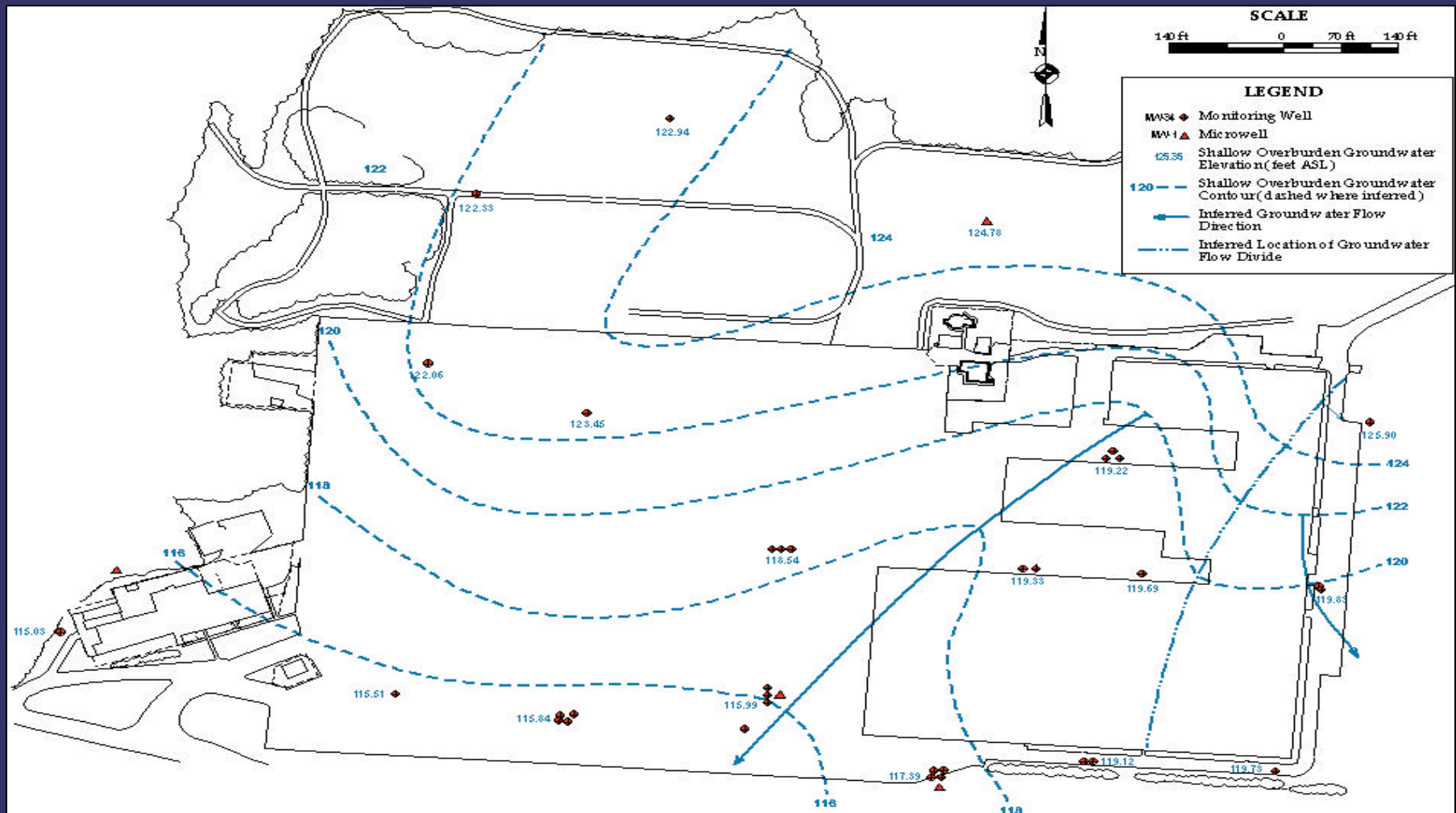
Groundwater Evaluation

- **Site located in Zone II for Baldwin Pond Wells (1/2 mile) defined by Anderson-Nichols Conceptual Zone II Study**
- **Groundwater flow in South/Southwest direction**
- **58 GW wells installed (shallow, intermediate, deep and bedrock wells)**
- **Iterative process, 5 phases of drilling**
- **> 200 analyses of samples since 1996**
- **Analyzed for VOCs, metals, TPH and inorganic compounds**
- **VOCs exceed applicable MCP GW-1 guidelines**
- **Groundwater remediation is required**

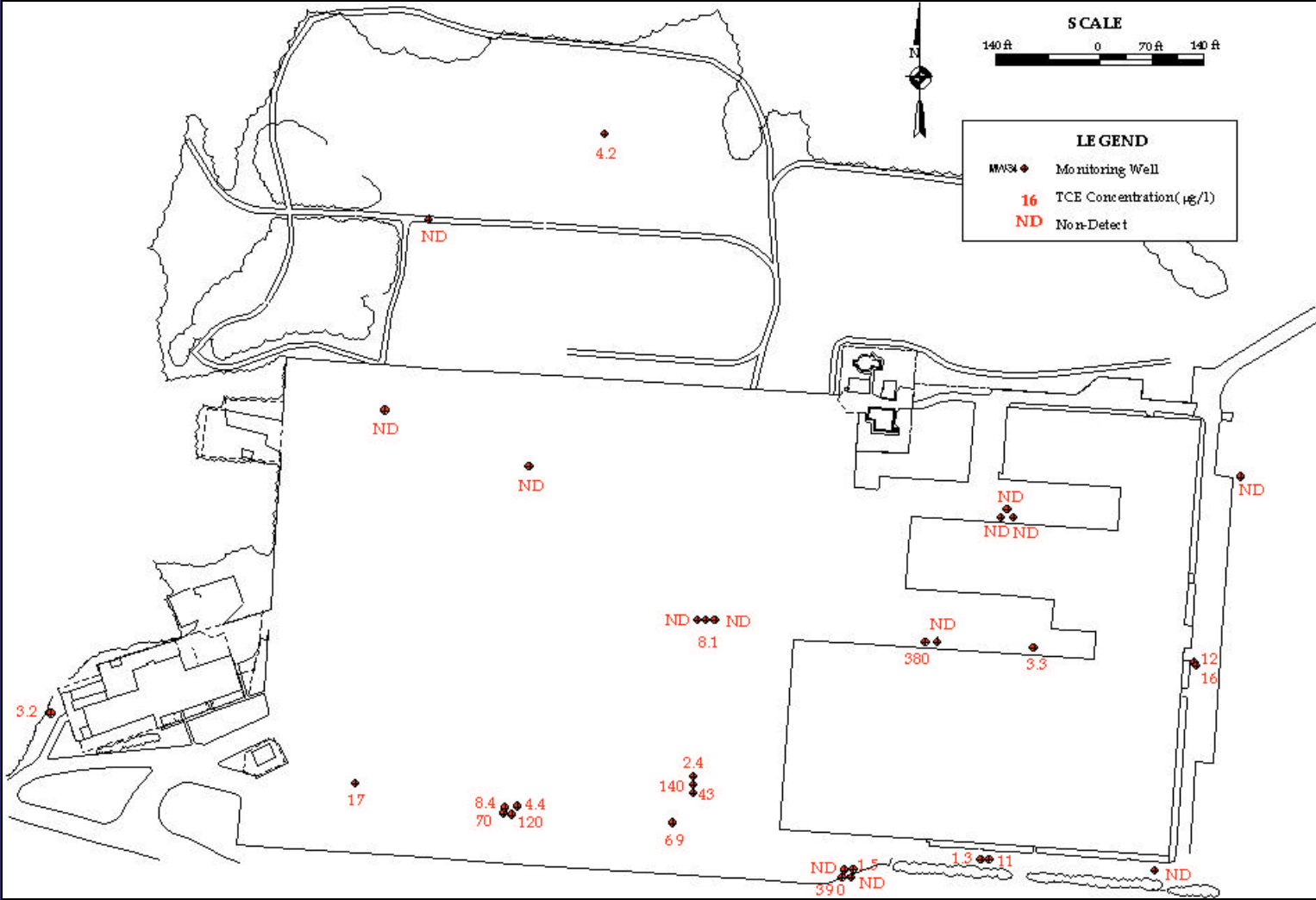
Groundwater Sampling



Groundwater Contour Map



Groundwater Concentrations



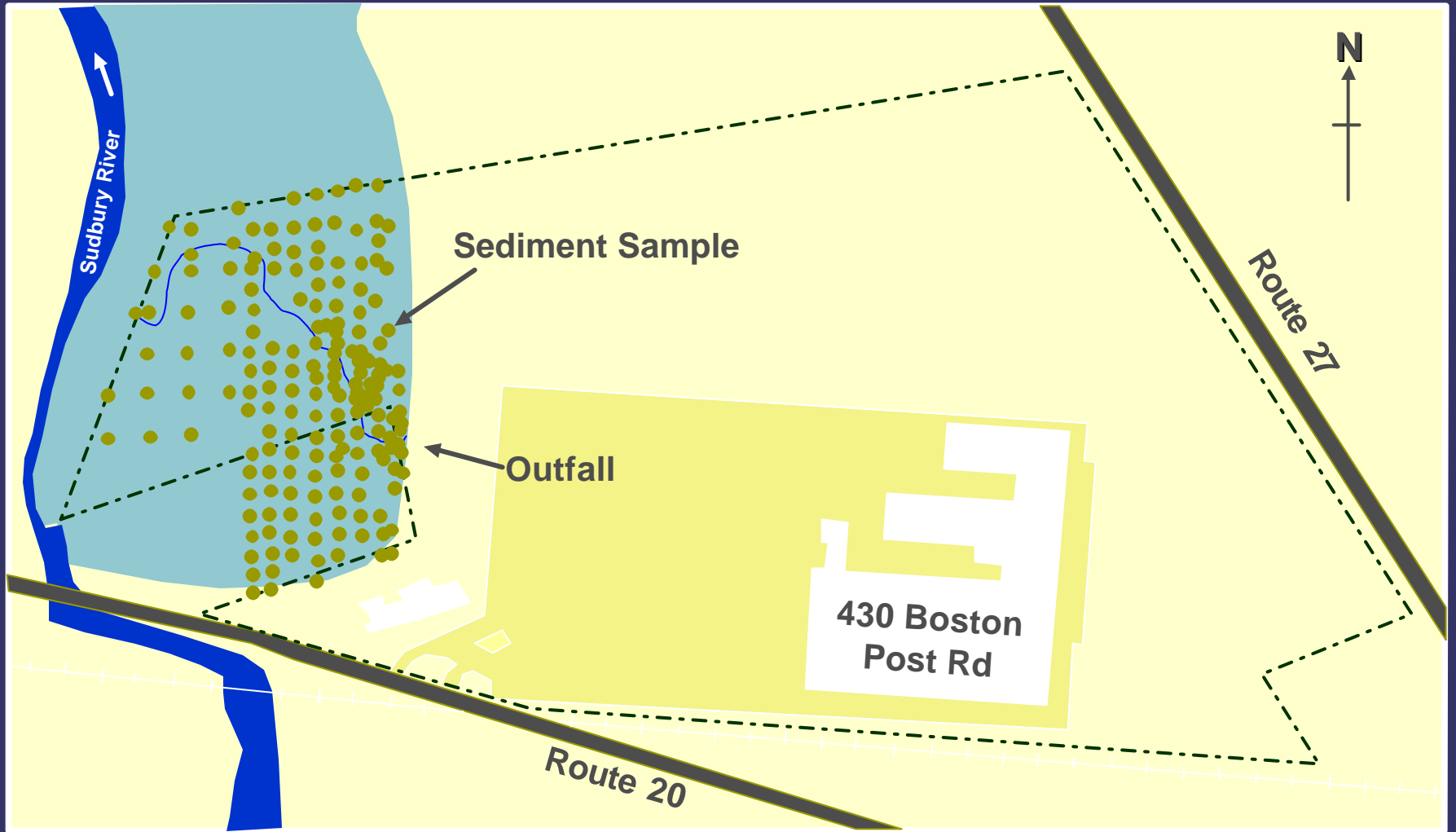
Sediment Evaluation

- **1986-91 U.S. Fish & Wildlife (“USFW”) sampling of Great Meadows National Wildlife Refuge**
 - mercury, arsenic, lead, cadmium, chromium, copper and PCBs detected throughout study area
- **1990 Raytheon identified butyl cellusolve release**
 - collected sediment and surface water samples in river and wetland near outfall
 - detected metals and PAHs
 - non-detect for butyl cellusolve, VOCs, PCBs and pesticides
 - Response Action Outcome (“RAO”) filed in 1995
- **1995 - additional sediment samples collected, could not duplicate USFW data**

Sediment Evaluation (cont.)

- **Phase II evaluation limited by seasonal access**
 - late 1998 delineated metals, petroleum, and PCBs near outfall
 - 1999 - completed 2 additional sampling rounds
 - 2000 - wetland and ecological specialists identified vegetation with stunted growth

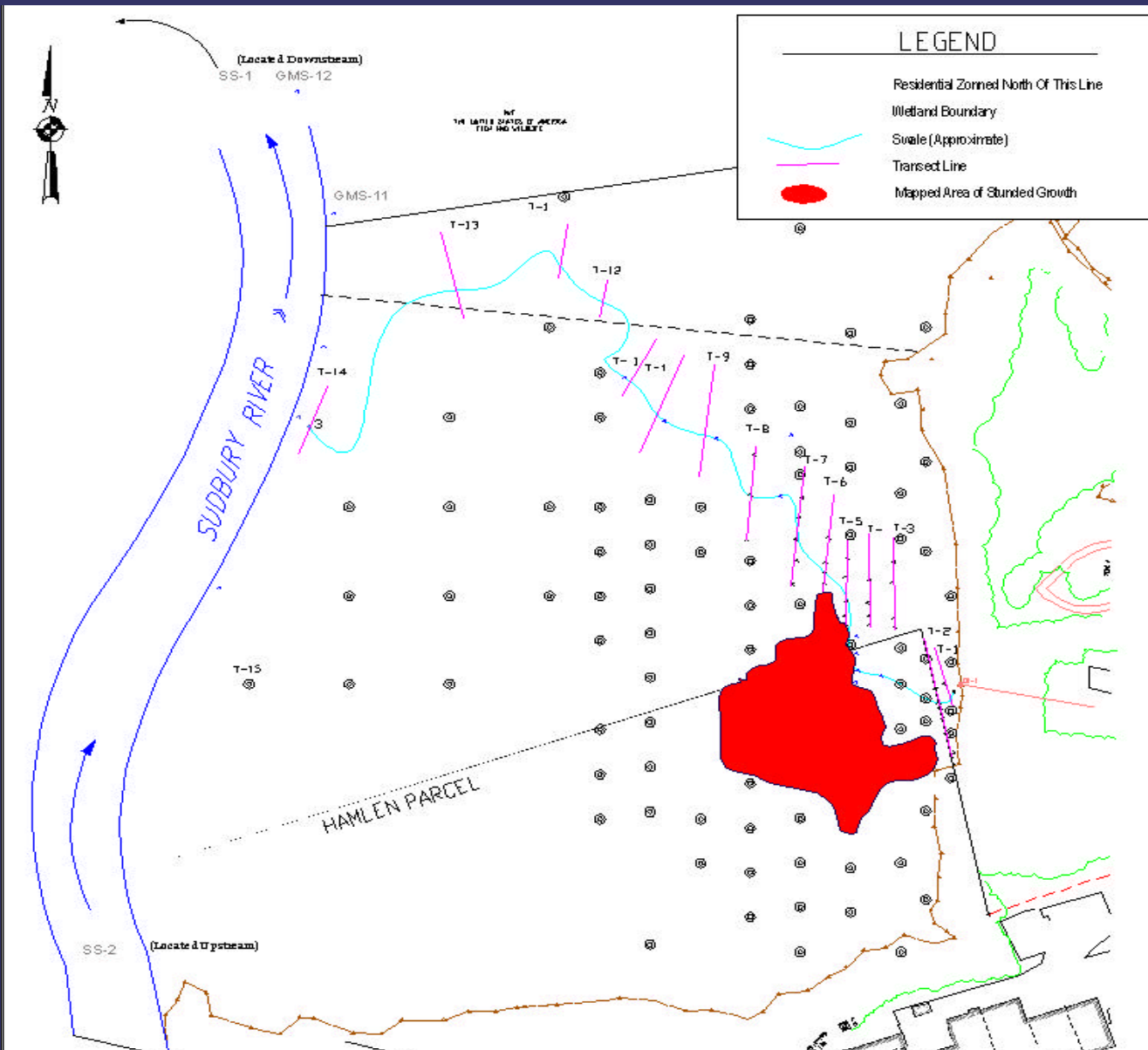
Sediment Sampling



Results of Sediment Sampling

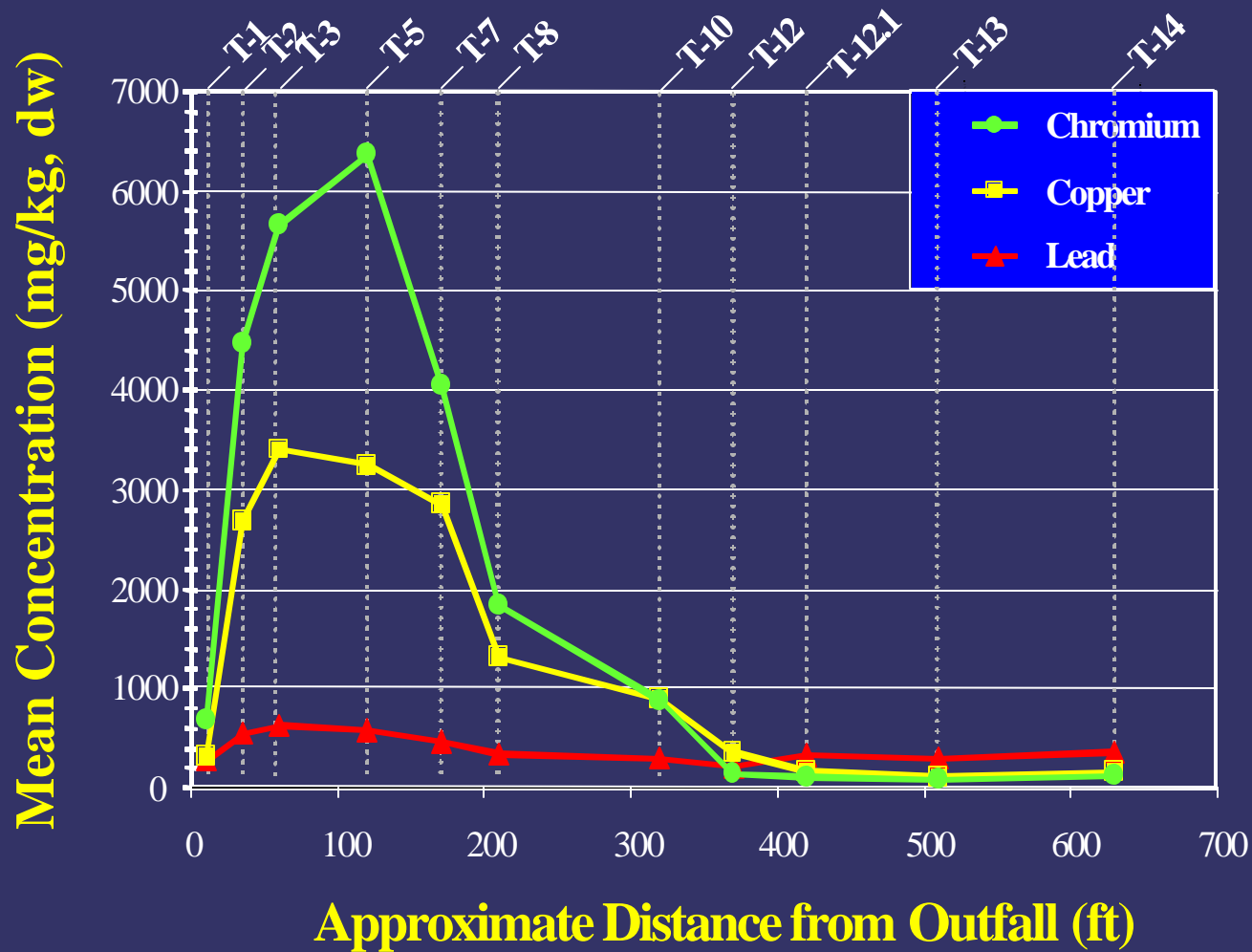
- **Majority of impact within 200 ft of Outfall (OF-1)**
- **Metals, PCBs and PAHs detected in Sediment at depths 0 - 12 inches**
- **Area of stunted growth coincides with higher concentrations of metals**



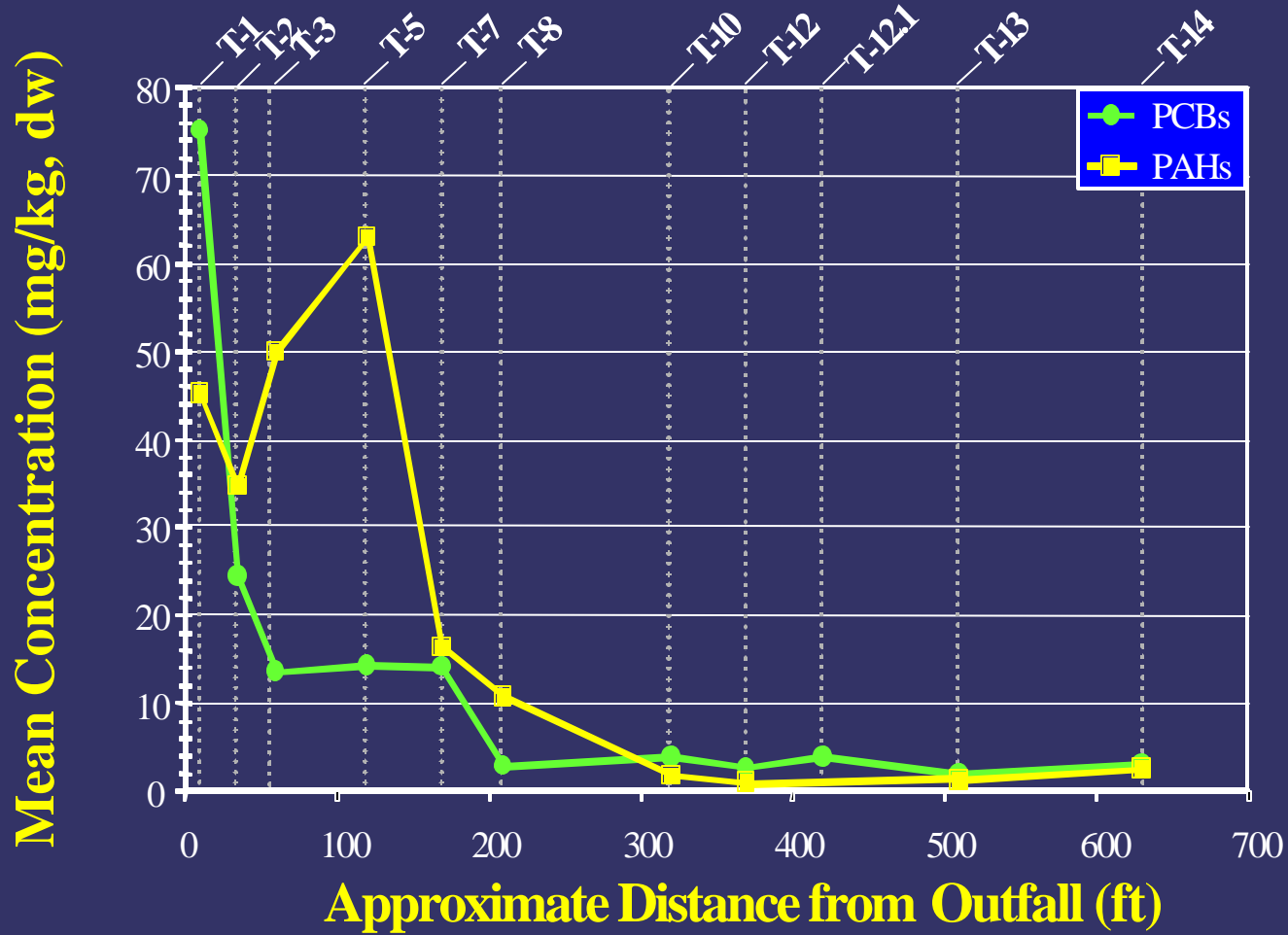


Area of Stunted Growth

Concentrations of Metals in Wetland Soils



Concentrations of PCBs and PAHs in Wetland Soils



Surface Water Investigation

- **1990 - Butyl cellusolve release**
 - Sampling included river surface water
- **1999 - 2000 Site Surface Sampling**
 - Three rounds of sampling conducted under flooded and low flow conditions in the wetland
 - Detections of OHM in isolated surface water in wetland under low flow conditions attributed to sediment impacts

Surface Water Investigation (cont.)

- **Nyanza Superfund Site Investigation (1986- present)**
 - Former landfill located upstream in Ashland
 - Current EPA investigation of Sudbury River
 - Nyanza has impacted background concentrations in the Sudbury River

Risk Characterization

- **Risk Methodology specified by the DEP**
- **Involves two components**
 - Human Health
 - Ecological
- **Drives extent of clean-up**

Method 3 Risk Characterization

- **Method 3 approach is a site specific assessment**
- **Human Health Risks Identified**
 - Groundwater concentrations exceed drinking water standards; risk posed to future potential receptors
 - Wetland sediments pose a potential long term risk to trespassers within the area of stunted growth

Method 3 Risk Characterization

- **Exposure assumptions for trespasser**
 - Young adult
 - Thirty days per year for twelve years
 - Head, forearms and hands exposed
 - Daily ingestion of 50 mg of sediment and 50 ml of surface water
- **GW-1 categorical definition requires clean-up to drinking water standard**

Stage I and II Environmental Risk Characterization (ERC) Summary

- **An area of stunted growth is present on part of the site**
- **Effects on wetland plants are the primary driver for ecological risk in the area of stunted growth**
- **No evidence of risk outside the area of concern**

Conclusions of Phase II Investigations

- **Extent of OHM impact limited to groundwater and wetland sediment**
- **Areas of site groundwater and wetland sediment to be evaluated in Phase III**
- **Land use controls required to mitigate risk**

Draft Phase III Remedial Action Plan

- **Purpose**

- Evaluate remedial technologies against performance standards established by the DEP
- Select the preferred remedial technologies for abatement of impact in wetland sediments and in groundwater

Conclusions of Phase III

- **Wetland Sediment**

- Excavation and off-site disposal of impacted sediments (approximately 1.5 acres)
- Restoration of disturbed wetland area
- Implementation of land use controls

- **Groundwater**

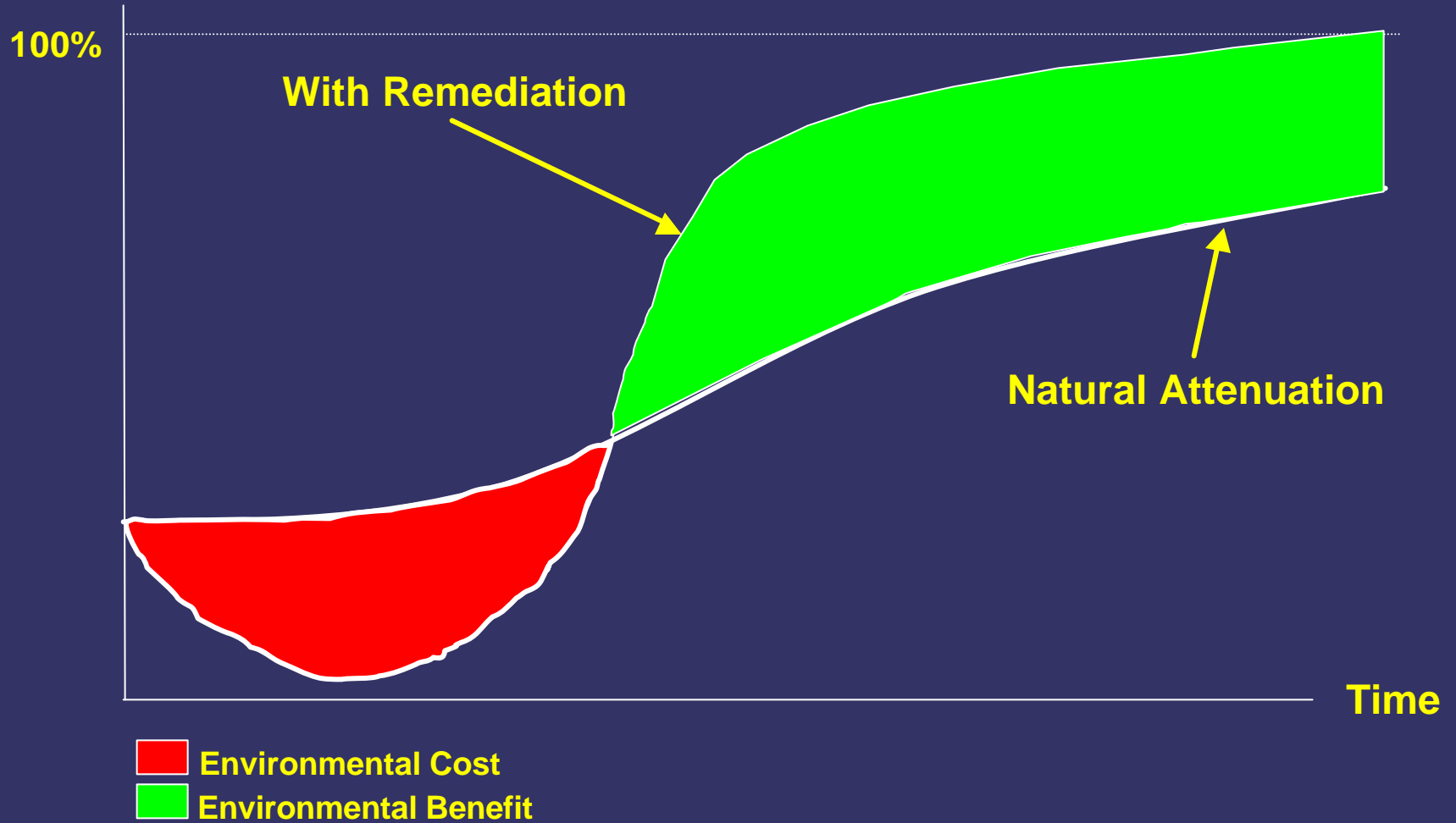
- Chemical Oxidation
- Pilot Study began October 6th

Net Environmental Benefit Analysis (NEBA)

- **A conceptual framework used for evaluating remediation options**
- **NEBA balances the ecological benefits of planned remediation against the ecological costs in an attempt to:**
 - encourage the selection of alternatives that offer the greatest potential benefit to the environment
 - *Answers: Is the cure worse than the disease?*

NEBA

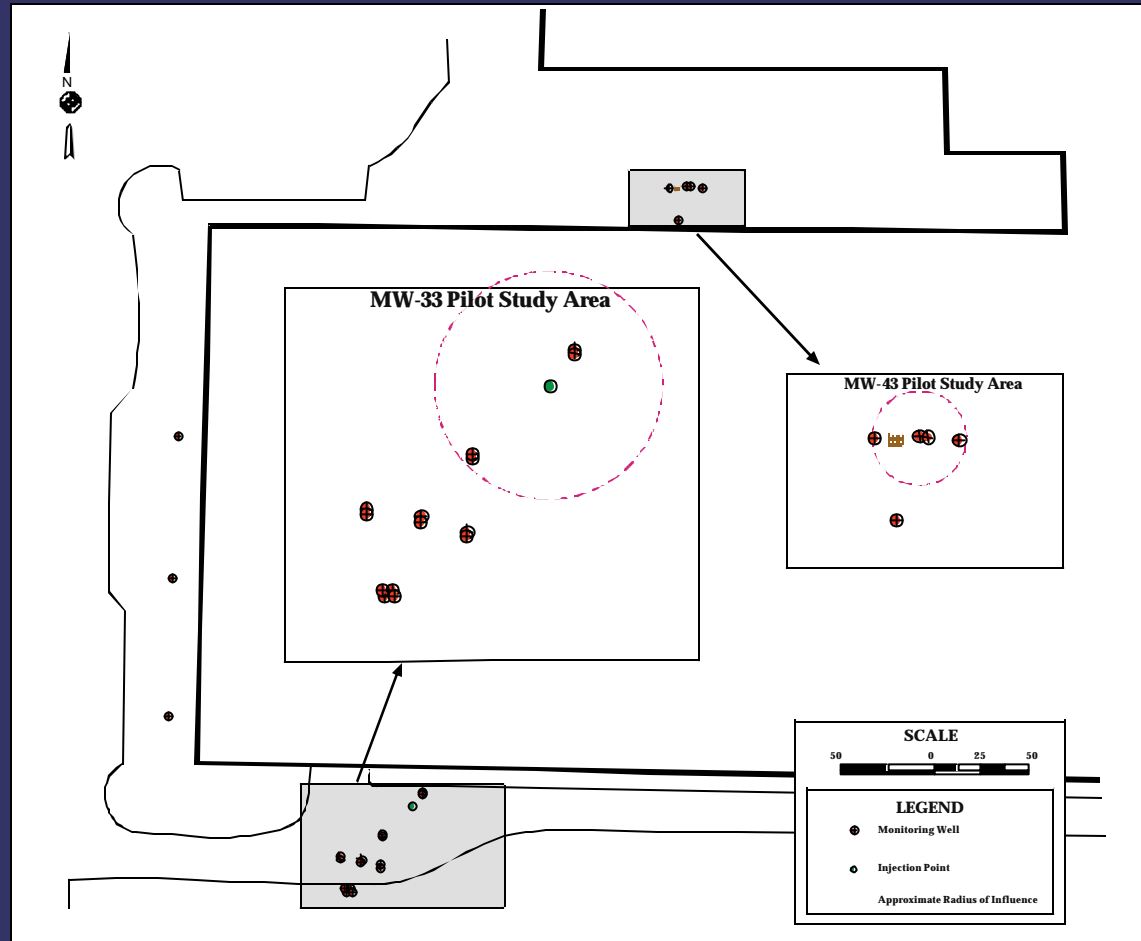
Ecological Services



Wetland Permitting

- **EPA TSCA Risk Based Approval**
- **DEP Water Quality Certification Process (401 Permit)**
- **Chapter 91 License Review**
- **Army Corps of Engineers Sec. 404 Review**
 - Wild and Scenic Rivers Review
- **MA Environmental Protection Act (MEPA) Review**
- **Wayland Conservation Commission Review**

Groundwater Pilot Study Area



Tentative Site Schedule (pending regulatory approvals)

- **Winter 2001** – **Submit Phase II and III Reports**
- **Winter 2001** – **IRA Completion Report**
- **Winter 2001/2002** – **Complete Groundwater Pilot Study/RAM Completion Report**
- **May 2002** – **Submit Phase IV Remedy Implementation Plan**
- **2001-2002** – **Wetland Permitting**
- **2002** – **Potential Implementation of Groundwater Remediation**
- **Summer/Fall 2002** – **Implement Wetland Remediation**

PIP Schedule

- **26 November - Comment period extended by 20-days. Written comments submitted to Raytheon**
- **A summary of the comments received and a response to those comments will be prepared**
- **Documents will be made available at the information repositories (Public Library and Board of Health)**
- **Notice of Availability of the documents will be sent to the PIP mailing list**

Public Involvement Process

- **Future opportunities for the public to comment on submittals:**
 - Phase IV Remedy Implementation Plan
 - IRA and RAM Plans and Completion Reports
 - Response Action Outcome(s) (including AULs)
 - Other regulatory approvals

Contact Information

Ronald C. Slager, Jr.

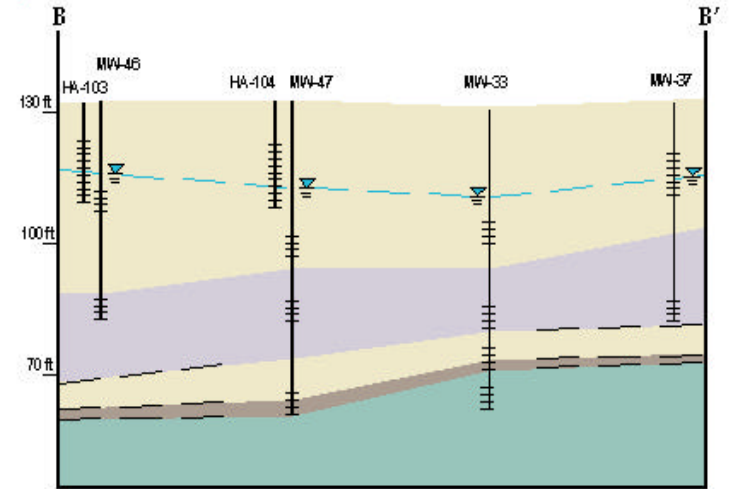
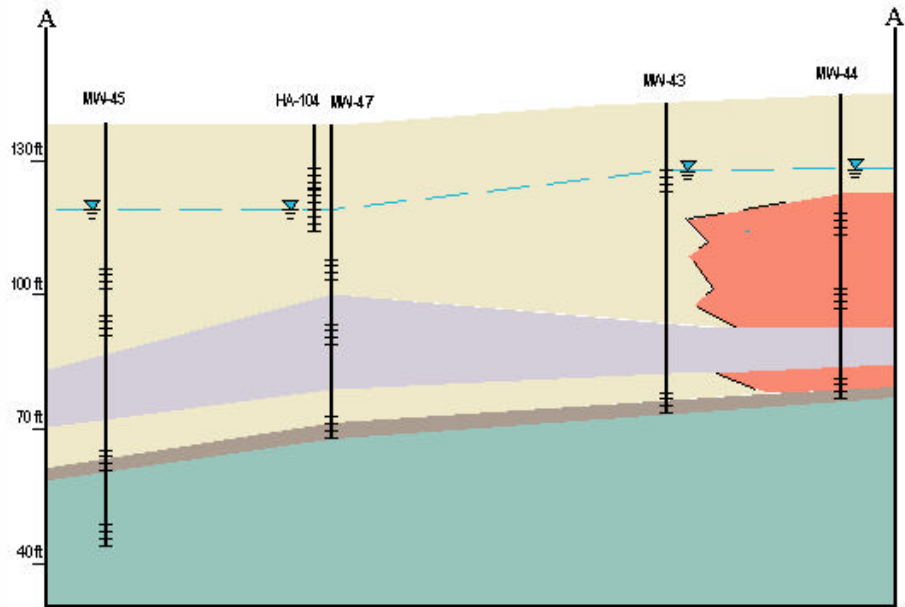
Raytheon Company

MS -1-2-1567

1001 Boston Post Road

Marlborough, Massachusetts 01752

Cross Section



APPROXIMATE SCALE

Horizontal: 1" = 140'
Vertical: 1" = 30'

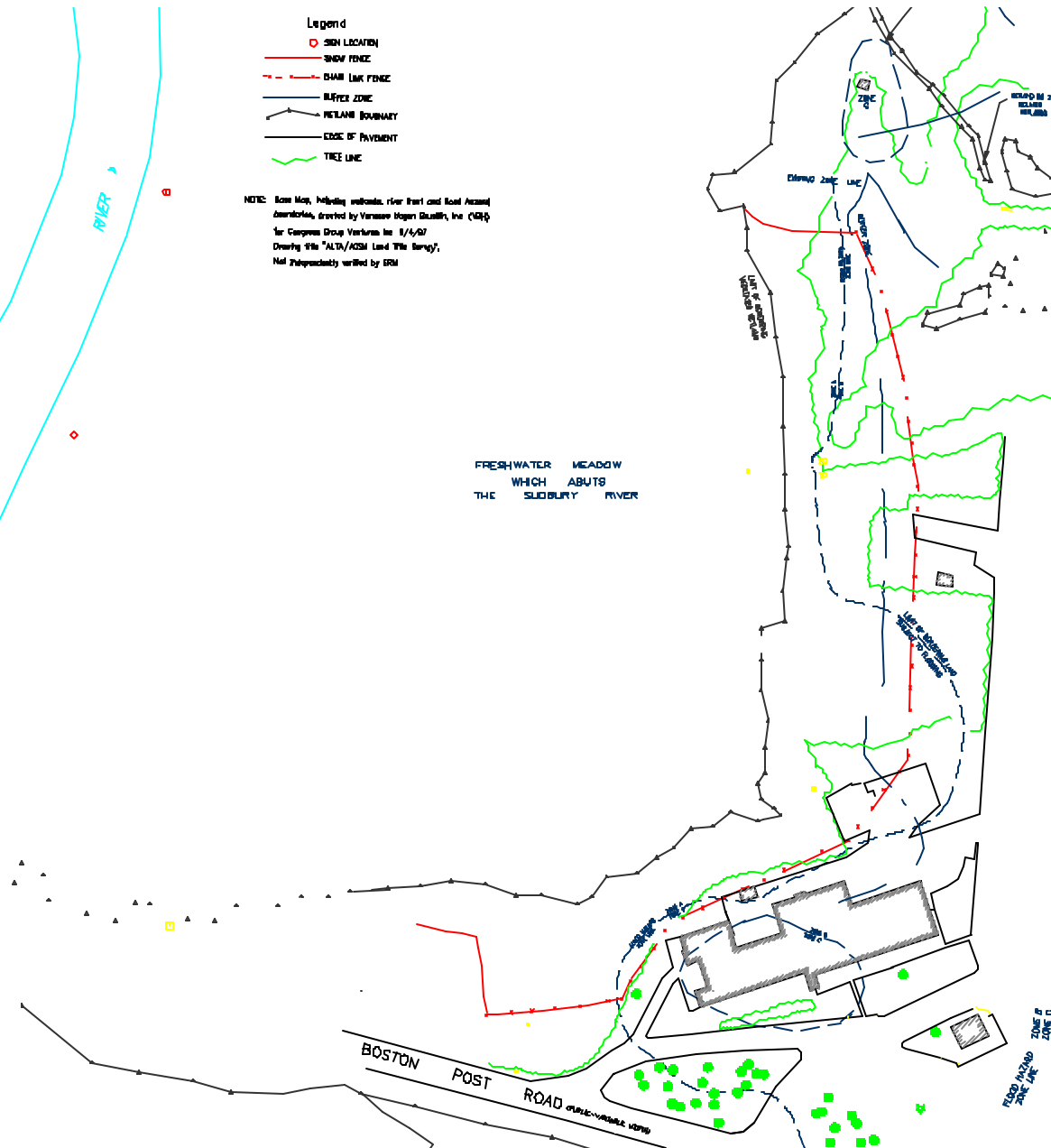
NOTE:

All elevations are approximate and are relative to mean sea level.

LEGEND

MW-33 Existing Monitoring Well

--- Shallow Overburden Groundwater Table



Location of Fence Installation

Major Steps in the ERC (based on MCP Guidance)

Stage I Screening-Level ERC

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graph TD; A[Stage I Screening-Level ERC] --> B[Stage II ERC<br/>Problem Formulation<br/>Analysis<br/>Risk Characterization]; B --> C[Risk Management];
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Stage II ERC
Problem Formulation
Analysis
Risk Characterization

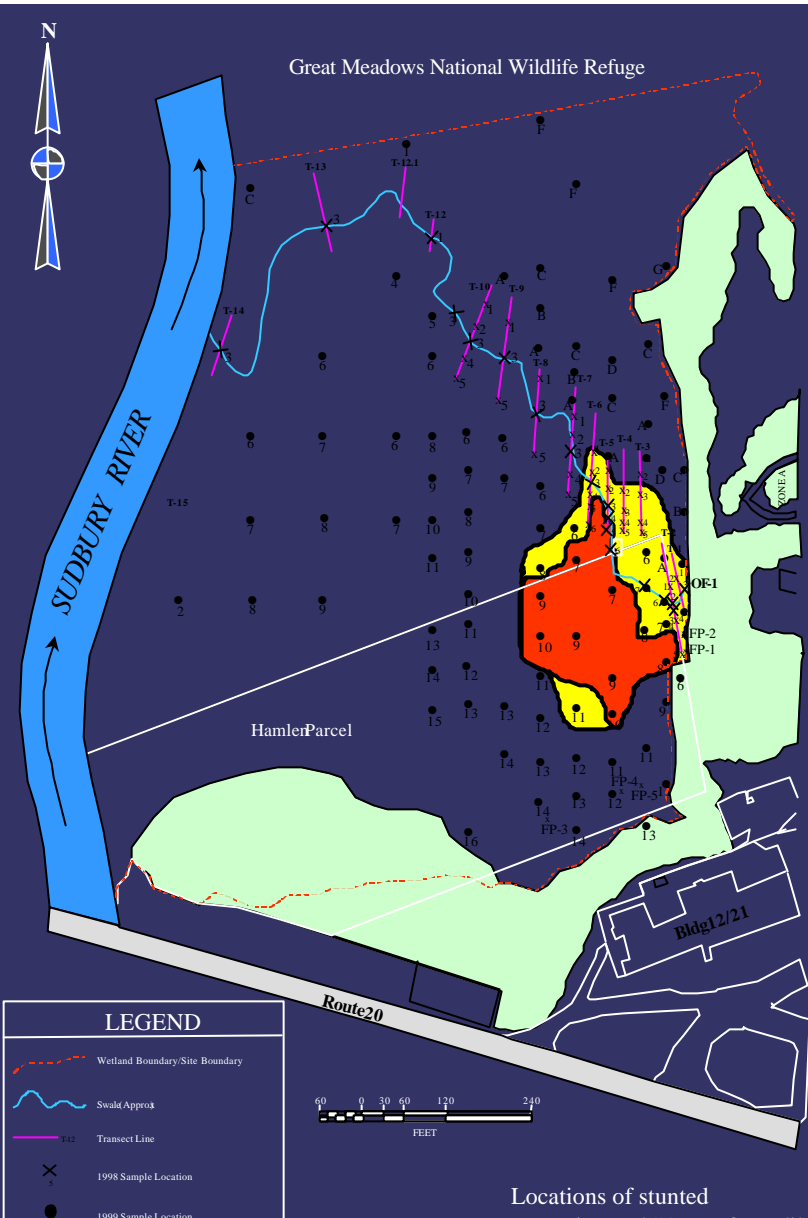
Risk Management

Goals of the Stage I Screening- Level ERC

- **Identify potential exposure pathways**
- **Determine whether risk of harm is “readily apparent”**
- **Eliminate from further consideration any exposure pathways and chemicals that clearly do not pose a significant risk of harm to the environment**

Results of the Stage I Screening- Level ERC

- **Exposure pathways include surface water, wetland sediments, wetland soils, & biota**
- **Risk of harm is “readily apparent” in the area of stunted vegetation (see next slide)**



Area of Readily Apparent Harm (ARAH)

Basis of ARAH in draft ERC:

- Stunted vegetation
- Exceedances of Federal and State water quality criteria
- PCBs > 50 mg/kg
- Elevated levels of copper and chromium associated with plant toxicity



Contaminants of Potential Ecological Concern (COPECs)

- **Metals:**

Antimony (Sb)	Manganese (Mn)
Arsenic (As)	Mercury (Hg)
Cadmium (Cd)	Silver (Ag)
Chromium (Cr ³⁺)	Tin (Sn)
Chromium (Cr ⁶⁺)	Vanadium (V)
Copper (Cu)	Zinc (Zn)
Lead (Pb)	

- **PCBs**





Stage II ERC

Approximate location of wetland



Typical “low-flow” or
non-inundated condition
(photo taken on 6/28/70)

Air photo of Raytheon site
(removed to reduce file size)

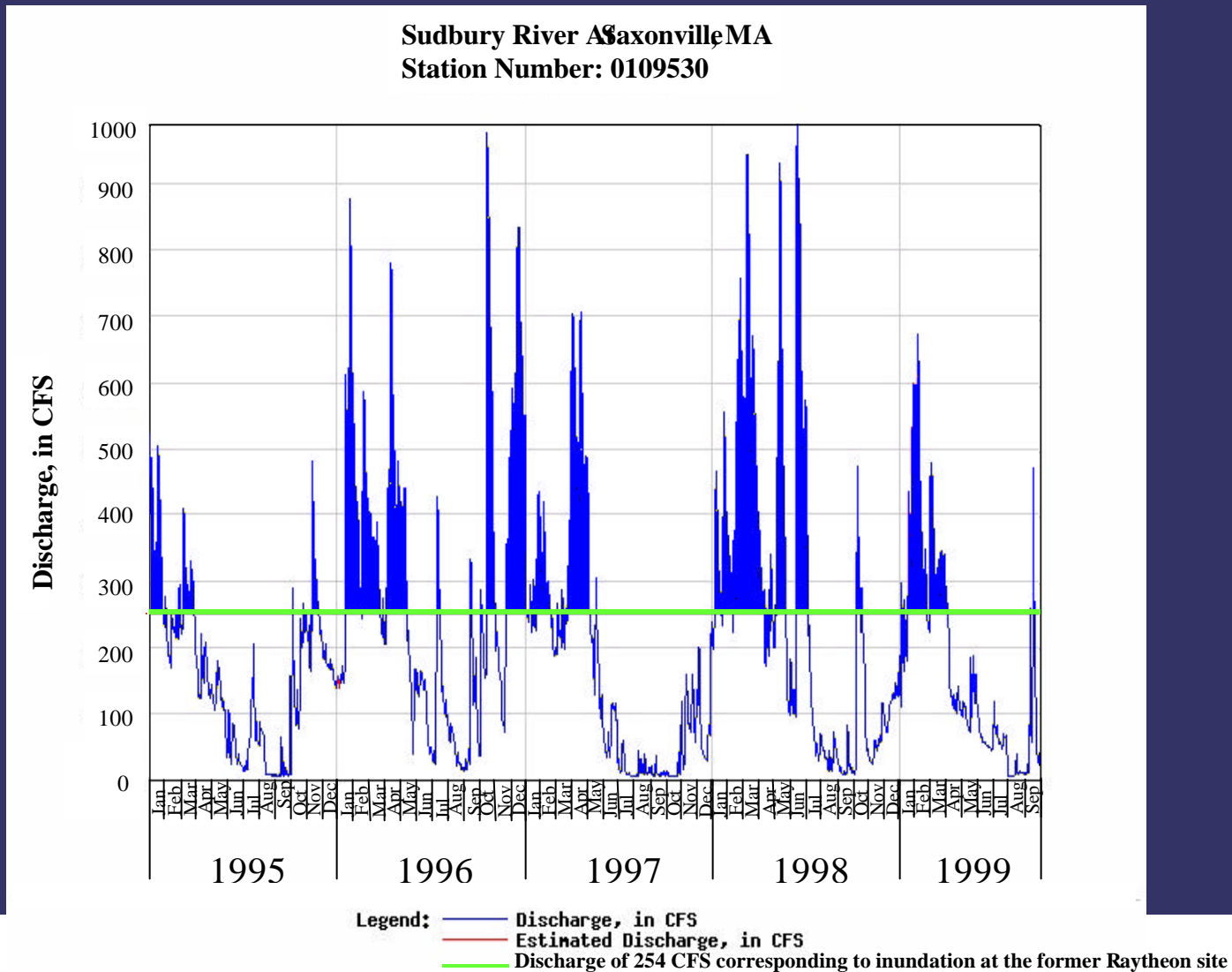
Approximate location of wetland



Typical “high-flow” or
inundated condition
(photo taken on 3/25/68)

Air photo of Raytheon site
(removed to reduce file size)

Historical Flow Data for the Sudbury River (1995-1999)



Exposure Pathways and Potential Receptors of Concern

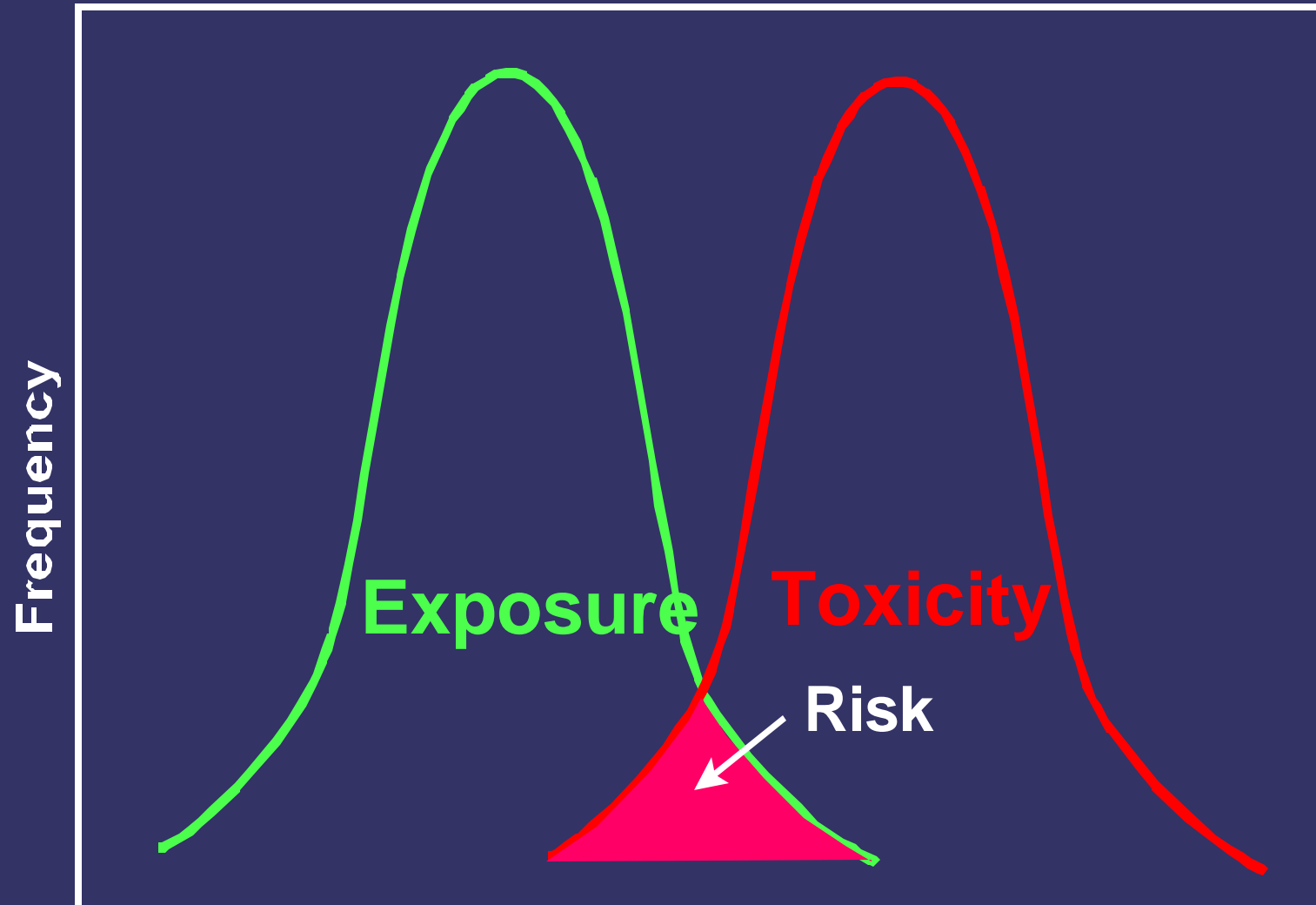
Aquatic

- Invertebrates
- Fish
- Amphibians

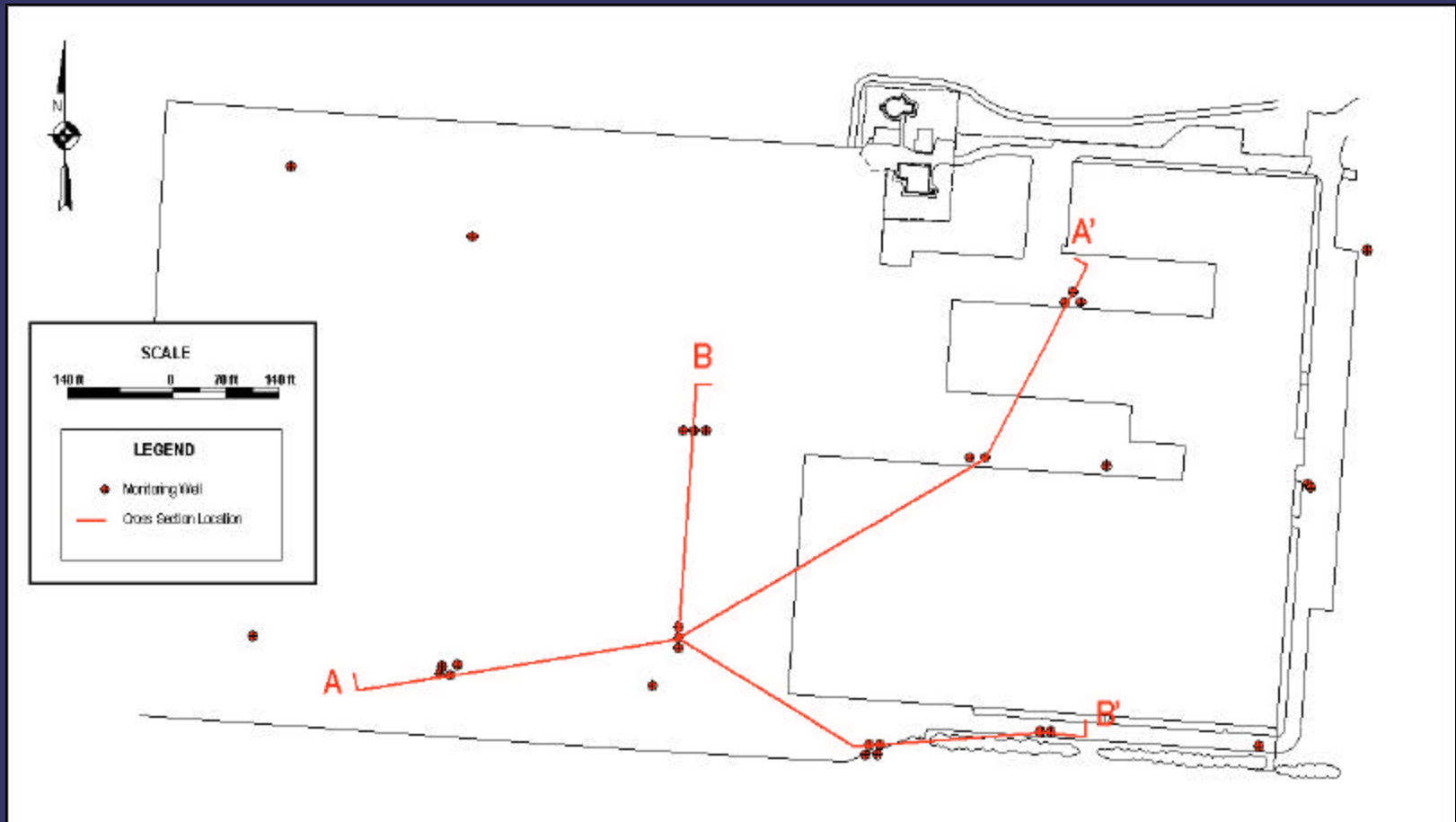
Terrestrial

- Plants
- Meadow Vole
- Muskrat
- White-tailed Deer
- Mallard
- Red-Tailed

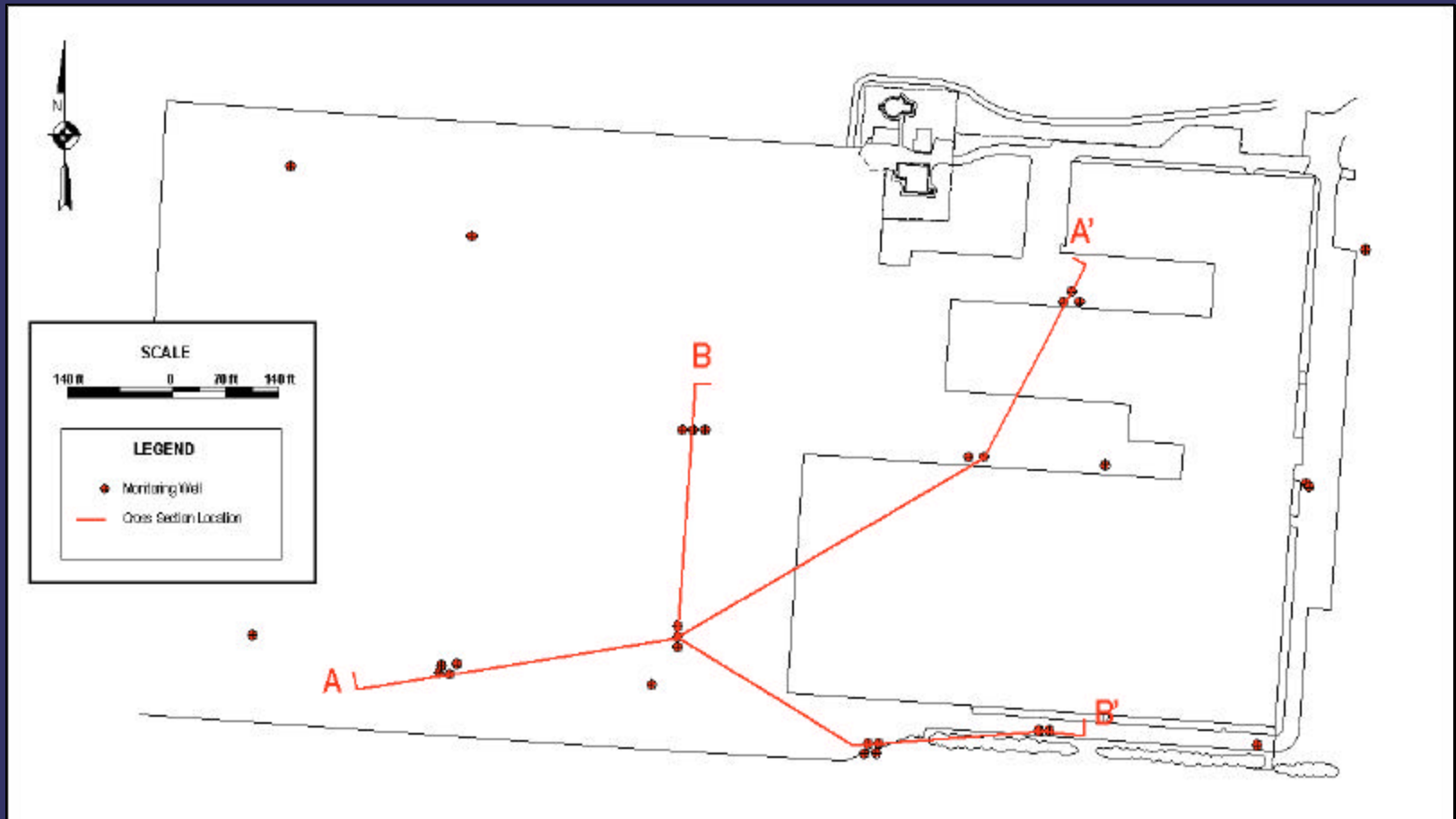
Characterizing Risk



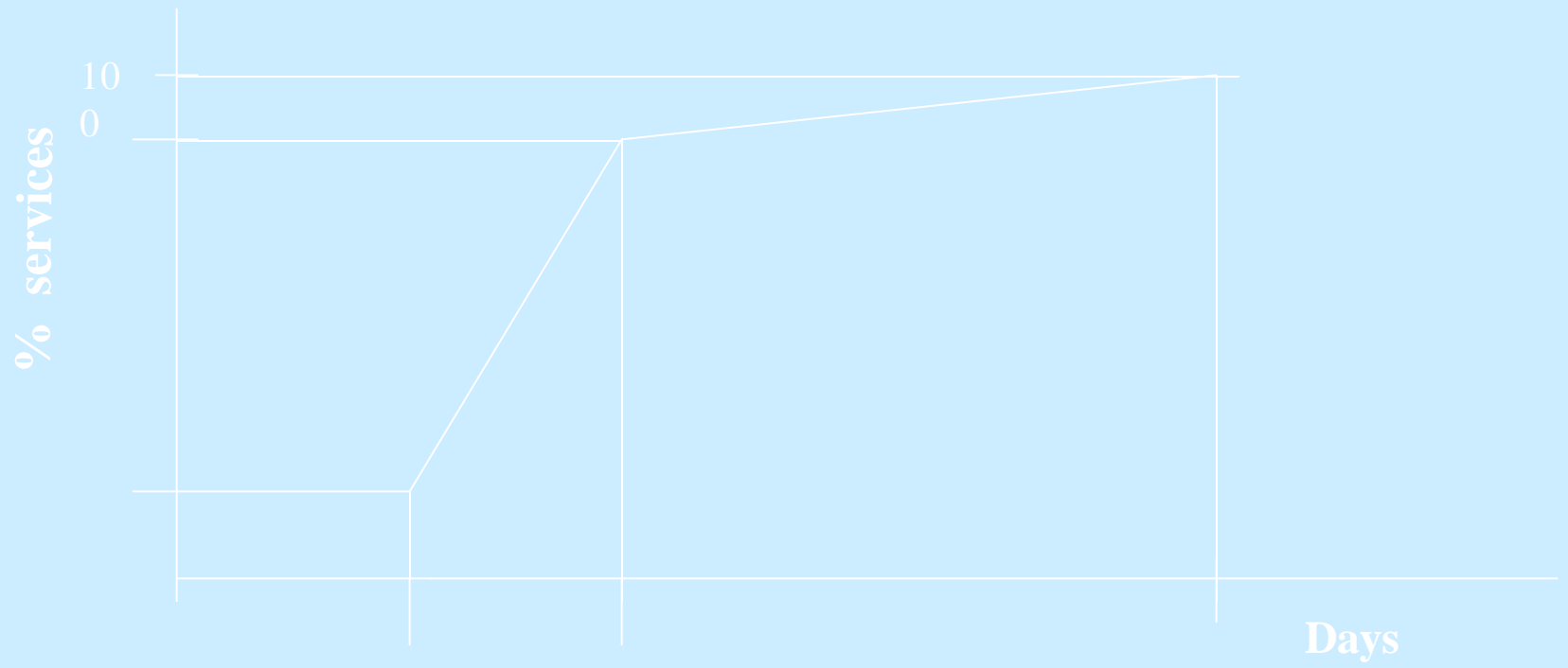
Plan View of Cross Sections



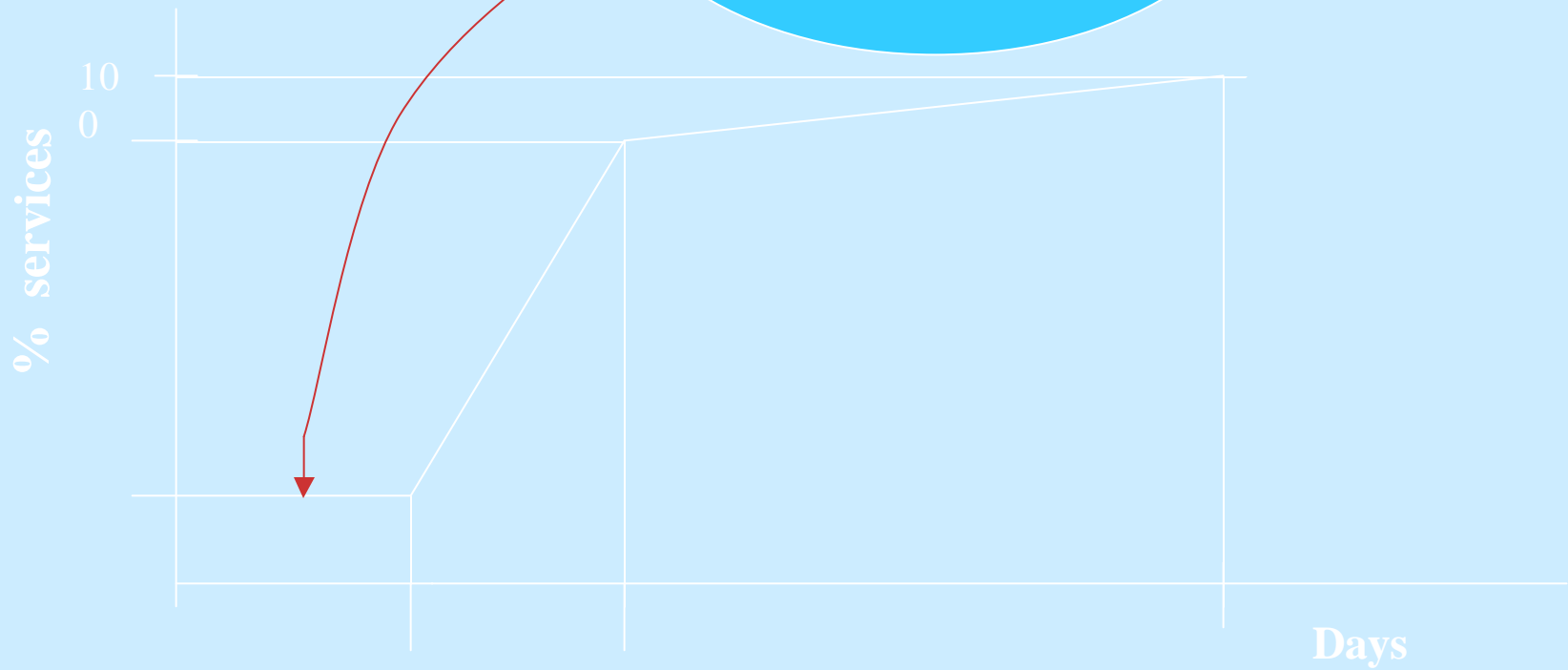
Cross Section Locations



General Recovery Curve

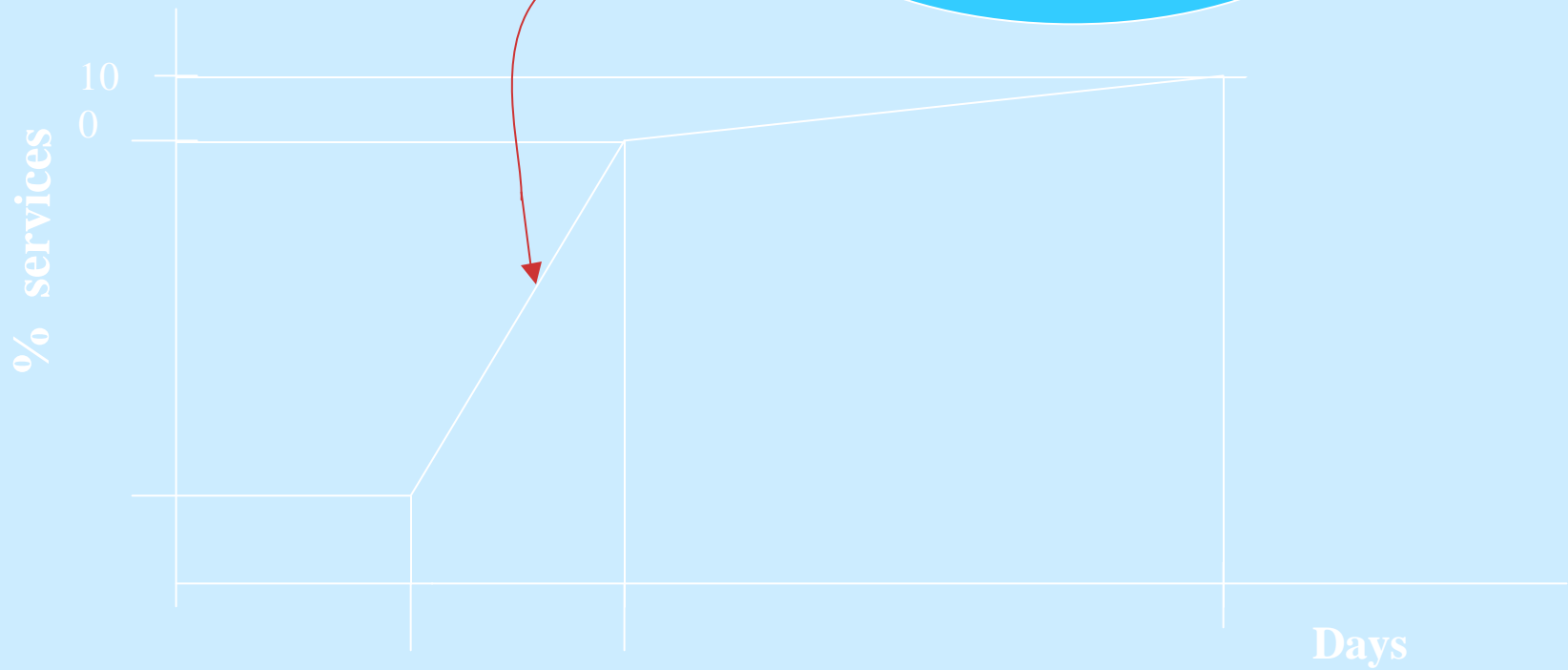


General Recovery Curve

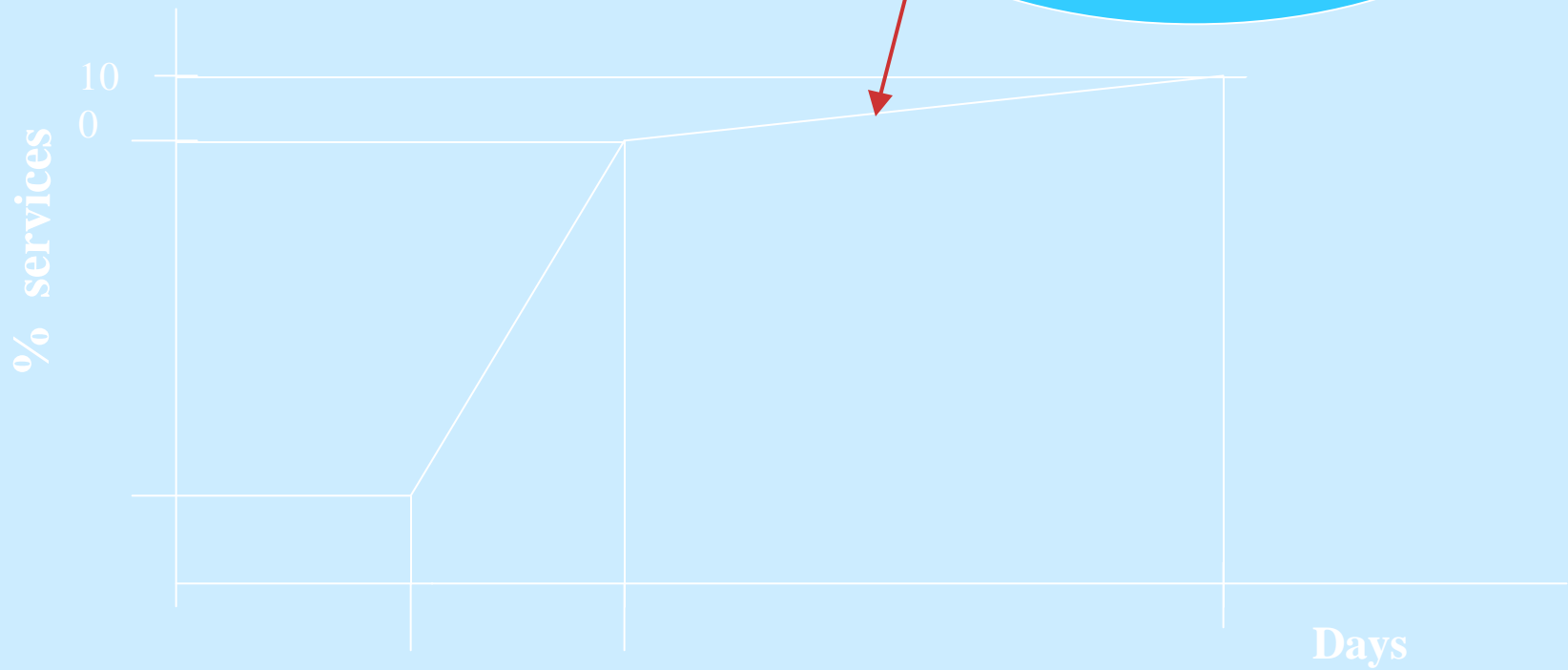


General Recovery Curve

Once the soil has been replaced there is a rapid recovery as plants become established and grow, soil colonized, organic matter deposited

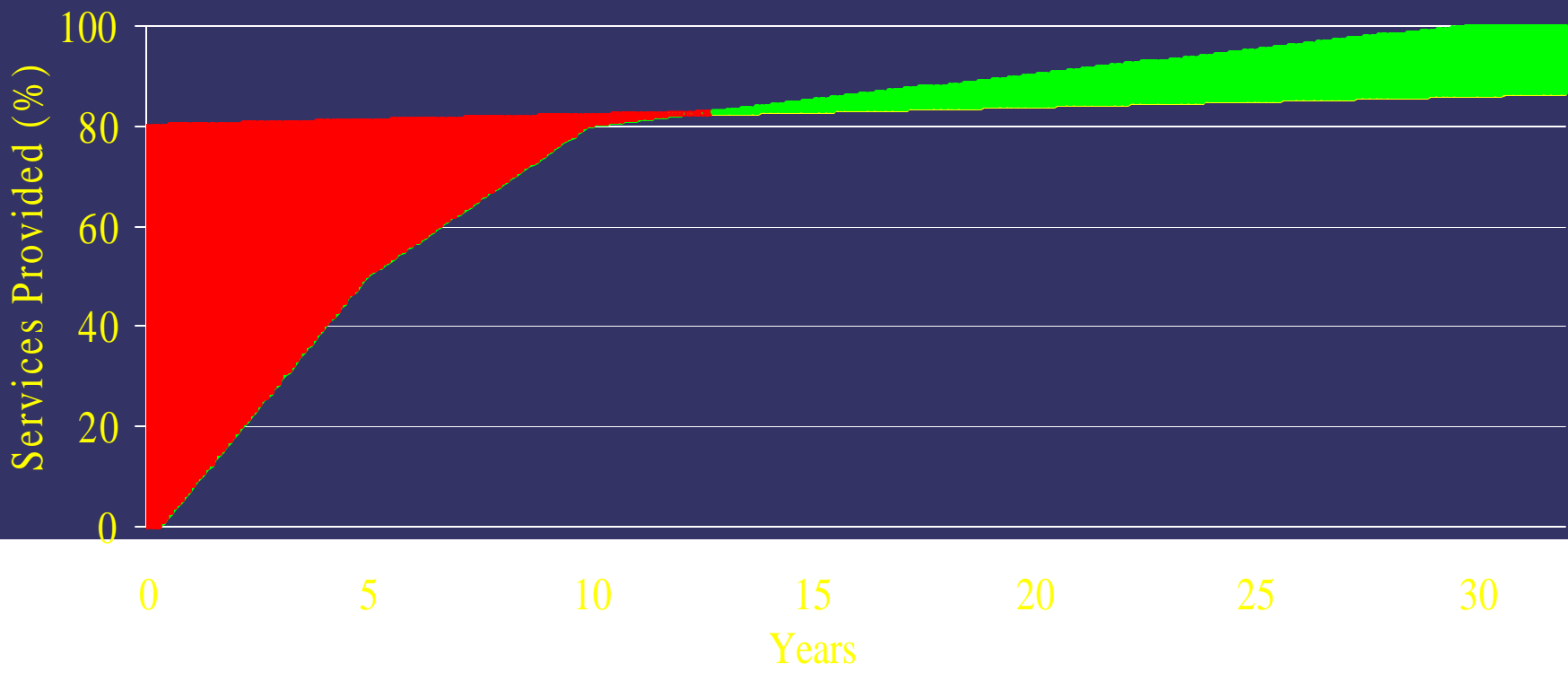


General Recovery Curve



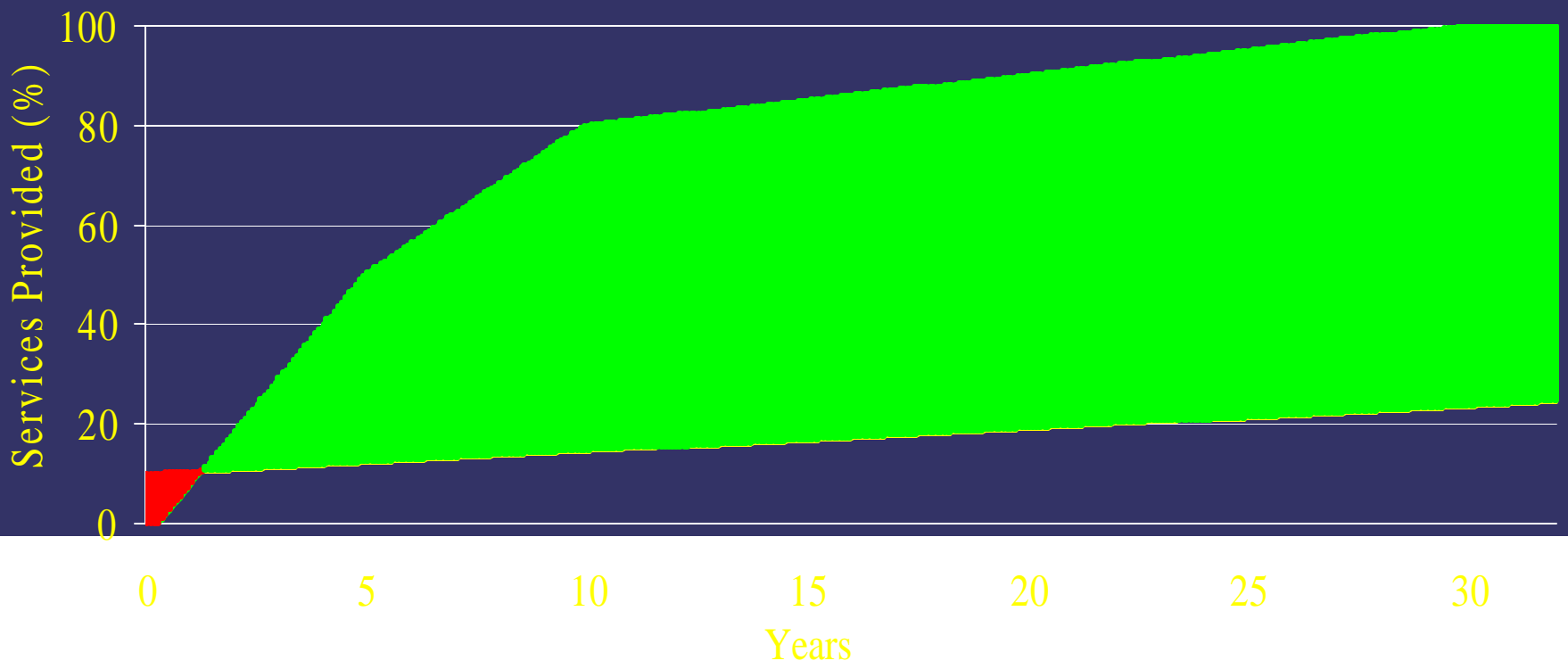
Benefits and Costs of Remediation

Yellow Zone--Initial Services 80%



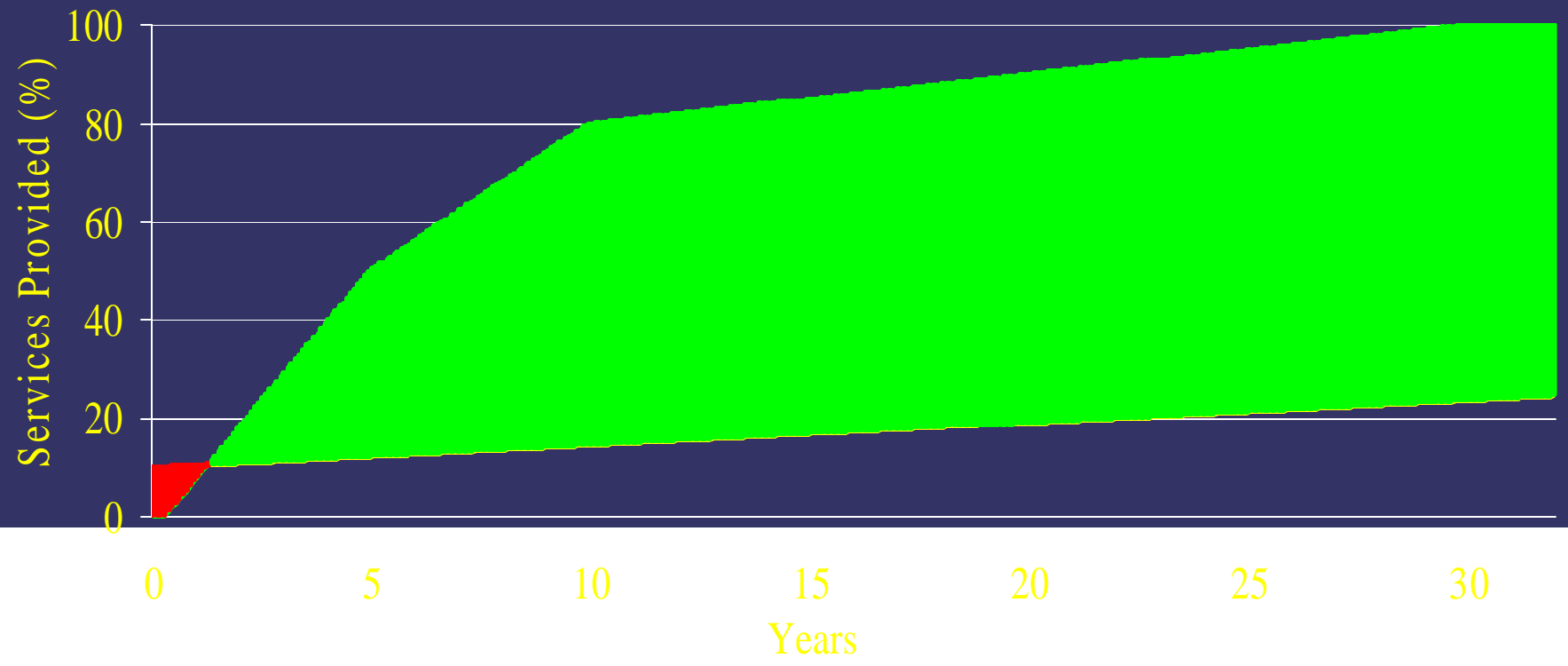
Benefits and Costs of Remediation

Red Zone--Initial Services 10%



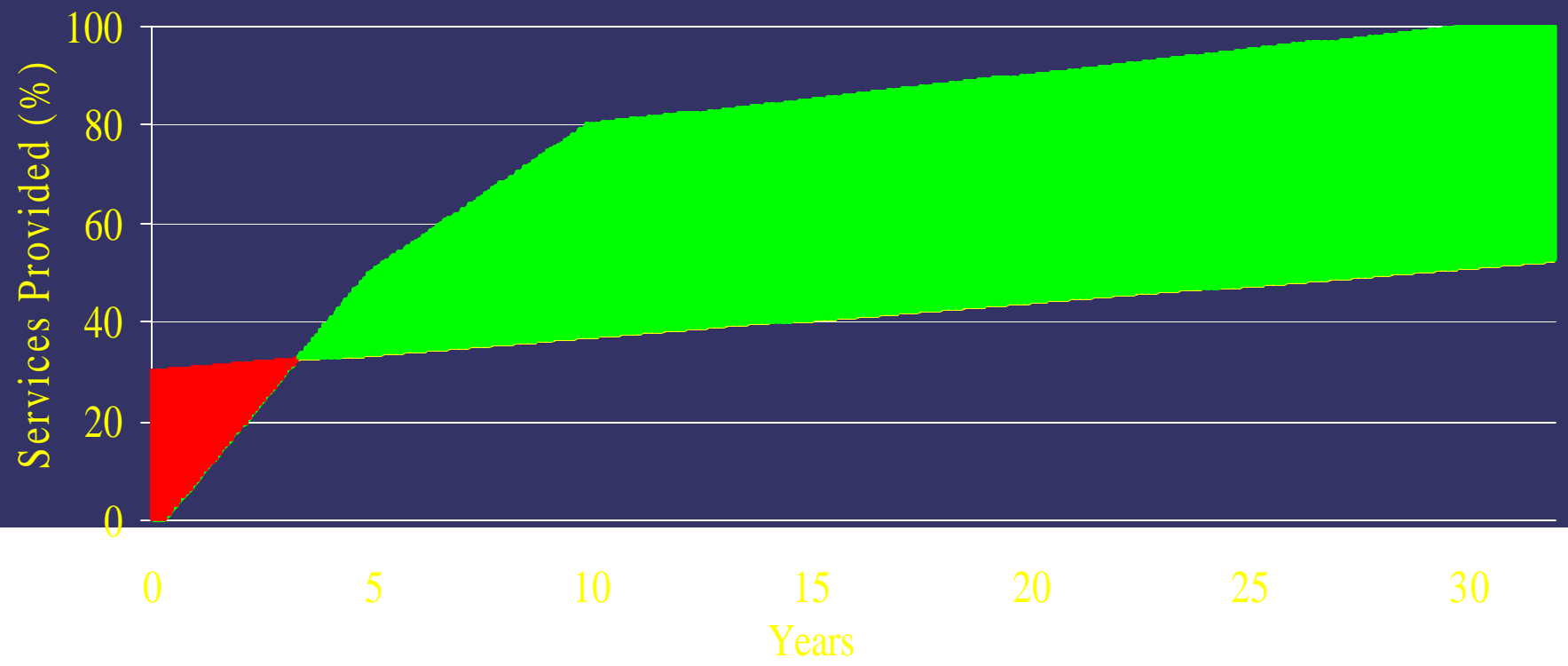
Benefits and Costs of Remediation

Initial Services 10%



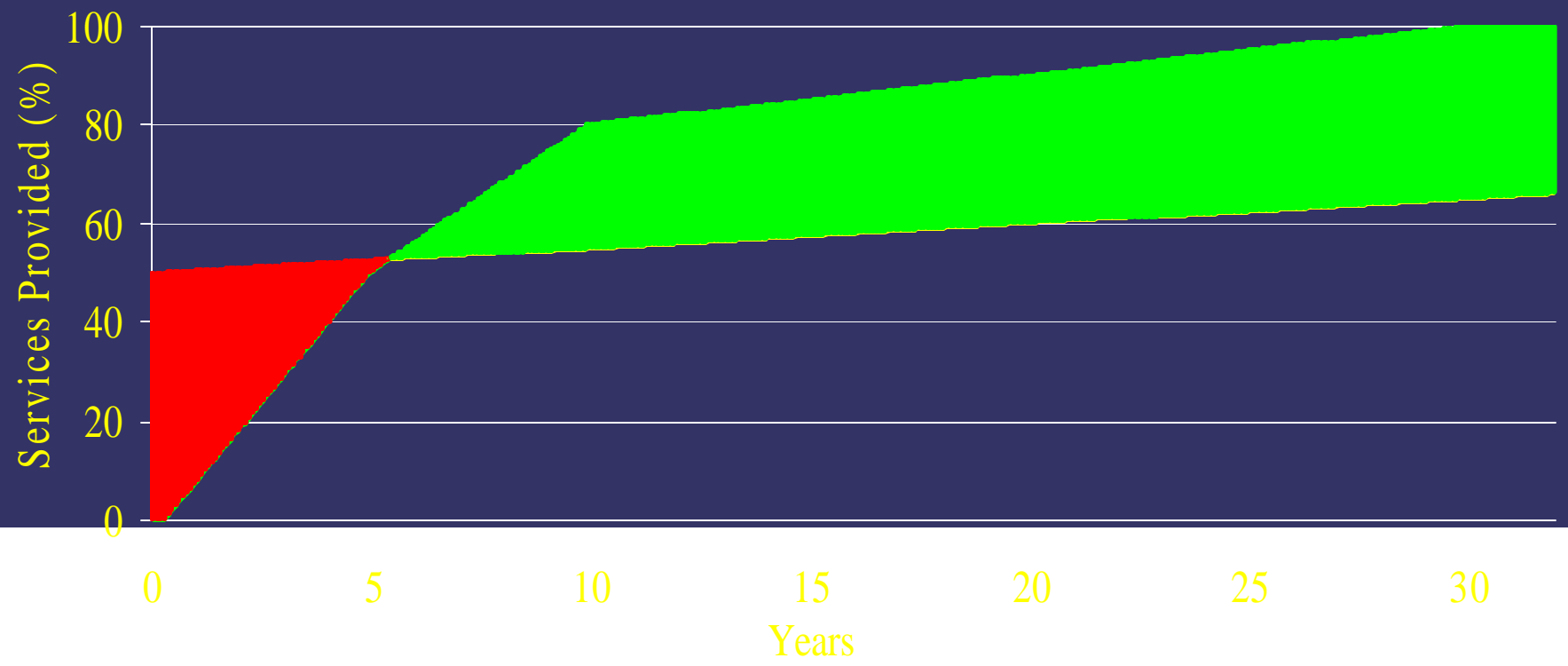
Benefits and Costs of Remediation

Initial Services 30%



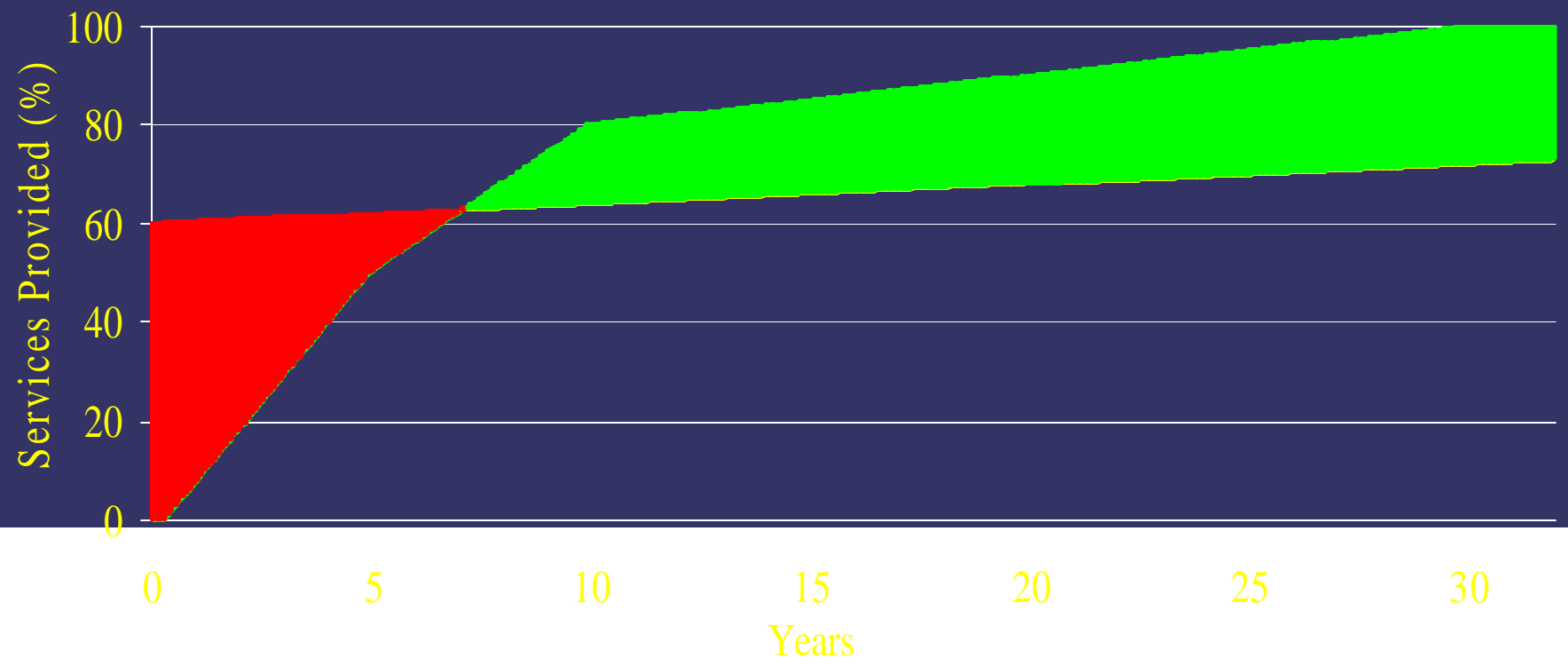
Benefits and Costs of Remediation

Initial Services 50%



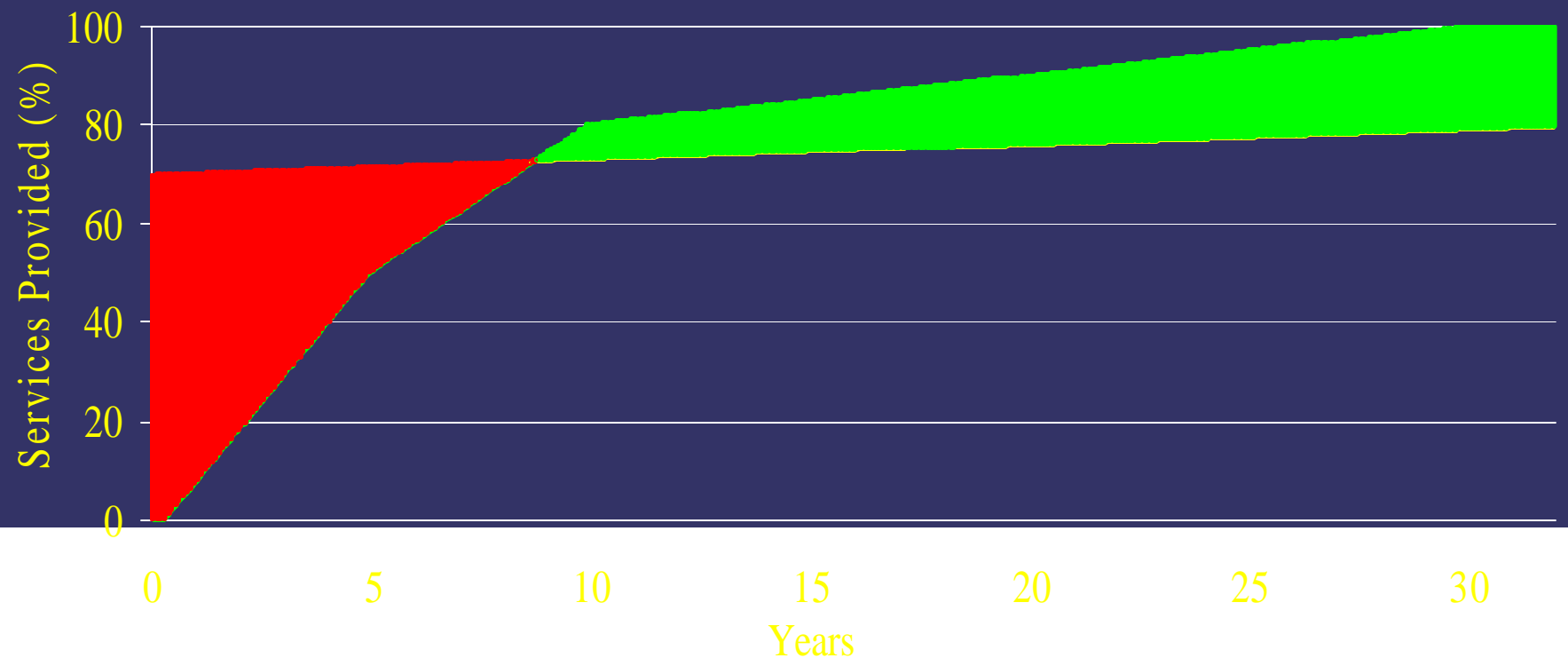
Benefits and Costs of Remediation

Initial Services 60%

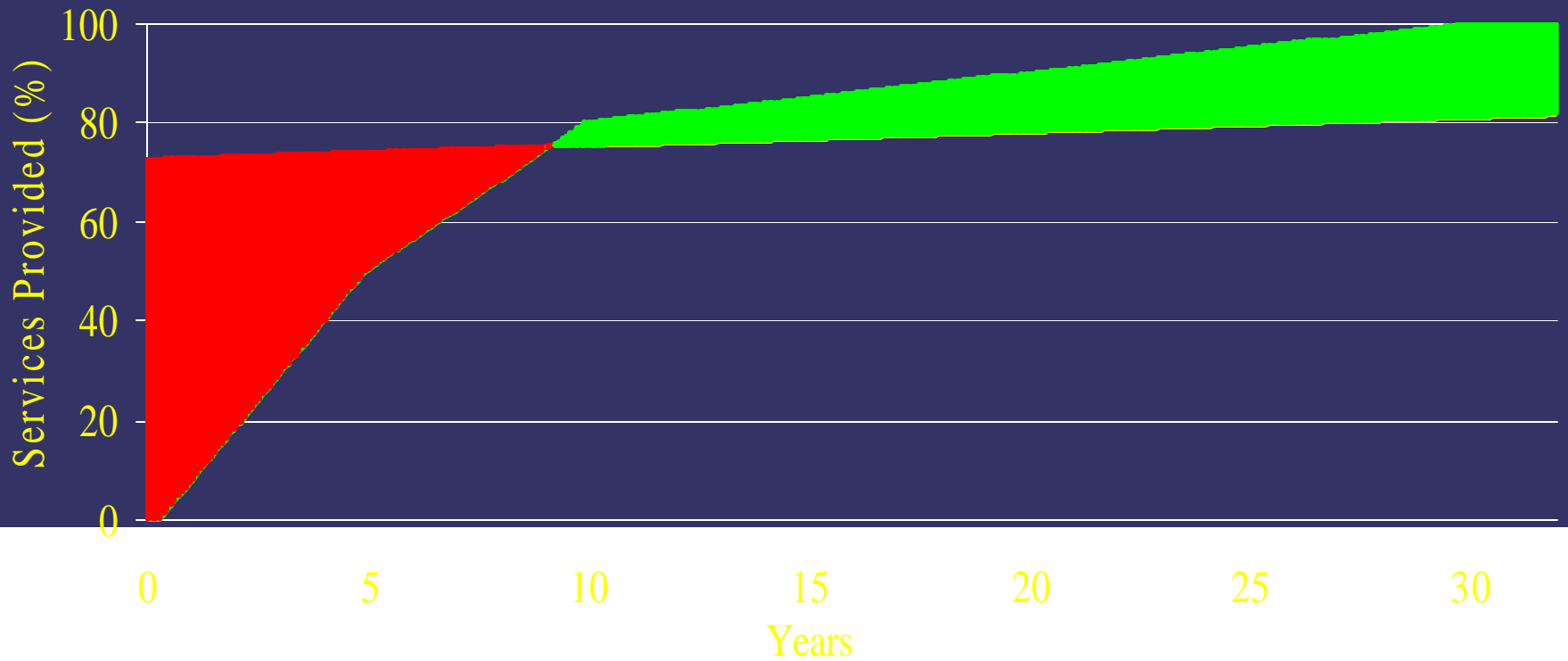


Benefits and Costs of Remediation

Initial Services 70%



Benefits and Costs of Remediation Equated



Benefits and Costs of Remediation Equated

