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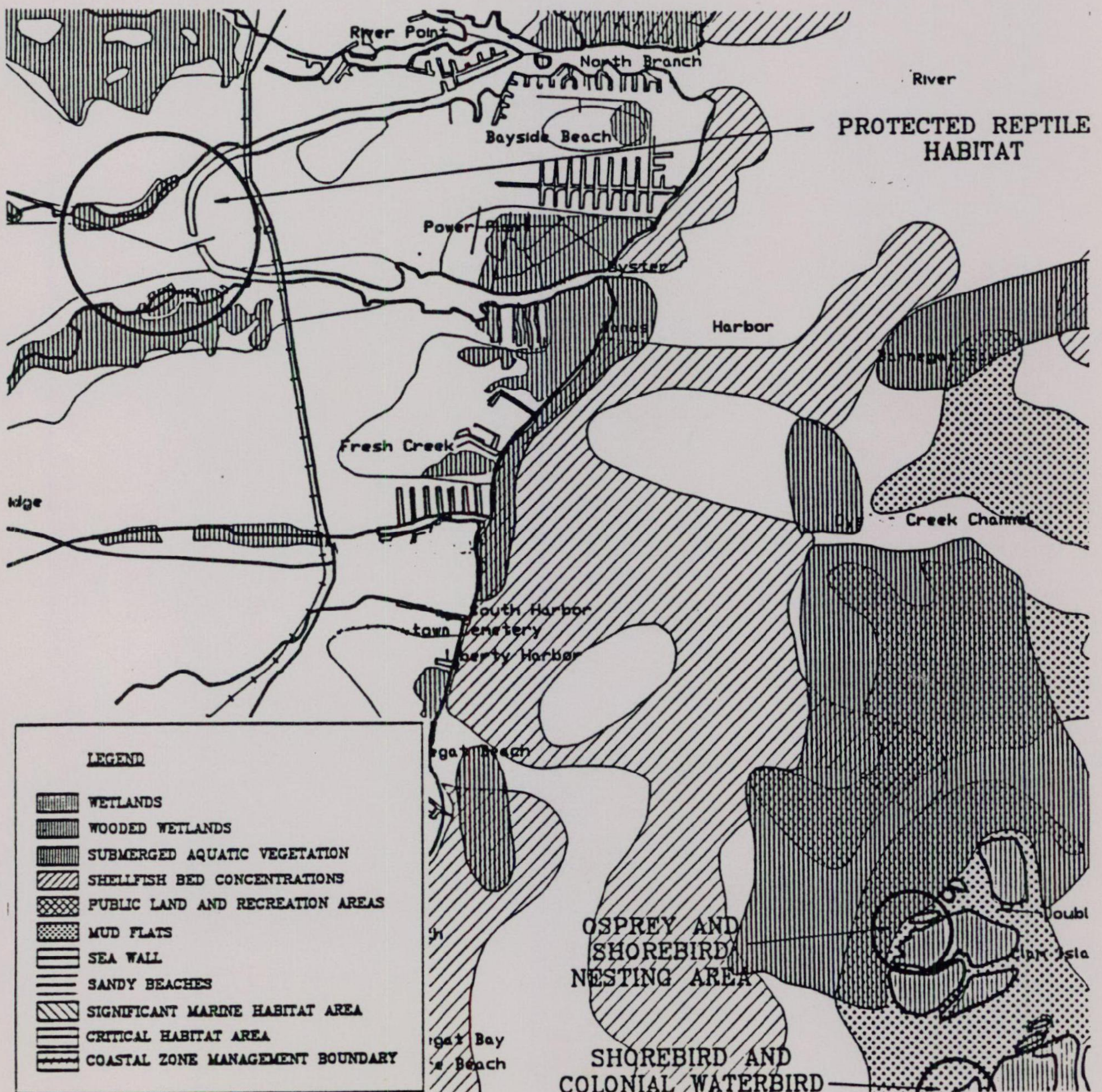
Environmental Protection Agency
Region III

Hazardous Waste
Management Division
Office of RCRA Programs
RCRA Corrective Actions Program

RCRA Facility Investigation/ Corrective Measures Study

Ecological Assessment Guidance Document

Draft Interim Final



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INTRODUCTION

Historically, the programs under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the Resource Conservation and Recovery Act (RCRA), have focused primarily on identification, analysis, and mitigation of chemicals with adverse human health effects. However, with the dawning of improved technology and better science, increasing environmental toxicity information, and greater public interest in the environment, the U.S. Environmental Protection Agency (EPA) is placing more emphasis on the importance of reducing ecological risk, in addition to human health risk.

The EPA, in a recent report, The Nation's Hazardous Waste Management Program at a Crossroads: The RCRA Implementation Study, July 1990, determined that the RCRA Program, to date, has not effectively utilized available data on the ecological impacts and risks posed by chemical releases to the environment. In the report, EPA made the following recommendations:

- Foster and develop the capability to conduct ecological risk assessments for RCRA facilities.

- Validate and transfer to RCRA Program staff currently available biological hazard and risk assessment methods that could be applied to RCRA issues.

- Focus research efforts to develop ecological risk assessment methods that could be applied routinely in the analysis of complex wastes and effects on biological populations, communities, and ecosystems.

EPA is currently working to establish policies and guidelines for addressing ecological impacts at regulated facilities. Various field methods and protocols exist, but there have been no directives to consistently implement specific techniques in each program. It is the intention of this document to integrate existing information on ecological studies with the RCRA corrective action process in order to establish a consistent format of environmental evaluation during the RCRA Facility Investigation (RFI) and the Corrective Measures Study (CMS).

Biological communities (ecosystems) are visible indicators of environmental health. The concept of chemical source reduction in the environment is far more difficult for the public to comprehend than a recognizably clean river, lake or stream. Ecological integrity implies environmental health, and as can be seen from many public health assessments, human health is directly related to ecological health. Therefore, a comprehensive environmental compliance program will include the utilization of ecological impacts data, in addition to the traditional chemical data collected to evaluate and correct harmful pollutant contamination.

1. Purpose, Scope and Intent

1.1 Purpose

The purpose of this document is to provide an applied scientific framework for consistently designing and implementing RCRA Facility Investigation/Corrective Measures Study (RFI/CMS) Ecological Assessments that will evaluate pertinent ecological aspects of a RCRA facility. These ecological aspects include, but are not limited to:

- Mapping Ecosystems within or near the site requiring protection,
- Establishment of a Reference Condition
- Determination of a Healthy or Impacted Ecosystem
- Effects of the site's contaminants on Impacted Ecosystem(s), and
- Effects of Corrective Actions

This document is not intended to be a comprehensive guide; instead it provides a working format for developing an Ecological Assessment within the RFI/CMS Process. This document cites, utilizes and compiles available precedented State and Federal methods and procedures that are applicable to the Ecological Assessment Process.

Detailed descriptions of specific field or laboratory methods are out of this document's scope, instead references are given for further information.

The authors of this document recommend that project managers designate and consult with qualified, applied Biologists and field Ecologists as early as possible in the RFI process and throughout the Corrective Action Process. Early participation by a project Biologist or Ecologist will ensure that the proper Work Plan is developed so that representative data is collected, an appropriate database is initiated and reviewed, and the subsequent report reflects the actual or potential impacts on the site ecosystem.

This document is designed to facilitate communication between the Project Manager, Field Biologists/Ecologists, Engineers and Geologist/Earth Scientists. Support for designing and evaluating Ecological Assessments may be available from technical assistance groups in those EPA Regions that have formed them. In other Regions, Field Biologists/Field Ecologists may be found on the staffs of other EPA offices and contractors, or on the staffs of other Federal agencies. The role of these specialists is discussed in greater detail in section 2 of this document.

Sources for relevant information are given at the end of appropriate text. Appendix A is a compilation of references for information on ecological basics.

1.2 Ecological Assessment Definition and Objectives

Ecological assessment, as discussed in this document, is a qualitative and/or quantitative investigation of the actual or potential impacts of a RCRA facility's operation on the ecosystem or parts of ecosystems within the facility's boundary and surrounding areas.

The objective of an RFI/CMS Ecological Assessment is to assess both qualitatively and/or quantitatively, the impact and potential impact of hazardous waste and non-RCRA waste generated, stored, treated or disposed of at a RCRA Facility on ecosystems within the site boundary and adjacent areas.

The RFI/CMS Ecological investigative process can provide valuable data to determine if an ecosystem has been impacted. And in the case where ecosystem impacts have been identified, these data can be utilized for designing and implementing corrective action to cease detrimental impacts and where possible to restore an impacted ecosystem back to a healthy condition. The Ecological Assessment requires a thorough evaluation and interpretation of collective geographic, physical, chemical and biologic factors at and near a site to describe the nature and extent of the actual or potential harm to an ecosystem. Therefore, the Ecological Assessment may also directly supply data for associated Human Health Risk Assessment calculations.

Ecological Assessment seeks to determine the nature, magnitude, and transience or permanence of observed or expected effects. One critical goal of Ecological Assessment is to reduce the uncertainty associated with predicting and measuring adverse effects of a site's contaminants (EPA/540/1-89/001).

2. Role of Project Biologist/Ecologist

Just as the hydrogeologist or engineer is required to be present during the scoping sessions, it is imperative that an appropriate ecological representative be present. Early participation by an ecologist will ensure that the proper Work Plan is developed so that representative biotic samples are collected, an appropriate database is developed and reviewed, and the subsequent report reflects the actual or potential impacts on the site ecosystem. Figure 1 illustrates Associated Project Ecologist Activities in the RCRA Facility Investigation and Corrective Action Process. The steps described in the figure at times overlap and are not necessarily performed at the same stage for every site.

The involvement of the Project Ecologist is critical in the development and review portions of the Work Plan, quality assurance/quality control measures, sampling programs, data interpretation, and corrective measure analysis. Because the objectives of the Ecological Assessment review are unique from other portions of the facility investigations, it is important that the Project Ecologist include the proper sampling, analytical and review considerations that are appropriate for ecological investigations. The Project Ecologist may also recognize cross-over tasks in other sampling or characterization programs (ie. soil sampling, hydrologic characterization, human health risk criteria) that may be utilized as data for Ecological Assessment Review purposes.

During the sampling phase of the Ecological Assessment, a Project Ecologist's presence is required to monitor and oversee certain portions of the sampling program. This may include quality assurance and quality control (QA/QC) tasks, such as bioassay or biotic specimen sampling splits, and review of field sampling procedures and methods. In the event that unforeseen sampling obstacles or limitations are encountered in the field, the Project Ecologist can provide assistance or advice on alternative sampling methods or schemes. The Project Ecologist will validate that proper sampling protocols have been followed and that the data collected represents true biotic conditions at the site.

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Figure 1. ASSOCIATED PROJECT ECOLOGIST ACTIVITIES WITHIN RCRA CORRECTIVE ACTION PROCESS

(1)
Regulatory Agency Conducts RCRA Facility Assessment to:
- Identify solid waste management units,
- Collect existing chemical data,
- Identify chemical releases or suspected releases, and
- Determine need for further investigation.

(1A)
Visual Site Inspection to:
- Document existing site ecosystems at and near facility,
- Identify visibly or potentially impacted biotic conditions,
- Review historical chemical handling practices or incidences that may indicate a notable environmental concern,
- Determine need for further investigation.

(2)
Regulatory Agency Issues Permit and Permit Conditions

Enforcement Order to Facility Operator/Owner to:
- Perform chemical release investigation and/or
- Implement Interim Corrective Measures.

(2A)
Review of:
- RFI Work Plan to determine if potential receptors and contaminant, pathways will be suitably appraised,
- Interim Corrective Measure Plans to assess potential ecosystem, impacts and appraise most appropriate remedial technologies.
- Develop Biotic/Ecological Sampling Plan and Field Tasks
- Review and develop relevant portions of Quality Assurance Project, Plan.

(3)
Operator /Owner Conducts RCRA Facility Investigation to
- Confirm chemical release, and
- Characterize nature, extent and rate of chemical migration

(3A)
- Determine indicator chemicals and develop Project Compound List.
- Monitor and oversee biotic sampling program.

(4)
Regulatory Agency Performs RFI Based Health/ Environmental Assessment to Determine Need for:
- Interim Corrective Measures, or
- Corrective Measures Study.

(4A)
Perform Ecological Assessment to Determine Impact:
- Assess Site Ecosystem,
- Establish Reference Condition or Use Established Ecoregional data.
- Define sensitive, protected or special status habitats; threatened and endangered species within site ecosystem.
- Conduct biosurveys.
- Compare subject site and Reference Condition data.
- Determine if site ecosystem or parts within ecosystem are impacted.
- Develop and review database for ecological data.

(5)
Facility Operator/Owner Conducts Corrective Measures Study

(5A)
- CMS to assess potential ecosystem effects and appraise most appropriate corrective actions.

(6)
Regulatory Agency Evaluates Corrective Measures Study and Recommends Appropriate Corrective Measures.

(6A)
- Evaluate various risk scenarios for possible corrective action including no action.

(7)
Facility Operator/Owner Performs Corrective Measures Implementation.
- Design, Construction, Operations, Monitoring and Maintenance.

(7A)
- Monitor effects of corrective actions on ecosystem and progress toward completing objective of returning site ecosystem to healthy state
- Provide recommendations for ACL values.

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3. Elements of Ecological Assessment

The design and implementation phases of an RFI/CMS Ecological Assessment begin at the inception of the RCRA Facility Investigation. Figure 2. illustrates the project progression of an Ecological Assessment within RCRA Corrective Action Process.

Each site is unique, and therefore, each site demands specific attention to its distinctive characteristics. There is no definitive standard to establish the "completeness" of an Ecological Assessment, however, the following criteria should be properly evaluated and incorporated; as deemed necessary by the Project Ecologist; into each Ecological Assessment:

1) A visual ecological site inspection during the RCRA Facility Assessment. [A sample Site Reconnaissance Form can be found in Appendix E.]

2) An historical evaluation of the general site conditions, chemical handling, storage and incidences, land use, and ecological conditions.[As described in section 4 of this document.]

3) An evaluation of relevant chemical data associated with the facility; including locations, mobility, bioavailability, volumes, concentrations and toxic properties; and the relationship to ecosystem stress. [As described in section 9 of this document.]

4) Review of RCRA Facility Investigation Workplan to determine if potential receptors and contaminant pathways will be suitably appraised.

5) An ecosystem map assimilating information such as topographical features, hydric conditions, flora and fauna, and visual biotic stress (ie; stressed vegetation and absent indigenous species). [As described in section 6.1 of this document.]

6) Assessment of site ecosystem [As described in section 6 of this document.]

7) Establishment of Reference Condition or other comparative baseline value. [As described in section 6 of this document.]

8) A comparison of the site ecosystem parameters to a Reference Condition (healthy ecosystem), to determine if site ecosystems have been adversely impacted by chemical releases. [As described in Section 8 of this document.]

9) A determination of the proper corrective measures required for remediating an impacted ecosystem.

10) A monitoring program to evaluate the long-term effects of corrective actions on an ecosystem [As described in Section 12 of this document.]

The Ecological Assessment Checklist provided in Appendix G of this document provides a basis for determining the level of detail and data verification presented in a given Ecological Assessment.

More general components of the Ecological Assessment, which may be recognized as fundamental elements of risk assessment, are outlined below.

3.1 Historical Evaluation

The Ecological Assessment begins with an evaluation of the data obtained from the initial RCRA Facility Assessment and any available historical data pertaining to the facility. Review of historical data can help in characterization of the subject facility and aid in the development of a Work Plan for the RCRA Facility Investigation.

3.2 Receptor Characterization

The receptor characterization process should identify the ecosystem component at risk by specifying assessment and measurement endpoints or potential receptors. These receptors may be aquatic or terrestrial individuals, populations, biotic communities, or whole ecosystems.

3.3 Hazard Identification

The ecological assessment requires a hazard identification process to identify specific toxicological effects on the selected receptors. This involves the collection, organization and evaluation of all toxicological data available on the chemicals of concern and an interpretation of whether the stress condition is consistent with what is known about the chemical(s).

The hazard identification process evaluates chemical and non-chemical stresses, the type of ecosystem(s) involved, and the potential effects of the known hazards on an ecosystem. The hazard identification would include chemical abundance, chemical locations, and toxicological profiles of the indicator chemicals or the designated project compound list.

3.4 Exposure Assessment

The ecological assessment estimates the magnitude and nature of the exposed population to a chemical. Exposure refers to contact between the identified receptor and the environmental media (air, water, soil, food) containing the chemical of concern, or direct contact with the chemical, which may occur from an accidental spill.

Exposure assessments for ecological risk can involve a diverse group of species, habitats, and stresses. For chemical stresses, the possible fate and transport of the chemicals through the environment, needs to be considered, as well as the frequency and duration of exposures. When extrapolating laboratory toxicity data to field situations, bioavailability of the chemical (or the extent to which a chemical can be absorbed, ingested or assimilated by an organism) needs to be assessed for each site-specific potential exposure pathway.

3.5 Ecological Risk Characterization

The integration of data derived from the receptor characterization, hazard assessment, and exposure assessment combine to estimate or characterize the potential chemical impacts on an ecosystem. The risk characterization can be presented quantitatively or qualitatively, depending on the approach used in determining the various biotic parameters, and the applicability of the approach to the actual site ecosystem.

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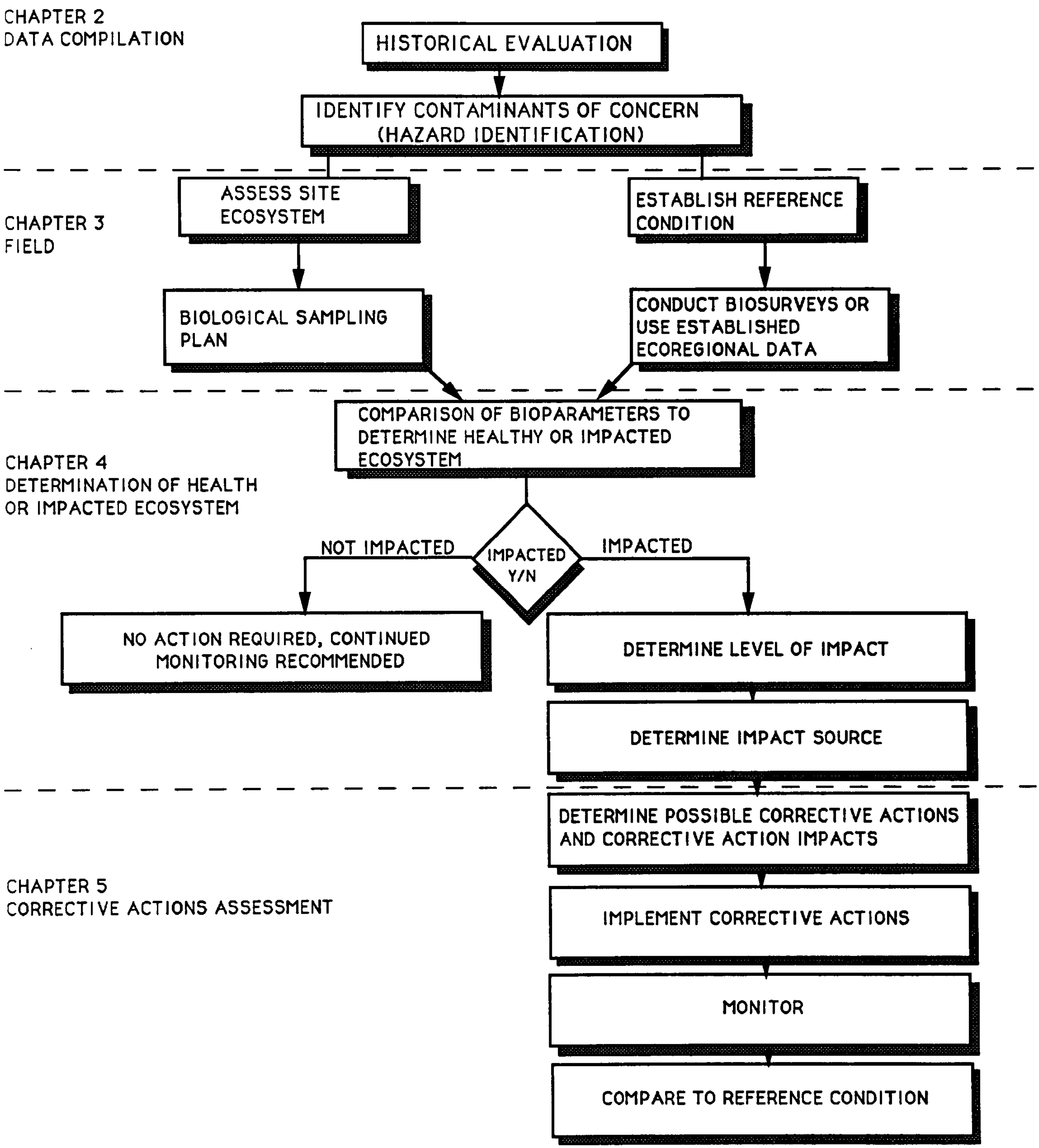
FIGURE 2. ECOLOGICAL ASSESSMENT WITHIN RCRA CORRECTIVE ACTION PROCESS: PROJECT PROGRESSION FLOWCHART



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Chapter 2
DATA COMPILATION

4. Historical Evaluation

Historical data research can provide valuable data for facility and subject site characterization. These data may provide information on past chemical handling and storage practices, land use variations over time, possible contaminants and current ecological conditions.

The federal resources listed below can provide data to be utilized in the historical data research process.

- U.S. Geological Survey (USGS) Topographic Maps give information such as site location in relation to surrounding land contours and physical features such as valleys, upland areas, surface waters and structures. The contours may provide surface water runoff and hydraulic gradient directions.

- U.S. Fish and Wildlife Service (USFWS) Wetland Inventory Maps can assist in identifying and characterizing wetlands inside site boundaries and adjacent areas.

- Natural Heritage Inventory or Natural Diversity Inventory maps provide probable locations of special status, threatened, rare, and endangered species. Certain maps illustrate protected critical habitats, and propagation.

- U.S. Department of Agriculture and Soil Conservation Service (USDA-SCS) maps of hydric conditions reflect groundwater within the region. Mapped aquifer boundaries and interconnections can outline potential groundwater concerns.

- U.S. Department of Agriculture and Soil Conservation Service (USDA-SCS) Soil Survey Maps present soil types and soil characterization. The maps may indicate the presence of hydric soil conditions associated with wetlands conditions.

It is highly recommended that aerial photographs be collected to illustrate the changes in site operation, function, and construction over time. Aerial photographs can be obtained from the USDA-SCS, USGS and other private aerial photograph agencies. Generally, photographs can and should be obtained for every decade (usually starting around the 1930s in some areas) leading up to the date of the assessment.

Soil boring logs, obtained from well installation or soil sampling, help to classify on-site soil types. On-site survey results from portable monitoring equipment readings and visual information may highlight areas with chemical concern.

Records of past ownership and operations can indicate historical chemical handling and disposal practices. Facility permits outline current and past operational and waste management practices at the site.

Under the Community Right-to-Know mandates, companys are required to maintain files of Material Safety Data Sheets (MSDSs) for chemicals stored or utilized at the facility. Facilities are mandated to file SARA Title III documents which specify chemical quantity, location and container type stored on-site. Reporting documents indicate chemical spill response and interim corrective measures which have taken place.

Hazardous Waste Manifests, which state the chemical name and/or hazard classification of the facility's chemical waste transported for disposal are kept on file at the facility for at least three years.

5. Contaminant(s) of Concern Identification (Hazard Identification)

5.1 Selection of Indicator Chemicals

The indicator chemical selection procedure is designed to identify the highest risk chemicals at a site so that the ecological assessment is focused on the chemicals of greatest concern. The following chemical characteristics are important factors in ranking chemicals in the indicator chemical selection process:

- quantity of chemical stored, disposed of on-site or released,
- chemical toxicity,
- measured chemical concentrations at the site,
- mobility of chemicals through various exposure pathways,
- bioavailability of the chemicals to the ecosystem, and
- potential of the chemical to bioaccumulate.

In developing a project compound list or selection of indicator chemicals, analyzing a group of chemicals as a package; such as the Target Compound List (TCL), formerly the Hazardous Substances List (HSL), the Target Analyte List (TAL), or Priority Pollutant List, found in 40 CFR Part 302.4 and 40 CFR Part 136 respectively; may reduce the laboratory analytical costs and required sampling time.

A detailed discussion on selection of indicator chemicals for public health evaluations can be found in Chapter 3 of Superfund Public Health Evaluation Manual, EPA 540/1-86/060.

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Chapter 3
FIELD

6. Site Ecosystem Assessment /Establishment of Reference Condition

6.1 Qualitative Map of Site Ecosystems

One of the initial steps in assessing a site's ecosystem is to identify and map observable flora and fauna communities, and distinct ecosystem boundaries. A properly completed ecological map provides a visual illustration of the site ecosystem qualities, an overview of the subject site ecodynamics, and establishes a working tool for documentation, data analysis and interpretation, decision making, field work planning, and other logistically significant applications.

A site ecosystem map should assimilate information such as:

- topographical features, including drainage features,
- surface waters,
- wetlands,
- vegetation types, and
- visual biotic stress

within the site's boundaries or near the site.

The various degrees of sophistication may range from hand-drawn maps, to maps generated from an interactive database system, such as a Geographical Information System (GIS). The level of detail required for an ecosystem map depends on the complexity of the site, the volume and types of compiled data, and the nature and extent of the chemical impacts on the site ecosystem. GIS mapping systems allow for more facile manipulations and comparisons of compiled data, and rapid illustration renderings.

When coupled with chemical data, structural locations, and other pertinent information reflecting a potential impact on the site ecosystem, the map becomes one of the most important aspects for planning and implementing project progression and making final determinations about the site ecosystem.

Geographical Information System maps generated from database information is further discussed in Section 8.1 of this document. A detailed discussion on qualitative mapping of ecological communities can be found in section 3.3 of Ecological Assessment of Hazardous Waste Sites: A Field and Laboratory Reference, EPA 600-3-89/013.

6.2 Sensitive, Protected or Special Status Habitats, Threatened and Endangered Species

An important element in assessing site ecosystems is identification of sensitive environments, critical habitats and the occurrence of threatened or endangered species within the ecosystem. The Endangered Species Act endeavors to conserve ecosystems which endangered or threatened species inhabit, and to conserve the species themselves (US EPA 230/10-88/041).

Natural Diversity Inventory programs; multiple index data systems containing locational and ecological information detailing occurrences of rare and endangered species, significant biological communities and geologic features; assist in identifying sensitive, Protected or Special Status Habitats and, Threatened and Endangered Species. Each of the 50 states has developed its own inventory program. Oftentimes these programs are not completely comprehensive; due to the limited amount of data available; but the data they can provide can only enhance the project baseline data of an assessment, and should be consulted when Ecological Assessments are conducted.

6.3 Reference Condition/ Baseline Determination

A key step in assessing biological impacts and potential impacts of contaminants on an ecosystem is the establishment of a reference condition. Standard experimental controls (established reference conditions) are rarely available; and for most surface waters, wetland areas and terrestrial ecosystems, baseline data were not collected prior to an impact. Therefore, impairment must be inferred from differences between the impact site and established reference conditions.

Reference conditions describe the characteristics of areas least impaired by human activities and are used to define attainable ecosystem parameters such as maximum diversity, uninterrupted ecotones, appropriate fecundity-to-diversity ratio and predator-to -prey ratio. A qualified Field Biologist/Field Ecologist is needed to identify and establish an appropriate reference condition for each assessment.

Series of ecoregional reference areas that represent attainable conditions can be consistently referred to when performing ecological assessments, thereby, eliminating the need to regularly repeat data collection and establishing a reference site condition for each project. Ecoregions are regions of ecological similarity based on hydrologic, climatic, geologic, or other relevant geographic variables. Ecoregional reference areas must represent similar habitat types which are representative of the region. Figure 3 is a sample ecoregion map. Regional EPA offices should be contacted to determine if ecoregional database systems are accessible for a given ecological site.

A detailed discussion on establishing a reference condition, can be

found in Chapter 5 of Biological Criteria, National Program Guidance for Surface Waters, EPA/440/5-90/004.
A detailed discussion on the Ecoregional Concept can be found in section 2.5 of Rapid Bioassessment Protocols for Use in Streams and Rivers: Benthic Macroinvertebrates and Fish. EPA/440/4-89/001 and Chapter 5 of Biological Criteria: National Program Guidance for Surface Waters. EPA/440/5-90-004.

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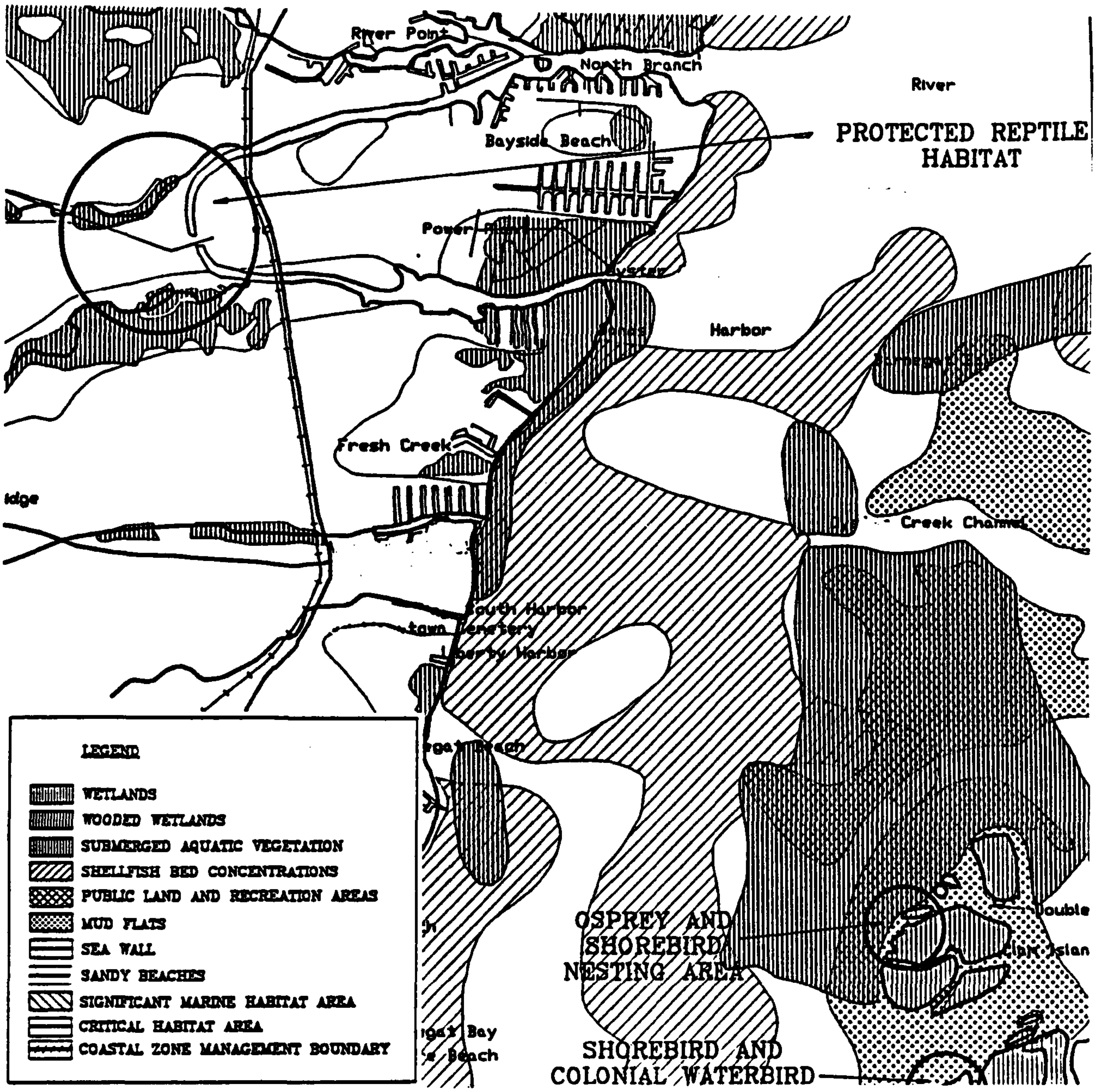
Figure 3. Sample Ecoregion Map



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7. Biological Sampling Plan Objectives

The purpose of a biological field sampling program is to identify specific ecological parameters and to collect data to assess the impacts and potential impacts of a contaminant on an ecosystem. Bioparameters identified during a biological survey may include:

- Predator-Prey Ratio,
- Population Fluctuations,
- Species Diversity,
- Species Fecundity-Species Diversity Ratio, and
- Ecotone Quality.

Prior to the implementation of a biological sampling program, it is recommended that pre-existing data be utilized to develop a formal sampling work plan. The sampling plan should be detailed in the Quality Assurance Project Plan (QAPP) and address specific objectives of the sampling effort, sampling protocols, schedule, and sampling logistics.

Benthic macroinvertebrates can be collected for use as water quality indicators using methods and biotic index systems described by Hilsenhoff (1982, 1987, 1988). These methods endeavor to collect benthic organisms which are representative of the benthic taxonomic communities. The biotic index system relates the various levels of chemical tolerance to the relative abundance of specific taxonomic groups. The relative abundance of these specific species is directly related to the degree of organic pollution.

The following references provide a detailed discussion on biological sampling concepts, criteria and methods: Rapid Bioassessment Protocols for Use in Streams and Rivers, Benthic Macroinvertebrates and Fish, EPA/440/4-89/001, Biological Criteria: National Program Guidance for Surface Waters, EPA/440/5-90-004, Ecological Assessments of Hazardous Waste Sites: A Field and Laboratory Reference, EPA/600/3-89/013, and Procedures for Quantitative Ecological Assessments in Intertidal Environments, EPA/600/3-78-087.

Cooperation with other environmental consultants in various disciplines (geology, engineering, health risk assessment) and coordination of sampling events (biological, physical, chemical) will decrease crossover sampling efforts, and may yield greater integrity to the collected data.

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Chapter 4
DETERMINATION OF HEALTHY OR IMPACTED ECOSYSTEM

8. Comparison of Bioparameters to Determine Healthy or Impacted Ecosystem

8.1 Ecosystem Data Comparison

Observable and quantitative bioparametric comparisons between site ecosystems and the reference condition may include:

- Species Diversity,
- Stressed Vegetation,
- Vegetative Succession,
- Relevant Vegetative Abundance,
- Land Use and Land Characteristics, and
- Riparian Vegetation.

Ecosystem mapping is an invaluable method for illustrating and comparing data. Comparison of visible or qualitative information may be adequate for screening ecological impacts and for certain subject sites. However, qualitative methods may not reflect low-dose, chronic, long-term influences of chemical impacts on an ecosystem that can only be detected as subtle fluctuations or variations in biotic populations.

Quantitative methods can yield large quantities of data that can be compared statistically by analysis of variance between data sets (site ecosystem vs. reference condition). Quantitative analysis of data sets, over time, may also reveal subtle alterations in biotic populations, which may not be obvious from a qualitative review.

Investigative methods can be grouped as qualitative or quantitative approaches. While qualitative methods cannot be used to develop standards or to quantify results, they can be very effective as screening or ranking tools to set priorities (EPA, Nov. 1988).

Due to the copious amounts of field datum points, data needs to be compiled in a way to facilitate its illustration and evaluation. A database could be used to compile data including: protected, endangered, threatened and rare species; areas of special, protected or sensitive status; and inventories of critical habitats or priority natural resource areas. Significant hydrological and geological features of the region may also be included. Such a database could be an analytical tool to aid in the assessment of chemical impacts on the environment, especially related to regional ecosystems, and provide decisive information for ecological-risk management.

An interactive database can be incorporated with ecological and health risk assessment calculations, in order to interpret risk driven remediation calculations, review various contaminant concentration impact scenarios, and provide pertinent information to the corrective measures remediation review process. An example of an interactive database is GIS, Geographic Information Systems which provide data entry, storage, manipulation, analysis, and display capabilities for geographic, environmental, cultural, statistical, and political data in a common spatial framework. The data associated with spatial data may include site boundary, chemical characteristics, field measurements, ecosystem mapping and stressed vegetation data.

Qualitative data compilation and analysis is an excellent screening method for determining site eco-conditions. It can be very powerful if executed correctly and can always be utilized for other aspects of the project. Quantitative analysis of data usually requires more intensive planning for sampling logistics, data storage and data analysis, and data interpretation. Quantitative analysis may not be necessary for some projects, where qualitative data comparison would be sufficient. A qualified Biologist should be consulted for determining the appropriate approach and level of effort required for each project.

8.2 Bioparameter Interpretations: Healthy or Impacted Ecosystem

A qualified, applied Biologist or Field Ecologist familiar with the regional ecosystems and local ecological variations should be consulted for interpretation of the compiled data and comparison of bioparameter data such as reduction in population size, species diversity, and predator-prey ratio. An Ecologist/Biologist knowledgeable about regional and local ecological micro-variations will be able to conclude from properly executed sampling program site characterization and data analysis if an ecosystem or components of an ecosystem are impacted or potentially impacted by a chemical release.

A detailed discussion on bioparameter interpretations can be found in sections 3.3.1, 3.3.2, and 3.3.3 of <u>Risk Assessment Guidance for Superfund Volume II: Environmental Evaluation Manual</u>, EPA/540/1-89/001 and <u>Biological Criteria: National Program Guidance for Surface Waters</u>, EPA/440/5-90-004.

9. Level of Impact Determination

9.1 Contamination Characterization

As part of the hazard assessment, a contamination characterization or analysis of potential or known chemicals at the facility is required. Determination of the nature and extent of contamination is comprised of a summary of contamination sources and descriptions of contaminated areas. The spatial extent of contamination is determined through review of historical data, sampling and monitoring of the various media (water, sediments, soils, air).

Contamination characterization is a dual objective with site characterization incorporating collection of physical and chemical data and an evaluation of a chemical's potential to cause ecological harm.

Sample locations and frequency of sampling can follow a randomized scheme, systematic approach, biased methods or a combination of the three techniques. The proper approach must be determined on a site-by-site basis and must evaluate and employ the most effective method that reflects the actual nature and extent of chemical contamination of the subject site.

The chemical sampling, including locations and schedules for groundwater, soil, surface water, sediment, air, and subsurface gas contamination as described in the Interim Final RCRA Facility Investigation (RFI) Guidance Manual, EPA 530/SW-89-031 should be evaluated from an ecological perspective to see if actual site conditions are being represented over time. That is, ecological considerations (ie; time of year, proximity to wetlands, etc.) may influence the locations and times of these sampling events and parameters.

9.2 Ecological Risk Characterization

Contaminants can cause changes in ecosystem structure and function. As contaminants modify the species composition and relative abundance of populations in a community, the complex patterns of matter and energy flow within the ecosystem may also change. If certain key species are reduced or eliminated, this may interrupt the flow of energy and nutrients to other species not directly experiencing a toxic effect. If plant life is adversely affected by a contaminant, the ecosystem as a whole may capture less solar energy and thus support less animal life. If microbial or invertebrate populations are disrupted, decomposition of dead plants and animals may not occur rapidly enough to supply sufficient mineral nutrients to sustain the plant community.
These ecodynamics can be measured both qualitatively and quantitatively; qualitatively through observable effects and quantitatively through population census biomass production and other methods.

10. Determination of Impact Source

Source characterization aids in determining possible release pathways, monitoring procedures and the nature and scope of any corrective actions forthcoming.

Waste characterization enables the RFI project manager and Project Ecologist to better evaluate monitoring locations and constituents, monitoring procedures, release rates, and which unit released which contaminant (EPA/530/SW/-87-001). Waste characterization is also essential in determining the nature and scope of any corrective actions needed.

A detailed discussion on source characterization can be found in section 2.2.3 of Interim final RCRA Facility Investigation (RFI) Guidance, EPA/530/SW-89-031, Chapter 7 of Draft RCRA Facility Investigation (RFI) Guidance; Vol I, EPA/530/SW-87-001, Chapter 3 of Risk Assessment Guidance for Superfund, EPA/540/1-89/001, and Biological Criteria; Natural Program Guidance for Superfund, EPA/440/5-90-004.

Chapter 5
CORRECTIVE ACTION ASSESSMENT

11. Corrective Action

11.1 Purpose and Determination

The 1984 amendments to RCRA greatly expanded EPA's authority to implement Corrective Action at hazardous waste facilities. The expanded RCRA Corrective Action Program is a cleanup program for all hazardous waste facilities, whether operating or closing and is similar in purpose to EPA's Superfund Program.

The purpose of Corrective Action is to cease detrimental impacts and where possible return impacted ecosystem to a healthy condition. The type of Corrective Action depends on the contaminants of concern and site-specific stressed ecological parameters. Contaminant changes in ecosystem structure and function need to be interpreted by the Project Ecologist.

The effect, both beneficial and detrimental, of the corrective action needs evaluation. Various risk scenarios need to be weighed. The scenarios should consider but not be limited to:

- impact of excavation,
- toxicant release through dredging,
- potential for siltation,
- treatment technology (on-site and off site),
- contaminant mobility, bioavailability and toxicity.

Corrective actions such as excavation of contaminated wetland sediments would result in high levels of siltation to streams, potential toxicant release and the destruction of a fragile wetland habitat . Such a corrective action could cause more damage than the contaminants toxic effects. Long and short term impacts must be considered for both corrective action and no action scenarios.

A no action alternative is a viable option when ecological assessments indicate:

- the lack of bioavailability due to strong contaminant attenuation to soil, clay or organic matter,
- contaminants are readily biodegraded in site matrix,
- or potential for high photolysis exists.

11.2 Artificial Wetlands Consideration

Constructed wetlands can be utilized as a cost effective treatment technology for a variety of project chemicals. Constructing a wetland, where one did not exist before, reduces the influent water quality requirements associated with natural wetlands, and ensures more reliable control over hydraulic conditions and vegetation management. A discussion on the dynamics, importance and definitions of naturally occurring wetlands can be found in Appendix C of this document.

Artificial wetlands can be constructed in most climatic regimes. Certain wetland species can tolerate winter freezing much better than aquatic plant systems. Experimental systems have been built in heavy clay soils and in an abandoned mine-tailing basin (Cobalt). Topography is an important consideration in the selection of an appropriate site since grading and excavating represent a major cost factor. Site selection criteria differs depending on the type of constructed wetland as well. A detailed discussion on design criteria can be found in chapter 3 of Design Manual: Constructed Wetlands and Aquatic Plant Systems for Municipal Wastewater Treatment, EPA/625/1-88/022.

In wetland conditions, metals such as copper, mercury, chromium, nickel, lead, zinc and cadmium precipitate from water and adsorb to organic matter, silt, clay, and sediments. Chemical, physical and biological interactions within the organic benthic layer of wetlands are the major mechanisms that account for approximately 90-95% of chelation, complexing, adsorption and biological assimilation. Plant uptake of metals accounts for less than one percent (Reed et.al, 1988).

It is recommended that exotic species only be introduced if it is improbable that viable spores/seeds would spread and germinate onto other areas. Examples of wetland and water body exotics include; Purple loosestrife Lythrum salicaria, Hydrilla verticillata, Egeria (Elodea) densa (giant waterweed).

11.3 In-situ Bioremediation

In-situ bioremediation is a proven technology that cost-effectively treats organic contamination in subsurface and surface environments. Bioremediation reduces both contamination dissolved in ground water and residual soil-bound contamination. To maximize effectiveness, the technology is implemented after site-specific laboratory studies are conducted.

Implementation involves enhancing the natural degradation process by infiltrating necessary nutrients to the contaminated subsurface/surface, aeration and water recovery. After the process is complete, the microorganisms die back to prior natural population levels. Bioremediation is low impact as compared to excavation or incineration. Another advantage is that it is a final treatment process; an endpoint is reached.

12. Monitoring

12.1 Monitoring Program Scope and Objectives

The objective of the monitoring program is to assess the progress and effectiveness of the corrective action at reaching its objective of returning the ecosystem to a healthy condition. Design and implementation of a biological monitoring program is necessary to effectively evaluate the success of corrective action. Site specific ecological parameters indicative of ecosystem stress are selected and monitored. The monitoring program includes detailed ecological surveys, measurements of the structure and function of the particular ecoregion, and comparisons to previously determined reference conditions. The monitoring program's design needs to address but not be limited to the following:

- Time frame and stability of site recovery
- Predator/Prey ratio
- Appropriate fecundity in relation to species diversity
- Maximum species diversity
- Uninterrupted ecotones
- Duration and season of initial sampling data
- Length of monitoring program, ideal and feasible
- Analysis of contaminant concentration over time
- Aerial photography applications

The benefits of monitoring a RCRA site ecosystem that has been determined to be a non-impacted site include the potential to identify concerns that may have gone unnoticed during the initial phase of EA and to detect new concerns as they occur

12.1.1 Monitoring Schedule

The monitoring program schedule is site-specific. Considerations must be made as to chemical contaminant half-life, bioconcentration, biomagnification, biodegradation, photolysis rate, bioavailability and mobility. The corrective action schedule must also be considered, for example, corrective action could take up to 20 years. Monitoring may be necessary during the action if it is a bioremediation that is slated for 2-5 years and directly after plus extended monitoring after an excavation remediation. The duration of monitoring is effected by site size, bioparameters, contamination characteristics, etc. Data collected during a corrective action could be used to determine if process modifications are necessary to increase effectiveness, thereby taking into account site specific complexities.

Points to consider when designating monitoring locations are contaminant point of discharge, location of initial data collection and areas most adversely affected by contaminant discharge.

Further information can be found in Risk Assessment at Hazardous Waste Sites (EDs) FA Long, G.Schweitzer ACS. 1982.page 7

APPENDICES

Appendix A.	Ecological Basics Reference Materials
Appendix B.	Keyword Definitions
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APPENDIX A. ECOLOGICAL BASICS REFERENCE MATERIALS

Title: Risk Assessment Guidance for Superfund Volume II Evaluation Manual
EPA/540/1-89/001
Key Sections
Chap.3 Basic Concepts for Ecological Assessment
Chap.4 The Role of Technical Specialists in Ecological Assessment
Chap.5 Planning an Ecological Assessment

Title: Biological Criteria, National Program Guidance for Surface Waters
EPA/440/5-90/004
Key Sections
Chap.3 The Conceptual Framework
Chap.5 The Reference Condition
Chap.6 The Biological Survey
App.A Common Questions and Their Answers

Title: Review of Ecological Risk Assessment Methods EPA/230/10-88/041
Key Sections
Chap.2 Discussion and Characterization of Methods
App.C Ecological Assessments Method Summaries

Title: Rapid Bioassessment Protocols for Use in Streams and Rivers, Benthic Macroinvertebrates and Fish EPA/440/4-89/001
Key Sections
Chap.2 The Concept of Biomonitoring (Ecoregion Concept)
Chap.3 Overview of Protocols & Summary of Components
Chap.5 Habitat Assessment & Physicochemical Parameters
Chap.6 Benthic Macroinvertebrate Biosurvey & Data Analysis
Chap.7 Fish Biosurvey & Data Analysis
App.A Guidance for Use of Field & Lab Data Sheets

Title: Procedures for Quantitative Ecological Assessments in Intertidal Environments EPA/600/3-78/087
Key Sections
Sec. 2 Sampling Program Design Considerations
Sec. 3 Collecting and Processing Samples

Title: Macroinvertebrate Field and Laboratory Methods for Evaluating the Biological Integrity of Surface Waters EPA/600/4-90/030
Key Sections
Chap.4 Selection of Sampling Locations
Chap.5 Sampling Methods
Chap.7 Data Evaluation

ECOLOGICAL BASICS REFERENCE MATERIALS (Continued)

Title: Ecological Assessments of Hazardous Waste Sites: A Field and Laboratory Reference EPA/600/3-89/013
Key Sections
Chap.3 Assessments Strategies and Approaches
Chap.7 Biomarkers
Chap.8 Field Assessments

Title: Protocol for Bioassessments for Hazardous Waste Sites EPA/600/2-83/054
Key Sections
pg.7 Bioassessment Protocol

Title: Superfund Exposure Assessment Manual
EPA/540/1-88/001
Key Sections
Chap.2 Contaminant Release Analysis
Chap.3 Contaminant Fate Analysis

Title: Methods for Evaluating Stream, Riparian and Biotic Control US Department of Agriculture
Key Sections
pg.2 Sampling Design
pg.7 Stream Habitat Evaluation
pg.24 Riparian Zone
pg.26 Fish Population Evaluation
pg.36 Macroinvertebrate Analysis

Title: Ecological Risk Assessment Methods: A Review and Evaluation of Past Practices in the Superfund and RCRA Programs EPA/230/3-89/044
Key Sections
Chap.3 Site-Specific Methods Used to Characterize Actual Impacts at OSWER Sites
Chap.4 Site-Specific Methods Used to Characterize Potential Impacts at OSWER Sites
App. A Summary of Site-Specific Methods Used to Characterize Actual Ecological Impacts
App. B Summary of Site-Specific Methods Used to Characterize Potential Ecological Impacts

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Title: Summary Report on Issues in Ecological Risk Assessments EPA/625/3-91/018
Key Sections
Sec 2.4 Population Modeling in Ecological Risk Assessments

ECOLOGICAL BASICS REFERENCE MATERIALS (Continued)

Title: Superfund Public Health Evaluation Manual
EPA/540/1-86/060
Key Sections
Chap.3 Selection of Indicator Chemicals
Chap.4 Estimation of Exposure Point Concentrations of Indicator Chemicals
Chap.8 Development of Performance Goals and Analysis of Risks for Remedial Alternatives
Chap.9 Summarizing the Public Health Evaluation

Title: Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA EPA/540/G-89/004
Key Sections
Sec 1.4 The Remedial Investigation/Feasibility Studies Process Under CERCLA

Title: Federal Manual for Identification & Delineation of Jurisdictional Wetlands MultiAgency, 1989
Key Sections
Part 2 Mandatory Technical Criteria for Wetland Identification
Part 3 Field Indicators and Other Available Information
Part 4 Methods for Identification and Delineation of Wetlands
App. B Examples of Data Sheets

Title: RCRA Orientation Manual EPA/530/SW-86/001
Key Sections
Sec. 2 Subtitle D of RCRA-Managing Solid Waste
Sec. 3 Subtitle C of RCRA-Managing Hazardous Waste
Sec. 4 Subtitle I of RCRA-Managing Underground Storage Tanks

Title: Interim Final RCRA Facility Investigations (RFI) Guidance
EPA/530/SW-89/-031
Key Sections
Vol 1 Procedures to follow in developing a work plan
Vol 2,3 Media-specific for characterization of the nature, extent and rate of contaminant release
Vol 4 Case studies

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APPENDIX B. KEYWORD DEFINITIONS

Assessment Endpoints: Formal expressions of the actual environmental values that are to be protected. They are environmental characteristics, which if affected, indicate the need for corrective action

Bioavailability: The extent to which a chemical can be absorbed, ingested or assimilated by an organism.

Bioaccumulation: The net uptake of chemicals by organisms directly from water or through consumption of food containing the chemicals.

Bioassay: The employment of living organisms to determine the biological effects of some substance, factor, or condition.

Bioconcentration: The net uptake of chemicals by aquatic organisms from water.

Biological Assessment: Evaluation of the biological condition of a ecosystem using biological surveys and other direct measurements of resident biota.

Biological Criteria: Numerical values or narrative expressions that describe the reference biological integrity of ecological communities inhabiting areas of a given designated life use.

Biological Integrity: The condition of the ecological community inhabiting an unimpaired area of a specified habitat as measured by community structure and function.

Biomagnification: The net increase in chemicals in organisms at successively higher trophic levels as a consequence of ingesting contaminated organisms at lower trophic levels.

Biomass: The total amount of living material, plants and/or animals, above and below the ground in a particular habitat or area.

Biome: A major biotic unit consisting of plant and animal communities having similarities in form and environmental conditions.

Bioparameters: Key biological variables such as species diversity, predator: prey ratio, and fecundity rates that characterize an ecosystem.

Biosurvey: Collecting, processing, and analyzing representative portions of a resident community to determine the community structure and function.

Biota: The fauna and flora of a given area.

Chronic Toxicity: Involves long-term effects of small doses of a contaminant and their cumulative effects over time. Theses effects may lead to death of the organism or disruption of such vital functions as reproduction.

Community: An assemblage of populations of plants, animals, bacteria, and fungi that live in an environment and interact with one another forming a distinctive living system with its own composition, structure, environmental relations, development, and function.

Corrective Action: An order EPA issues at a facility when there has been a release of hazardous waste or constituents into the environments. Corrective action may be required beyond the facility boundary and can be required regardless of when the waste was placed at the facility.

Ecological Assessment: A qualitative and/or quantitative investigation of the actual or potential impacts of a RCRA facility on the ecosystem or parts of ecosystems within the facility's boundary and surrounding areas.

Ecosystem: The biotic community and its environment which, together, function as a system of complementary relationships, with the transfer and circulation of energy and matter.

Ecotone: Zone where two or more different communities meet and integrate. This zone of intergradation may be narrow, wide, or local (ie. a zone between a field and a forest).

Facility: All contiguous land, structures, and improvements on the land, used for treating, storing, or disposing of hazardous waste. A facility may consist of several treatment, storage, or disposal operational units, e.g., one or more landfills, surface impoundments, or a combination of the above.

Fecundity: Potential capability of an organism to produce viable offspring.

Impairment: Detrimental effect on the biological integrity of a ecosystem caused by an impact that prevents attainment of the designated use.

Measurement Endpoint: A quantitative expression of an observed or measured effect of the hazard; it is a measurable environmental characteristic that is related to the valued characteristic chosen as an assessment endpoint.

Receptor: The entity (e.g., organism, population, community, ecosystem) that might be adversely affected by contact with or exposure to a substance of concern.

Trophic level: Functional classification of organisms in a community according to feeding relationships; the first trophic level includes green plants; the second trophic level include herbivores; and so on.

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APPENDIX C. Wetlands

Importance and sensitivities

Freshwater and marine wetlands perform several critical ecological functions as a result of their unique characteristics. These include :

- Hydrologic benefits such as flood attenuation and groundwater discharge;
- Water-quality benefits such as the removal and cycling of sediments, organic materials and nutrients, and stabilization of banks and shorelines and control of erosion;
- Chemical absorption/filtration benefits exhibited by aquatic plants' roots and stems in a wastewater treatment process;
- Mitigating effect that plants have on climatic forces such as wind, sunlight, and temperature; and
- Wildlife benefits such as providing habitats and food sources for fish, shellfish, waterfowl and other birds, mammals and wildlife. (EPA/540/1-89/001, EPA/625/1-88/022)

Wetlands have the capability to filter (via precipitation, adsorption, biodegradation and plant uptake) out silts, metallics and organic chemicals from influent water. However, the very nature of this capability lends fragility to the wetland ecosystem. There is a carrying capacity past which increased chemical loading produces a detrimental impact and potential irreversible modifications of the wetland ecosystem.

Definition

The Environmental Protection Agency (EPA), Army Corps of Engineer (CE), Fish and Wildlife Service (FWS), and Soil Conservation Service (SCS) are involved with wetland identification and delineation. Although each of these Federal agencies has formulated their own definition of "wetland", all are conceptually the same; they all include hydrology, vegetation, and soils as their basis for identifying wetlands.

The regulatory definition used for administering Section 404 of The Clean Water Act is as follows:

> Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

On-site determinations of wetlands may be made utilizing two methods or a combination of the two methods: hydric soil assessment procedure, and plant community assessment procedure. These methods require visual identification and classification of soils and vegetation in order to determine whether the area is a wetland or non-wetland.

Detailed descriptions of methods for determining and delineating wetlands can be found in The Federal Manual for Identifying and Delineating Jurisdictional Wetlands (January, 1989). Currently, this manual is under review. Significant revisions to several areas of the manual, including the baseline determination for wetlands (hydrology, vegetation, and soils), technical validity of acceptable indicators of wetland hydrology, definition of "growing season", and the definition of a disturbed wetland and its delineation procedures are being considered.

For further information on the determination and delineation of wetlands and their importance and sensitivities, refer to the Federal Manual for Identifying and Delineating Jurisdictional Wetlands (January, 1989), America's Wetlands: Our Vital Link Between Land and Water (February, 1988), and Mid-Atlantic Wetland: A Disappearing Natural Treasure (June, 1987).

APPENDIX D
SOURCES OF INFORMATION TO ASSIST IN DETERMINING WETLANDS

DATA NAME	SOURCE
Topographic Maps (mostly 1:24,000; 1:63,350 for Alaska)	U.S. Geological Survey (Call 1-800-USA-MAPS)
National Wetlands Inventory Maps (mostly 1:24,000; 1:63,350 for Alaska)	U.S. Fish and Wildlife Service (FWS) (Call 1-800-USA-MAPS)
County Soil Survey Reports	U.S.D.A. Soil Conservation Service (SCS) District Offices (Unpublished reports-local district offices)
National Hydric Soils List	SCS National Office
State Hydric Soils List	SCS State Offices
County Hydric Soil Map Unit List	SCS District Offices
National Insurance Agency Flood Maps	Federal Emergency Management Agency
Local Wetlands Maps	State and local agencies
Land Use and Land Cover Maps	USGS (1-800-USA-MAPS)
Aerial Photographs	Various sources - USGS, U.S.D.A. Agricultural Stabilization and Conservation Service, other Federal and State agencies, private sources
Satellite Imagery	EOSAT Corporation, SPOT Corporation and others
National List of Plant Species That Occur in Wetlands (Stock No. 024-010-00682-0)	Government Printing office, Superintendent of Documents, Washington, D.C. 20402
Regional Lists of Plants that Occur in Wetlands	National Technical Information Service, 5285 Port Royal Head, Springfield, VA 22161 (703-487-4650)
National Wetland Plant Database	FWS
Stream Gauge Data	CE of Engineers District Offices and USGS
Soil Drainage Guides	SCS District Offices
Environmental Impact Statements and Assessments	Various Federal and State agencies
Published Reports	Federal and State agencies, universities, and others
Local Expertise	Universities, consultants, and others
Site-specific Plans and Engineering Designs	Private developers

Table excerpted from the Federal Interagency Committee for Wetland Delineation. 1989. Federal Manual for Identifying and Delineating Jurisdictional Wetlands. U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, and U.S.D.A. Soil Conservation Service, Washington, D.C. Cooperative technical publication. 76 pp. plus appendices.

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APPENDIX E. sample SITE RECONNAISSANCE FORM

This form is intended as a preliminary ecological evaluation of the site. It is a general assessment to characterize the overall site conditions. This form is to be completed while conducting a thorough site-walk. All applicable observations (i.e. streams, ponds, stained soil, possible wetlands, etc.) will be recorded on a site map. Adjacent properties will also be observed and documented.

Attach all photographs (labelled), maps and any other pertinent material that may aid in characterizing the site ecosystems.

The following materials are recommended for field investigations:
- Compass,
- Topographic Map,
- Site Maps
- Camera
- Flora and Fauna Field Identification Books

GENERAL SITE INFORMATION:

Date & Time of Reconnaissance: ______________________________
____

Facility Name: ____

Site Location: ____

____

Weather Conditions: ____

Season Reconnaissance Performed: ____________________________

Name of Field Personnel and Titles __________________________

ON-SITE RECONNAISSANCE: General Site Observations

1. Label and describe general ecological features such as grasslands, forests or woods, lakes, streams, wetlands, lagoons or inundated areas. Whenever possible, describe the general types of vegetation (woody plants, vines, shrubs, grasses, emergent, herbaceous, etc.), trees (saplings, mature, deciduous, coniferous, etc.) and relative abundance (ie; dense, mixed,

sparse).

2. Label any visible dead, dying, damaged, or dwarfed vegetation.

3. Describe the appearance of any observable stream, lake or ponded water. (clear, color, turbid, etc.)

4. If possible, determine the approximate depth of the labeled water body.

5. If possible, determine the approximate width or width ranges of the labeled water body.

6. Describe the flow rates of streams. (stagnant, slow, rapid, turbulent)

7. Label and describe any visible drainage into the streams, including any surface drainage, swales, culverts, springs or seeps.

8. Is the riparian vegetation (overhanging vegetation along stream banks) intact along the streams.

9. Briefly describe any additional observations relating to adjacent properties (i.e. lakes, streams, vegetation, etc.).

Person responsible for Site Reconnaissance form (Print name):

Signature:

Date:

APPENDIX F. Alternate Concentration Limits (ACLs)

Hazardous waste regulations under RCRA require facility owners and operators to utilize design features and control measures that protect ground water from hazardous chemical releases. Under 40 CFR Part 264, Subpart F, all operable units are subject to groundwater monitoring and corrective measures.

Maximum contaminant limits for groundwater protection are listed for 14 hazardous constituents under 40 CFR Part 264.94. If the constituent is not listed, then the concentration limit or protection standard is set at background water quality level. Under 264.93, the Regional Administrator will specify, for each hazardous constituent in the facility permit, concentration limits or groundwater protection standards for the ground water.

Specifically the concentration of a hazardous constituent:

1) Must not exceed the background level of that constituent in the groundwater,

2) Must not exceed the maximum concentration of the values given in Subpart 264. 94, and

3) Must not exceed an alternate concentration limit (ACL) established by the Regional Administrator.

Variances to the first two protection standards above can be applied for by the applicant if it can be proven that the detected hazardous constituents do not pose a substantial present or potential to human health or the environment. That is the applicant would apply for an ACL. Some States prohibit the release of any contaminants to the groundwater and do not allow for an ACL.
However, in the event that an ACL variance is applicable and field demonstration is required, an environmental risk assessment must be performed. The environmental risk assessment must determine the probable exposure pathways for hazardous constituents to reach environmental receptors. These exposure pathways must include characterization of probable surface water and terrestrial receptors.

If environmental receptors are actually being exposed to ACL constituents above chronic toxicity levels, or above background levels if chronic toxicity data are not available, then field evaluations of the impacts should be performed to support the proposed ACLs.

The ACL human health and environmental assessment process is similar to an ecological assessment in that it utilizes the same components of risk characterization. And as in an ecological assessment, an Environmental Biologist or Ecologist should be consulted for guidance through this process, as specific impacts to aquatic and terrestrial receptors must be addressed.

More complete information regarding ACLs can be found in Alternate Concentration Limit Guidance, ACL Policy and Information Requirements, 1987 EPA/530-SW-87-017.

APPENDIX G. Ecological Assessment Checklist

This checklist is intended to assist in evaluation of the extent to which an RFI/CMS Ecological Assessment was performed.

GENERAL SITE INFORMATION:

RCRA Facility Name ______________________________

Site Location ______________________________

Date of Ecological Assessment (EA) ____________________

Company that performed EA ______________________________

1. Historical Data Research

Check which of the following elements were included in the research effort:

____ U.S. Geological Survey (USGS) Topographic Maps
____ U.S. Fish and Wildlife Service (USFWS) Wetland Inventory Maps
____ Natural Heritage Inventory or Natural Diversity Inventory Maps
____ U.S. Department of Agriculture and Soil Conservation Service (USDA-SCS) maps of hydric conditions
____ U.S. Department of Agriculture and Soil Conservation Service (USDA-SCS) Soil Survey Maps
____ Soil boring logs, obtained from well installation or soil sampling
____ On-site survey results from portable monitoring equipment readings
____ Records of past ownership and operations
____ Facility permits
____ Material Safety Data Sheets (MSDSs)
____ Hazardous Waste Manifests

Were aerial photographs secured for this property? If so, list the resource agency and dates of the aerial photographs.______________________________

____

Was any significant information obtained from the aerial photograph review? If so, describe this information and if it was verified (Use a separate sheet if necessary).

____

____

2. Indicator Chemicals or Project Chemical List determined?
____ YES, ____ NO

3. Ecosystem map provided?
____ YES, ____ NO

The ecosystem map illustrates:

	Provided on separate map:
____ fauna communities	____
____ flora communities	____
____ topography	____
____ hydric conditions	____
____ observable biotic stress	____
____ wetlands	____

Was data verified? ____ YES, ____ NO

If yes, how? ____

____

Was data field tested? ____ YES, ____ NO

Are photographs included? ____ YES, ____ NO

3. Were site or engineering maps secured and utilized?
____ YES, ____ NO,

If yes, map dates?

____

4. Reference Condition established: ____ YES, ____ NO

Was data verified? ____ YES, ____ NO

If yes, how? ____

____

Was data field tested? ____ YES, ____ NO

Date of field test ____________________________________

Field test performed by _______________________________

5. Sensitive, Protected or Special Status Habitats, Threatened and Endangered Species Assessment and identification.
____ Natural Diversity Inventory information consulted

Method used ____________________

6. Biosurveys conducted? ____ YES, ____NO
If yes, explain (Use separate sheet if necessary):

____

____

7. Ecological parameters assessed and data provided?

____ Predator-Prey Ratio,
____ Population Fluctuations,
____ Species Diversity,
____ Species Fecundity-Species Diversity Ratio, and
____ Ecotone Quality.

8. Determination of Healthy or Impacted Ecosystem's within site boundaries and adjacent areas,

Ecosystem data compared:

____ Species Diversity,
____ Stressed Vegetation,
____ Vegetative Succession,
____ Relevant Vegetative Abundance,
____ Land Use and Land Characteristics, and
____ Riparian Vegetation.

9. Evaluation of effects of site's contaminants on Impacted Ecosystem(s) provided? ____ YES, ____NO

If yes, was data verified? ____ YES, ____ NO,

Was data field tested? ____ YES, ____ NO,

If yes, when and by whom ____________________

____

10. Effects of corrective action evaluation provided?
____ YES, ____ NO

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APPENDIX H. Environmental Protection Law and Regulation Summary

Protecting the environment is a clear objective of the statutes and directives administered by EPA. There are legal mandates which require some consideration of ecological impacts. As previously mentioned, there are no specific procedures, methods or formal conditions for conducting ecological assessment. Nevertheless, ecological assessment is clearly encouraged in all of them. The following is a summary of relevant environmental protection laws and regulations.

RCRA, Resource Conservation and Recovery Act
The Resource Conservation and Recovery Act of 1976, as Amended. RCRA requirements for ground-water protection, surface impoundments, waste piles, underground storage tanks, and surface treatment are all considered to be potentially applicable for both human health and protection of the environment at sites that contain RCRA-listed or characteristic wastes and where waste management activities took place after the effective date of the relevant RCRA Subtitle. The RPM or OSC should consult with the appropriate Regional RCRA staff to make this determination.

CERCLA, Comprehensive Environmental Response, Compensation and Liability ACT as amended by the Superfund Amendments and Reauthorization Act
The Comprehensive Environmental Response, Compensation and Liability Act, CERCLA, as amended by the Superfund Amendments and Reauthorization Act of 1986, requires EPA to ensure the protection of the environment in (1) selection of remedial alternatives and (2) assessment of the degree of cleanup necessary. Several sections of CERCLA make reference to protection of health and the environment as parts of a whole.

The Federal Water Pollution Control Act/Clean Water Act
The Federal Water Pollution Control Act, as Amended. This law, also known as the Clean Water Act, includes numerous sections that may pertain to Corrective Actions. Section 404 of the CWA, which requires protection of wetlands, is of particular importance evaluation.

TSCA, The Toxic Substances Control Act
The Toxic Substances Control Act of 1976. Section 2601 Ib) of the Toxic Substances Control Act states the policy of the Unites States that "... adequate data should be developed with respect to the effect of chemical substances and mixtures on health and the environment...."

CAA, The Clean Air Act
The Clean Air Act of 1970, as Amended. Under the CAA, EPA has established National Ambient Air Quality Standards for key pollutants. In the development of these standards, the Agency prepares Air Quality Criteria documents that investigate various effects of exposure to the subject pollutants, including those that occur on vegetation.

FIFRA, The Federal Insecticide, Fungicide and Rodenticide Act of 1947
The Federal Insecticide, Fungicide and Rodenticide Act of 1947, as Amended. FIFRA requires that all pesticides be registered with EPA. To obtain registration, manufacturers must supply EPA with certain data concerning environmental fate and transport, health effects, and ecological effects. EPA's Office of Pesticide Programs (OPP) has issued Registration Standards, which summarize the Agency's assessment of many pesticide active ingredients.

Endangered Species Act
Endangered Species Act of 1973, as Reauthorized in 1988. Section 7 of the Act requires Federal agencies to ensure that their actions will not jeopardize the continued existence of any endangered or threatened species. The U.S. Fish and Wildlife Service and the National Marine Fisheries Service have primary responsibility for this Act.

Fish and Wildlife Conservation Act
Fish and Wildlife Conservation Act of 1980. Section 2903 requires States to identify significant habitats and develop conservation plans for these areas.

Marine Protection, Research and Sanctuaries Act
Marine Protection, Research and Sanctuaries Act of 1972. Section 1401 declares the U.S. policy of regulating dumping to "... prevent or strictly limit the dumping into ocean waters of any material which would adversely affect human health, welfare, or amenities or the marine environment, ecological systems, or economic potentialities."

Coastal Zone Management Act
Coastal Zone Management Act of 1972. This legislation is designed to (a) encourage States to develop management plans to protect and preserve the coastal zone, and (b) ensure that Federal actions are consistent with these management plans.

Wild and Scenic Rivers Act
Wild and Scenic Rivers Act of 1972. Section 2171 declares that certain rivers "... possess outstanding remarkable scenic, recreational, geologic fish and wildlife, historic, cultural, or other similar value" and should be preserved. If corrective action is taking place at or near a river, a determination of whether it has been designated as "wild and scenic," and whether there are any action-specific ARARs regarding the site or its contaminants is recommended. The National Park Service has primary responsibility for this Act.

Fish and Wildlife Coordination Act
Fish and Wildlife Coordination Act, as Amended in 1965. Section 662(a) states that the Fish and Wildlife Service must be consulted when bodies of water are diverted or modified by another Federal Agency. The facility is to be constructed "with a view to the conservation of wildlife resources by prevention of loss, or damage to such resources as well as providing for the development and improvement thereof..."

The Migratory Bird Treaty Act
The Migratory Bird Treaty Act of 1972 implements many treaties involving migratory birds. This statute protects almost all species of native birds in the U.S. from unregulated "take", which can include poisoning at hazardous waste sites. The act is a primary tool of the U.S. Fish and Wildlife Service and other Federal agencies in managing migratory birds.

The Marine Mammal Protection Act
The Marine Mammal Protection Act of 1972. This law protects all marine mammals, some but not all of which are endangered species. The National Oceanic and Atmospheric Administration has primary responsibility for this Act. The Fish and Wildlife Service also has responsibility for some species.

Excerpted from Risk Assessment Guidance for Superfund, Volume II: Environmental Evaluation Manual, Interim Final. EPA/540/1-89/001.

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