



Introduction to the Monitoring Report Template

As part of the Navy's effort to incorporate continual process improvements, this template has been developed for preparing annual monitoring reports for the environmental restoration program. This template encourages consistency in the format for reporting monitoring results and managing sites in the monitoring phase. This was designed for Remedial Project Managers to use as a resource for developing and publishing monitoring reports to support the Navy's cleanup program.

Objective:
Develop a Standardized Approach and Template for Monitoring Reports



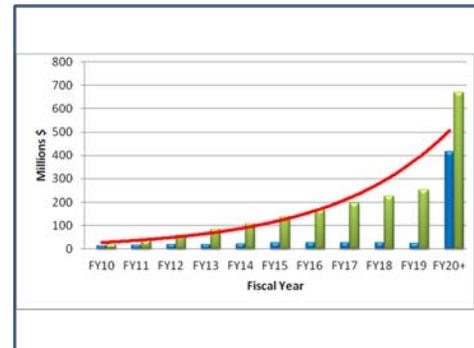
The goals of this effort are as follows:

- Provide a consistent format for use across the Navy
- Identify and report clean up goals
- Develop reporting format for results of trends
- Site Closure

This template is set up to provide insight on each element in the report. Each numbered section matches the Report Elements. The write up provides insight into the content and purpose of the section and suggested ways to achieve the goals for that element. The left hand column discusses the purpose of the section and information to be included. The right hand column provides examples or additional information to understand how to present the content.

Opportunity for Improvement?

- *Program Dollars Shifting to Monitoring*
- *Opportunity to Improve the Report Formats*
- *Opportunity to Include Optimization as Standard Step*
- *Capture Clear Conclusions and Recommendations*



Upward Trend Projected Over the Next 10 Years NAVFAC-Wide for IR LTM (Norm Date FY 2010). Estimated Accumulative Costs over \$400 Million in FY 2020



Monitoring Report Template



Report Elements

1 Introduction

- 1.1 Objective – Introduces the report including the site name, facility, stakeholders, decision documents and cleanup program.
- 1.2 Table of Contents – Presents the report layout to familiarize readers with content.

2 Site Description

- 2.1 Site Location and History – Provides appropriate level of background information to allow audience to understand the history of the site.
- 2.2 Key Decision Documents – Provides information on the key decision documents. This section is not meant to include all documents related to the site but to highlight the key documents that capture the actions required to address interim actions and close out the site.
- 2.3 Focused Conceptual Site Model – Provides a picture of the site. This allows readers to understand the conditions at the site. A clear understanding of the specific site provides focus to ensure actions being taken for remediation or monitoring address the site related concerns. This effort should only include the level of detail necessary to keep the effort moving towards the agreed on goals. Graphics are an effective technique for condensing substantial narrative, resulting in successful communication of complicated information.

3 Selected Remedy

- 3.1 Remedial Action Objectives (RAOs) – Restates the current RAOs developed.
- 3.2 Site Closeout Strategy – Provides a clear path to allow for completion of efforts at the site and reduces the possibility of straying from the agreed to path forward. This section should identify any interim goals, final goals and status of effort to meet those goals.

4 Monitoring Program

- 4.1 Monitoring Objectives – Data Quality Objectives- Provides clearly stated objectives and questions that the data being gathered will answer.
- 4.2 Sample Approach – Provides enough detail that the locations, constituents of concern, other parameters to be sampled, frequency, sampling procedures and methods for analysis are understood.

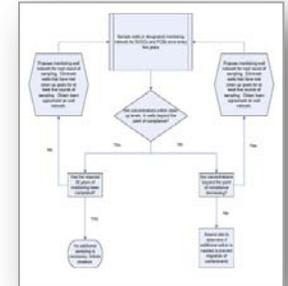
5 Data Evaluation

- 5.1 Sampling Results – Compiles results from the current rounds of sampling and appropriate historical data. This section includes figures and tables to clearly show the results of the monitoring efforts.
- 5.2 Trend Analysis Concentrations of Constituents of Concerns – Presents trends to allow reader to readily understand if the site conditions are as anticipated based on the CSM or if there are other conditions that need to be considered. It documents the status of the site to allow for understanding of where the site is on the path to closeout. Answers the question of whether the RAOs are being met or if the site is moving towards response complete.
- 5.3 Trend Analysis Costs – Documents historical and current cost to allow for an understanding of the use of limited resources to meet the requirements for the site.
- 5.4 Optimization and Site Closeout Progress – Documents third party and routine optimization efforts at the site and captures the history and outcome of optimization. Trend analyses are discussed to document progress towards site closeout.

- 6 **Conclusions** – Clearly and concisely states conclusions drawn from the trend analysis.

Format Features

- *Decision Trees*
- *Conceptual Site Models*
- *Trend Charts*





1.



Introduction

This element is designed to ensure the reader understands the intent of the report. Include the facility, site name, site identification number of sampling events, and date of sampling in the document title and introduction paragraph.

The section should clearly state the title, date, and author of the applicable Decision Document (s).

Any Guidance or Policy Documents used to prepare the report should be included in the introduction and in the list of references.

Clearly state the Lead Agency and controlling Stakeholders

1. Introduction

This Remedial Action Operations and Long-Term Monitoring (LTM) Report presents the Year 12 (Round 16) groundwater and ecological monitoring activities completed at Site 1, Landfill at Oyster House Creek for Naval Radio Transmitting Facility (NRTF) Driver, located in Suffolk, Virginia (the facility). The LTM at Site 1 is required in accordance with the selected remedy identified in the site's Record of Decision (ROD) **signed in September 1997**. This Remedial Action Operations and LTM report was prepared by CH2M HILL under contract to the United States Navy (the Navy), Naval Facilities Engineering Command (NAVFAC) for submittal to the Navy and the Virginia Department of Environmental Quality (VDEQ).

Example from Draft Naval Radio Transmitting Facility (NRTF) Driver Report



1.1



Objective

This element includes the specific objectives of the current report. A bulleted presentation should indicate the objectives that are discussed in detail later in the report.

Suggested topics to be covered in the bullets

- Results of monitoring
- Update on status of remedy implementation
- Trend Analysis
- Progress towards meeting Remedial Action Objectives (RAO)
- Progress towards meeting exit strategy
- Recommendations and Conclusions

Example from (NRTF) Driver Report

1.1 Objective

The LTM being conducted at Site 1 evaluates whether contamination has migrated outside the landfill boundary and if the selected remedy—Institutional Controls (ICs) (site restrictions with LTM)—remains protective of human health and the environment.

The objectives of this report are to:

- Present the results for Round 16 of Site 1's LTM Program
- Evaluate these results through trend analysis of all 16 rounds of data collected over the past 12 years
- Better define metrics used to evaluate whether Remedial Action Objectives (RAOs) have been met at the site
- Present an exit strategy for LTM at Site 1 and describe the site's progress toward closure



1.2



Table of Contents

The purpose of this section is to describe the content of the report and familiarize the reader with the layout and features.

Include the section numbers and titles.

For the optional interactive CD, this section should include discussions on how to use the CD, the special features in the report, and some minor trouble shooting.

1.2 Table of Contents

The LTM Report is organized as follows:

- Section 1 – Introduction
- Section 2 – Site Background
- Section 3 – Remedial Action Objectives
- Section 4 – Land Use Controls with Long-Term Monitoring
- Section 5 – Optimization and Exit Strategy

Example from (NRTF)
Driver Report

When using the Interactive CD Format Include:

- Directions on loading and using the CD
- Purpose of the underlined text
- Definition of terms in **Bolded Text**
- Trouble shooting information



2.

Site Description

This main section should include an overview of the facility, surrounding area and base history.

This section provides an opportunity to share the overview with the reader to clarify how the site relates to the overall area and surrounding property.

This information can be obtained from historical documents.

Consider including the following:

- name of the facility, location,
- size,
- larger scale map showing the site and relationship to surrounding area,
- former use of the facility, current use and,
- future property owners.

Included as
Hyperlink

General Location Maps Embedded in Document

FIGURE 1
Base Location Map – NRTF Driver Site 1, Landfill at Oyster House Creek



LEGAL DESCRIPTION

Western Deep Water Well Site - Driver Radio Transmitting Facility
Sleepy Hole Borough - Suffolk, Virginia

Beginning at an iron pin having Virginia State Plane coordinates (NAD 83 South Zone) Northing 3,464,182.27 feet and Easting 12,059,282.22 feet respectively, and being located approximately 14.5 feet northeast of the northeast corner of the hairlink fence around the well pump. Thence from said point of beginning turning and running the following courses and distances: S 31° 09' 01" E 60.00 feet to a drill hole set in a concrete slab; S 58° 50' 59" W 63.00 feet to a point; N 76° 09' 01" W 7.07 feet to a point; thence N 31° 09' 01" W 55.00 feet to an iron pin; thence N 58° 50' 59" E 68.00 feet to the point of beginning and containing 4,068 square feet or 0.093 acre more or less. The above described parcel is a portion of the property acquired by the United States of America by deed recorded in Deed Book 178 Page 109 (City of Suffolk) dated 9/19/51.



2.1

Site Location and History

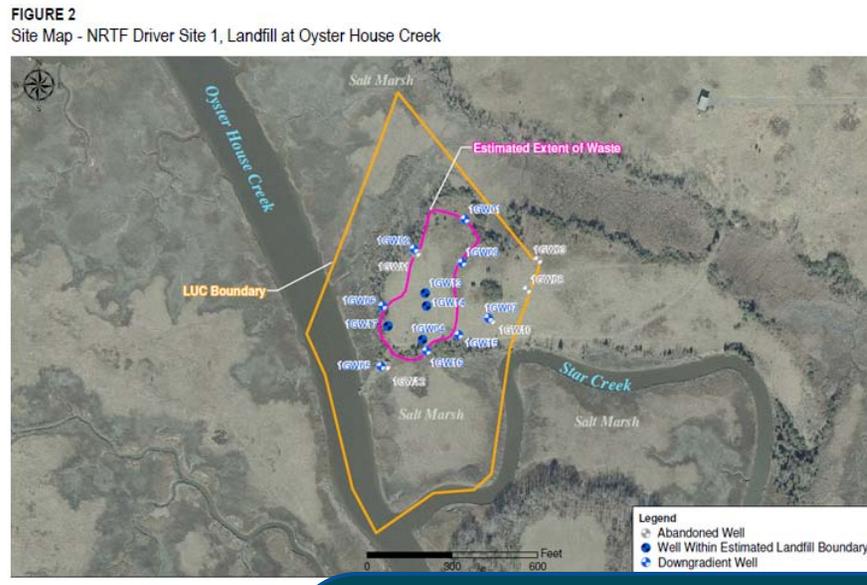
Maps Embedded in document showing well locations and site boundaries.

This section expands on the information provided in the introduction section 2. Information about the site including all the historical and current site names and identification, regulatory programs and drivers for actions at the site. This information can be shared in the narrative, embedded site specific maps, hyper links to additional documents and other sources of information.

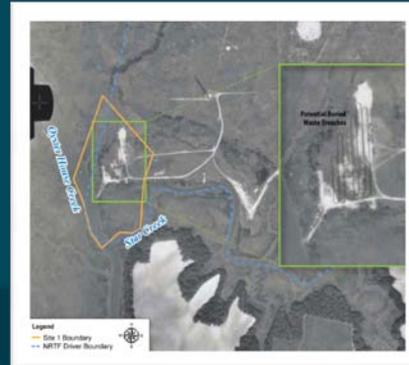
Suggested material to include could be maps showing extent of filling operations and aerial photographs.

This information can be obtained from historical documents.

In this example, the site is a closed landfill.



Included as [Hyperlink](#)





2.2

Key Decision Documents

This section provides information on key decision documents. Discussions of previous investigations should be included in this sub section where appropriate. All actions taken since the previous monitoring report shall be included in this section. This section should include enforcement activities and remedial actions taken.

The section should be only as detailed as required to communicate the critical information applicable to the site.

This example includes a summary table of previous investigations and actions used to demonstrate adequate investigation and efforts.

Example Table shown with hyper linked documents.

TABLE 1: PREVIOUS STUDIES AND INVESTIGATIONS

Previous Study / Investigation*	Date	Investigation Activities
Initial Assessment Study	1983	Site 12 was identified as a crash-crew training area. Due to small residual quantities of contamination and minimal potential for migration, no additional investigation was recommended.
RCRA Facility Investigation	1991	Soil, groundwater, surface water, and sediment sampling was conducted in the O 6 vicinity. Oil and grease (O&G) and total petroleum hydrocarbons (TPH) were detected in soil; O&G and metals were detected in groundwater; TPH was detected in surface water, and O&G was detected in sediment. Further investigation was recommended to determine the extent of petroleum contamination.
Technical Direction Memorandum	1993	Soil, groundwater, and sediment sampling was conducted to further delineate the extent of petroleum contamination at OU 6. Benzene and TPH were detected in soil and sediment and metals were detected in groundwater. Additional soil sampling to the depth of the water table for full suite analysis was recommended.
Geoprobe Site Check, Former Underground Storage Tank Location 4182	1996	Soil and groundwater sampling was conducted following removal of an underground storage tank. O&G and TPH were detected in soil and lead was detected in groundwater.
Remedial Investigation Report, OU 6, Site 12	1999 to 2005	16 surface soil (0 to 1 ft bgs), 32 subsurface soil (1 to 11 ft bgs), 7 groundwater (Surficial Aquifer), 3 drainage surface water, and 3 drainage sediment (0 to 0.5 ft bgs) samples were collected for analysis of metals, pesticides, polychlorinated biphenyls (PCBs), petroleum-related compounds, and/or dioxins/furans. At Burn Pit E, 2 surface soil (0 to 1 ft bgs), 28 subsurface soil (1 to 6 ft bgs), 16 groundwater (Surficial Aquifer) samples were collected for analysis of VOCs, SVOCs, and/or PCBs.
Feasibility Study, OU 6, Site 12	2006	Following an evaluation of remedial alternatives, excavation and off-site disposal for soil and MNA with LUCs for groundwater was selected as the Preferred Alternative.
Proposed Plan, OU 6, Site 12	2006	Invites the public to review and comment on the Preferred Alternative for addressing environmental contamination at Site 12 prior to final remedy selection.

*The documents listed are available in the Administrative Record and provide detailed information used to support remedy selection at Site 12.

CHAPTER 3. RECOMMENDATIONS

3.1 INTRODUCTION. Recommendations for possible courses of action are provided for areas of potential contamination identified in this Initial Assessment Study at the Naval Radio Transmitter Facility (NAVRASTRANSFAC) Drive, Virginia. Confirmation Studies, under the NACIP Program, are recommended for sites posing a potential danger to human health or to the environment. Three sites have been recommended for further action, shown in Table 3-1. These sites should be included in the Remedial Action Map for NAVRASTRANSFAC, Drive.

Facilities Engineering Command (Confirmation Study) which has two characterizations. In the verification and monitoring determine identified in the IAS are present adverse environmental or health step is implemented to define the contamination, rate of migration if sites require remedial action Confirmation Study recommendation information for the work, such as

TABLE 4-10
DETERMINED GROUND SAMPLING
SITE 1
ANALYTICAL RESULTS

| ANALYTE | UNIT | CONCENTRATION |
|-----------|-------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| ARSENIC | mg/kg | ND |
| BARIUM | mg/kg | ND |
| BENZENE | mg/kg | ND |
| BROMINE | mg/kg | ND |
| CADMIUM | mg/kg | ND |
| CHLORINE | mg/kg | ND |
| CHROMIUM | mg/kg | ND |
| COPPER | mg/kg | ND |
| IRON | mg/kg | ND |
| LEAD | mg/kg | ND |
| MANGANESE | mg/kg | ND |
| MERCURY | mg/kg | ND |
| NICKEL | mg/kg | ND |
| SILICA | mg/kg | ND |
| SILVER | mg/kg | ND |
| ZINC | mg/kg | ND |

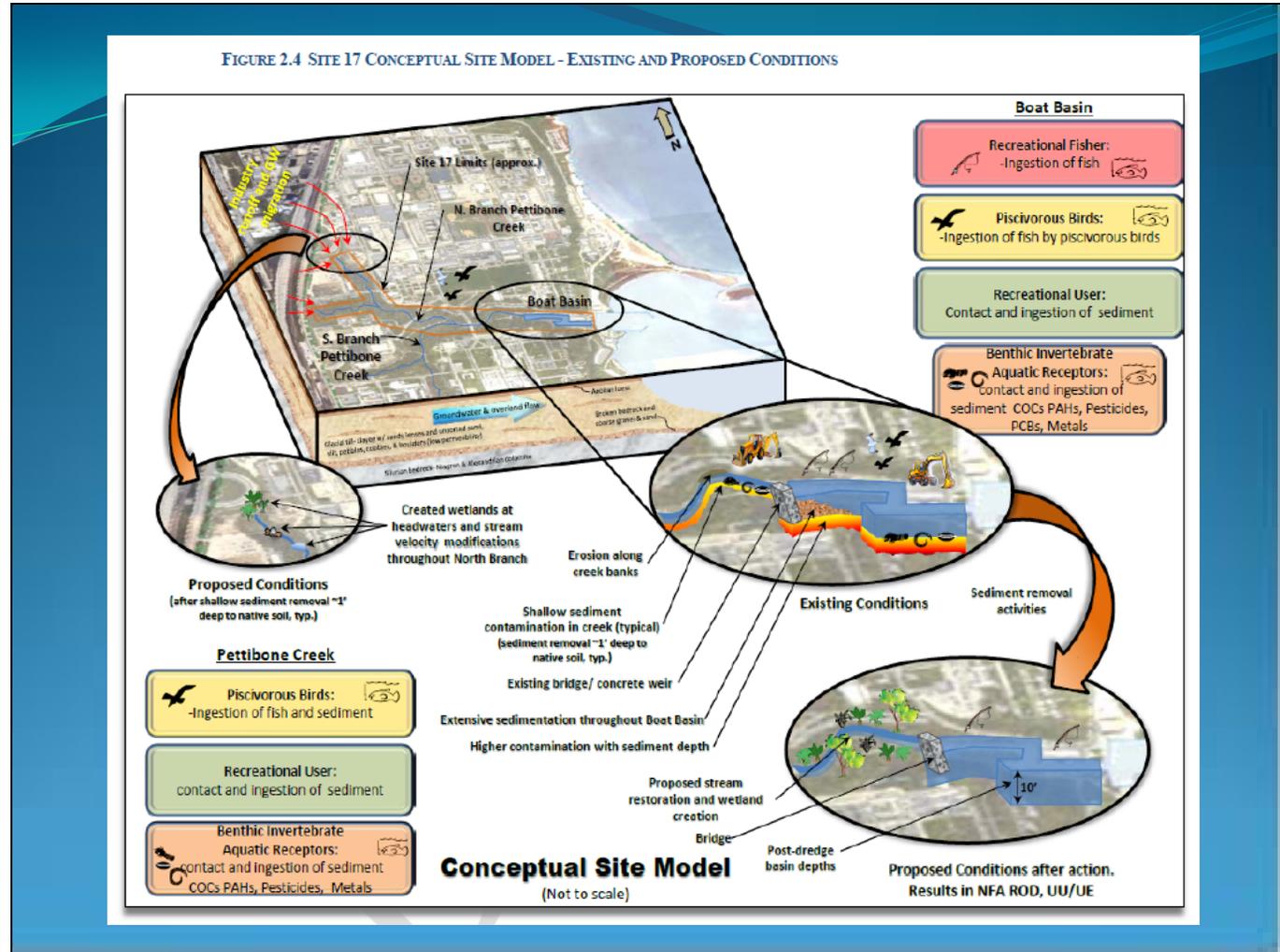


2.3

Focused Conceptual Site Model

This section is designed to ensure the reader understands the conditions at the site.

If appropriate, an interactive feature can show the past, present and future conditions at the site and links to actual photos. This information is key to understanding why the remedy is effectively meeting goals and how it might impact future actions at the site. A graphic is preferred to illustrate the site layout, hydrogeologic setting, source area and contaminated media, fate and transport mechanisms, exposure pathways, and potential current and future receptors.





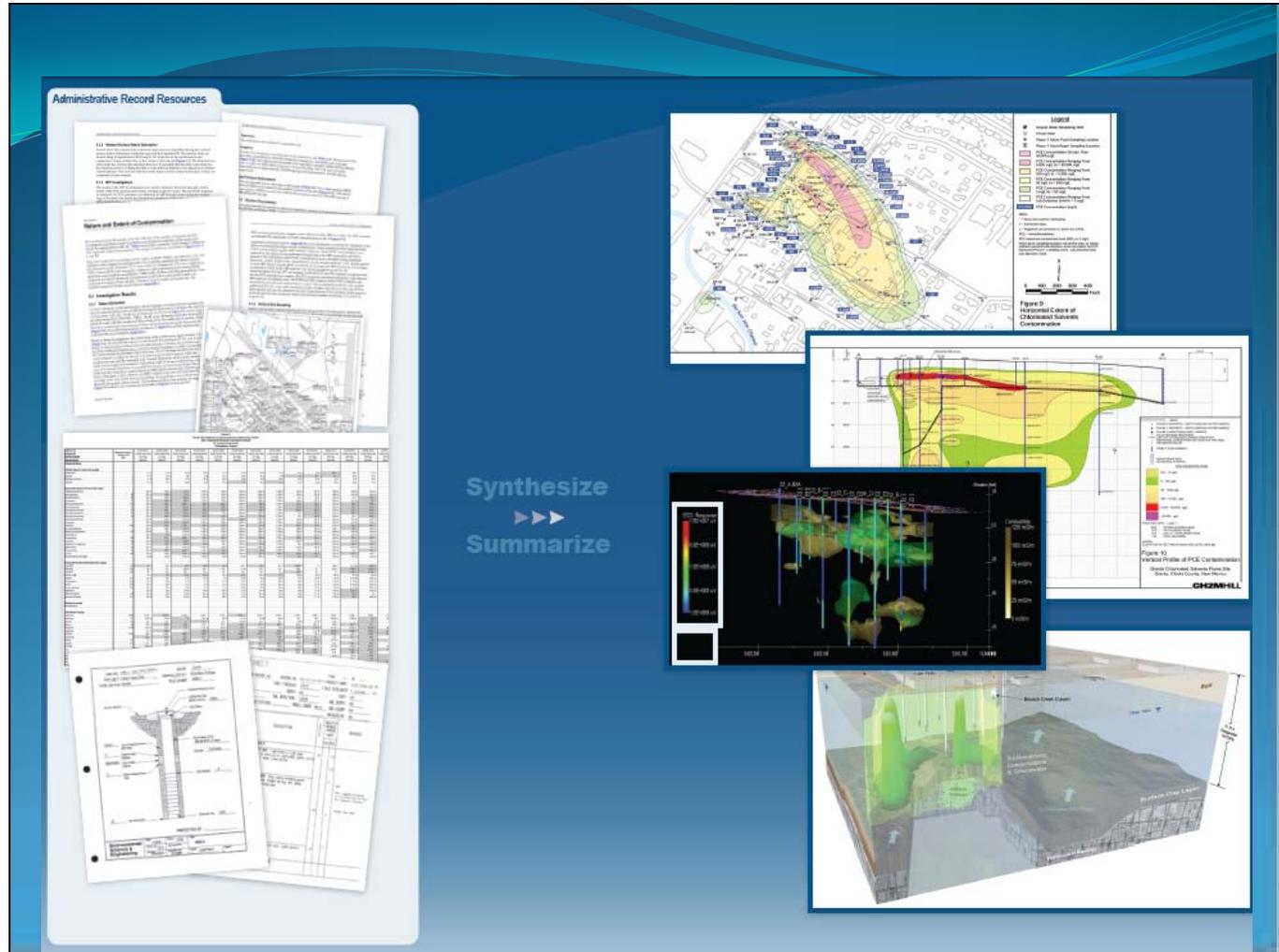
2.3 (continued)

There is flexibility to include only that information specific to understanding the site.

If the level of detail is necessary, comprehensive figures may be used in place of text, tables, and figures to demonstrate sources, subsurface hydrogeology, the lateral and vertical extent, and magnitude of contamination.

The documentation shown to the right illustrates types of information that can be included if necessary for a complicated site. This detail may not be required for all sites.

Focused Conceptual Site Model





3.

Selected Remedy

This introductory section should include a very brief statement of the remedies being implemented at the site.

There can be reference to documents that contain detailed description and specifics of each remedy.

4. Land Use Controls with Long-Term Monitoring

The selected remedy identified in the ROD consists of LUCs and LTM. This section discusses the ongoing implementation of the selected remedy and the current status of the site.

4.1 Land Use Controls

Periodic site inspections are conducted at Site 1 in accordance with the ROD to verify that LUCs (i.e., no intrusive activities and no shallow groundwater use) are still in place. These inspections coincide with the LTM sampling and Five-Year Reviews. Baker Environmental, Inc., along with Navy representatives, conducted the latest inspection of Site 1 on February 19, 2009 in conjunction with preparation of the 2nd Five-Year Review for NRTF Driver. No issues concerning the protectiveness of remedy in place were noted during the site inspection.

4.2 Long-Term Monitoring

The current LTM approach for Site 1 consists of the sampling of 12 monitoring wells and collection of two fish samples from Star Creek. Groundwater samples are analyzed for SVOCs and PCBs (one well only from within the landfill), and the fish samples are analyzed for PCBs. Water quality parameters for groundwater (temperature, pH, and conductivity) and groundwater levels are measured prior to the start of sampling activities. The results of LTM at Site 1 as well as recommendations are documented in annual LTM reports. Initial LTM included analysis of PCBs for all wells and analysis of SVOCs, pesticides, and inorganics for Star Creek and No Name Creek fish tissue. However, after four sampling rounds, none of the wells except one (1GW14) had PCB detections, so the recommendation was to continue sampling only 1GW14 for PCBs to monitor conditions within the landfill. Following three rounds of fish tissue collection, Aroclor-1260 was identified as the COC. Because Aroclor-1260 detections in fish samples from both creeks had decreased over time, the Year 5 LTM Report (Baker, 2003) recommended suspending fish sampling tissue collection. However, collection of fish tissue from Star Creek for PCB analysis was retained to monitor the effectiveness of the remedial action at Site 1.

During groundwater monitoring, select SVOCs (chlorobenzene compounds) and Aroclor-1260 have consistently been detected above their respective cleanup levels in one or more wells. Concentrations of 1,2,4-trichlorobenzene have trended downward in the central portion of the landfill (1GW13) since monitoring began, while other locations within the landfill and downgradient have remained generally the same. Concentrations of dichlorobenzenes (1,2; 1,3; and 1,4) have generally remained the same. This trend may be a result of degradation of 1,2,4-trichlorobenzene which degrades to the dichlorobenzene compounds. Concentrations of both dichlorobenzenes and 1,2,4-trichlorobenzene have been within cleanup levels beyond the landfill boundary during the last several rounds of sampling. Concentrations of Aroclor-1260 have been detected in 1GW14 only and have ranged from non-detect to 37 micrograms per liter (µg/L). Other chemicals have also been detected at concentrations greater than cleanup levels periodically during the LTM period, including hexachlorobenzene and 2,4,6-trichlorophenol. These chemicals have only been detected in wells within the landfill boundary.

The sample results and LTM program recommendations for Years 1 to 11 (Rounds 1 to 15) are contained in previous LTM reports, which are included in the NRTF Driver administrative record¹. The text and the embedded figures in the following sections present the Year 12 (Round 16) sample results and subsequent recommendations for LTM at Site 1. However, links to past round results and figures showing historical data are provided for ease of reviewing sample results over time.

“The selected Remedy identified in the ROD consists of LUCs and LTM.”

Reference Plats and recorded deeds as appropriate



3.1



Remedial Action Objectives

This section should contain the specific goals documented in the decision documents for the site.

Tables listing the chemicals of concern (COC) by each media requiring action, respective clean up levels, and a basis for the cleanup levels are helpful to understand the goals to reach site closeout.

This section reinforces the readers understanding of the goals and should be used to ensure the exit strategy is followed.

TABLE 2
Summary of Cleanup Levels – NRTF Driver Site 1, Landfill at Oyster House Creek

Contaminant of Concern	Cleanup Level (µg/L)	
	Groundwater	Fish Tissue
Aroclor-1260	0.5	54
1,2-Dichlorobenzene	600	N/A
1,4-Dichlorobenzene	75	N/A
1,2,4-Trichlorobenzene	70	N/A
2,4,6-Trichlorophenol	6.1*	N/A

* Groundwater cleanup level is the RSL since no MCL is available
µg/L = micrograms per liter

Cleanup Levels, Basis, and Media

Examples from (NRTF) Driver Report

Risk Table Example

TABLE 3
Summary of Remedial Action Objectives – NRTF Driver Site 1, Landfill at Oyster House Creek

Risk	RAO	Remedy Component	Metric/Cleanup Level	Expected Outcome
Landfill materials	Prevent future potential exposure to landfill materials	LUCs (site restrictions on intrusive activities, land use and development)	Maintain LUCs and confirmation of protectiveness during periodic inspections and Five-Year Reviews	Current land use (landfill with vegetative soil cover)
SVOCs in shallow groundwater	Prevent future potential exposure to contaminated shallow groundwater and monitor plume migration	LTM for shallow groundwater LUCs (site restrictions to prohibit withdrawal of groundwater and residential use)	Conduct LTM and maintain LUCs until 30 years of groundwater monitoring is conducted or cleanup levels are achieved for a reasonable timeframe at the point of compliance (i.e., outside the waste footprint) Confirmation of LUC protectiveness during periodic inspections and Five-Year Reviews	Deed Restrictions (waste will remain in place)
PCBs in fish tissue	Prevent future potential exposure to contaminated fish tissue	LTM for fish tissue	Conduct LTM until cleanup levels are achieved for a reasonable timeframe	Unlimited use/unrestricted exposure (UU/UE)



3.2



Site Closeout

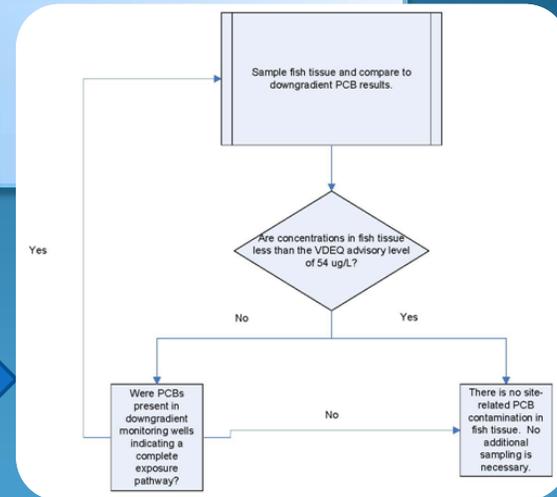
The purpose of this section is to clearly state the requirements to reach site closeout. The interim actions that have been completed, progress towards meeting site closeout criteria to date and future anticipated actions should be included. A decision tree format can be used to effectively communicate the future decision points.

The sections should focus the reader on required actions to reach site closeout.

- **Clearly State Actions Required to Accomplish Site Closeout**
 - How Many Samples Below Goals Before Sampling is Complete
 - Timeframes or Number of Samples Agreed to in Decision Documents
 - Levels Reduced to Acceptable Risk
- **Capture Current Status**
 - What Actions Have Been Completed
 - What Remains Outstanding
- **Document**
 - Any Changes or Revisions
 - Agreement on Reaching Interim Goals

Decision Tree Provides a Useful Tool

Focus on Site Closeout





4



Monitoring Program

This section provides a very short introduction to the Monitoring Objectives and Sample Approach sections. The suggested format includes short statements of the proposed sampling effort in a chart or bulleted format.

Example Using a Chart to Present Summary Information for the Monitoring Efforts

4. Monitoring Program

Table 4.1 summarizes the current monitoring approach by media and constituents for the site. Specific sampling requirements are discussed in further detail in sections 4.1 and 4.2 of this report.

Table 4.1
Summary of Sampling Constituents by Media

Media	Analytes		
	Volatile Organic Compounds	Inorganics	Pesticides
Sediments	X		X
Groundwater	X	X	X
Fish Tissue			X



4.1

Monitoring Objectives – Data Quality Objectives

This section includes a discussion of the data quality objectives. This information should have been addressed as the decision documents were developed and remedy chosen so this is designed to be a summary to ensure the purpose for the sampling effort and use of the data is understood and remains consistent with the agreed to goals. The Monitoring Plan should be followed or updated as necessary.

The purpose of restating is to ensure the team is on track to reach site closure and the use of the data is understood by all.

Understanding the Problem is the Key to Keeping on the Path to Closeout

Clearly State

- Problem
- Goals
- Information Inputs
- Boundaries of Study

4.1 Monitoring Objectives – Data Quality Objectives

4.1.1 Problem Definition and Goals

Past operations at Site 4 resulted in the release of chlorinated VOCs to the soil in the vicinity of building 106. A removal action conducted removed the source of the contamination, leaving the secondary (groundwater) contamination. Groundwater must be monitored to confirm that contaminants are not migrating off site at unacceptable levels and to determine if contaminate concentrations are decreasing naturally, and to determine when the clean up goals have been met.

4.1.2 Study Boundaries

Groundwater of interest is the Puz and Pmz hydrogeologic zones in the Site 4 subsurface. The vertical boundary consists of the Puz (upper groundwater boundary) and Pmz (lower groundwater boundary). Groundwater samples will be collected from these hydrogeologic zones, the horizontal boundary and monitoring well network are constrained by the topography and natural drainage of the site from the top of the ridge in the northwest to the main stream valley in the southeast.

4.1.3 Information Inputs

Groundwater concentrations for the COCs listed in section 4.2.

Groundwater geochemical field stabilization parameters listed in section 4.2.

Synoptic groundwater level measurements will be recorded to a precision of 0.01 foot within the same day in all wells being monitored to ensure measurements are representative of the same time frame.



4.2

Sample Approach

The purpose of this section is to clearly state the sampling plan.

It should include the matrix, sampling methods, locations, any site specific procedures, location specific sample parameters, laboratory methods, laboratory requirements and maps of the site.

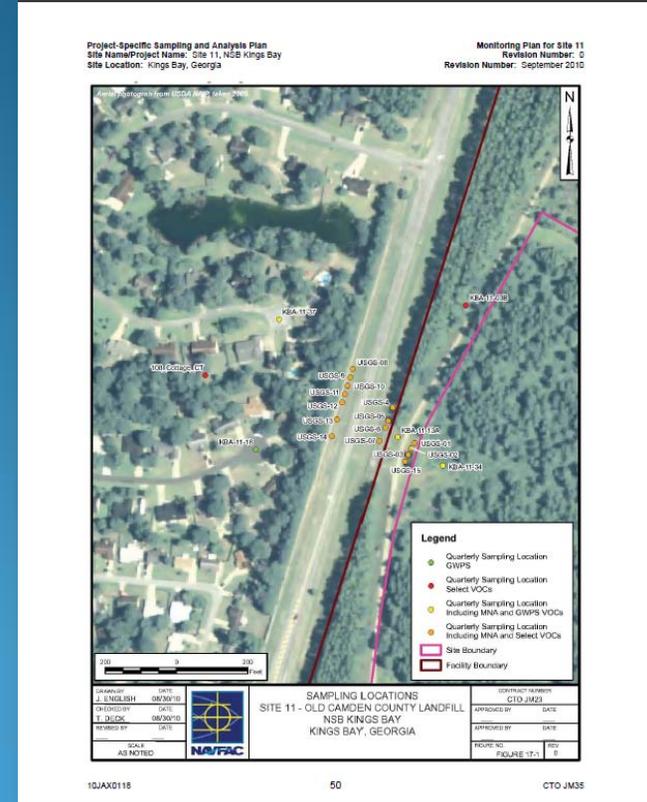
Ensure consistent methods are used to make certain the data can be compared to document when goals are met.

Examples of Natural Attenuation Parameters and Sample Location Map

Sampling Location/Well ID – 08MWT008			
Analyte	Frequency	Project Action Level (µg/L)	Minimum Project Quantification Limits (µg/L)
1,1,1-Trichloroethane	Annually	200	67
1,1,2-Trichloroethane	Annually	5	1.7
1,1-Dichloroethene	Annually	7	2.3
Dis-1,2-Dichloroethene	Annually	70	23
Trichloroethene	Annually	5	1.7
Vinyl Chloride	Annually	2	.7

Sampling Location/Well ID – 08MWT008	
Field Measurements	Frequency
Water Quality Parameters	
Dissolved Oxygen	Annually
ORP	Annually
pH	Annually
Temperature	Annually
Conductivity	Annually
Turbidity	Annually

Sampling Location/Well ID – 08MWT008	
Monitored Natural Attenuation Indicators	
Parameters	Frequency
Nitrate	Every 5 Years
Nitrite	Every 5 Years
Sulfide	Every 5 Years
Chloride	Every 5 Years
Total Organic Carbon (TOC)	Every 5 Years
methane	Every 5 Years
Ethane	Every 5 Years
Ethene	Every 5 Years





5



Data Evaluation

This section is designed to lead the reader into the data evaluation portion of the report. This section will highlight the detailed information that is included in the Sampling Results, Trend Analysis and Optimization and Site Closeout sections.

The information is only an overview and the most important results should be highlighted.

5. Data Evaluation

The results from the 16th round of groundwater sampling at the landfill site are presented in this report. Trend charts have been developed for the SVOCs and show considerable natural attenuation. Fish tissue results show no detection of PCBs in the current round of samples.



5.1

Sample Results

This section should clearly depict the results from the current monitoring event. It is also helpful to include results from past monitoring efforts to allow for comparison to the current results. When the site has a large number of sampling locations, parameters, or matrices it is helpful to show several different maps with limited information in each pop up data box. This allows for an easy review and understanding of key information for each element.

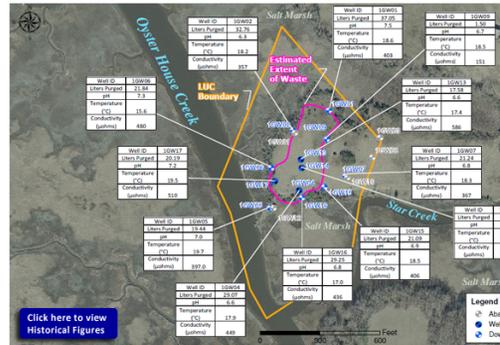
The number of sampling events shown should be determined based on the complexity of the site. Naval Installation Restoration Information Solution (NIRIS) is the Navy's repository for analytical data.

Current Round of Data with Option to View Historical Data

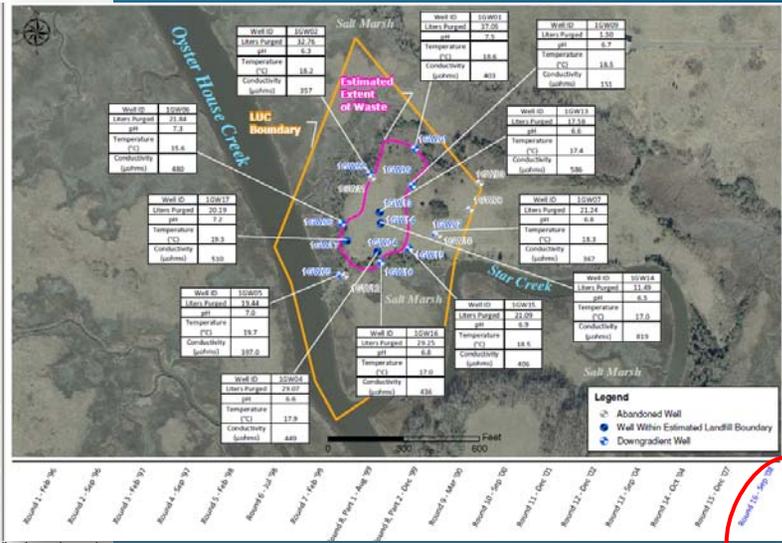
Field Methods and Water Quality Results

During the Round 16 sampling event, as with the previous 15 sampling rounds, grab groundwater samples were collected with bailers. Prior to sample collection, the groundwater level in each well was measured, the well volume calculated, and a minimum of three well volumes were purged from each well. Water quality parameters (pH, temperature, and conductivity) were recorded in a field log after each well volume was purged until field readings were considered stable (i.e., less than 10 percent variability and a minimum of three well volumes purged) (Figure 5).

FIGURE 5
Round 16 (2008) Water Quality Data - NRTF Driver Site 1, Landfill at Oyster House Creek



Groundwater temperatures during Round 16 ranged from 15.6 degrees Celsius (°C) the 12-year monitoring period, shallow groundwater temperature has been varied approximately 9 degrees Celsius (°C) to 25 °C depending upon proximity to the waste. Round 16 samples were collected in early September, resulting temperatures. pH was generally between 6 and 8, consistent with previous round neutral conditions. Conductivity during Round 16 ranged from 151 µmhos to 819 µmhos. This is consistent with the salinity data from Round 1 which ranged from 0.1 percent portions of the site to 3.95 percent along Star Creek (10W05). Collected data indicate temperature at the site are appropriate for biodegradation of 2,4,6-trichlorophenyl benzenes (near neutral pH and temperature >4°C). These chemicals also typically degrade under aerobic conditions, but no field data (i.e., dissolved oxygen [DO] or oxidation-reduction potential [ORP]) have been collected to date to confirm whether conditions are aerobic or anaerobic at Site 1.



Date of Data Shown is Circled Allowing for the Same Map to Show Data from Different Sampling Events

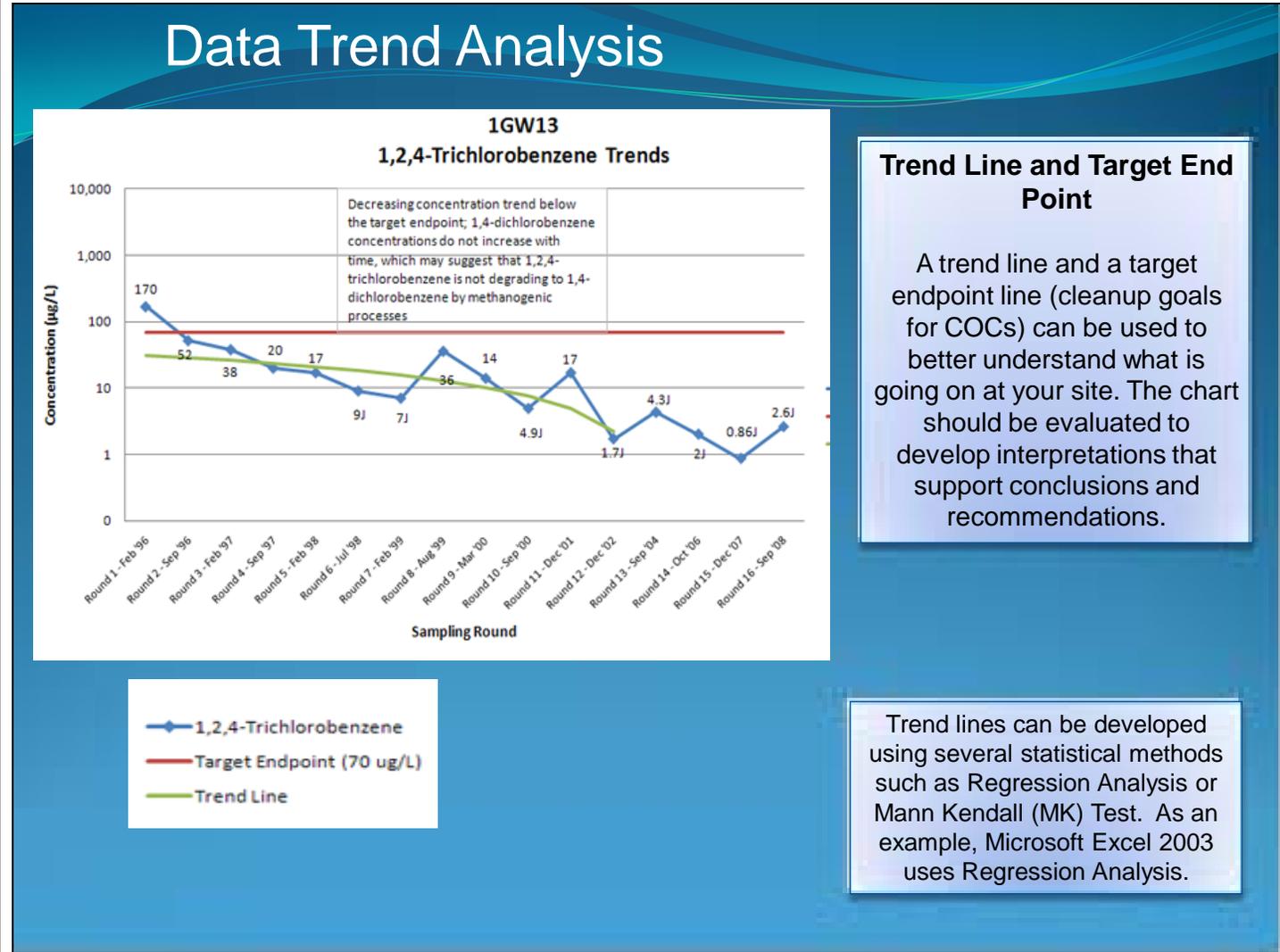


5.2

Trend Analysis – Constituents of Concern

The purpose of this section is to document what is happening to each contaminant or parameter at the site. Trend charts are a pictorial tool often used to show concentrations over time. These charts allow visual inspection of time series plots to understand the general indication of temporal trend.

In addition to the chart, include text that discusses the key findings, trends and conclusions that can be drawn from the sampling data.





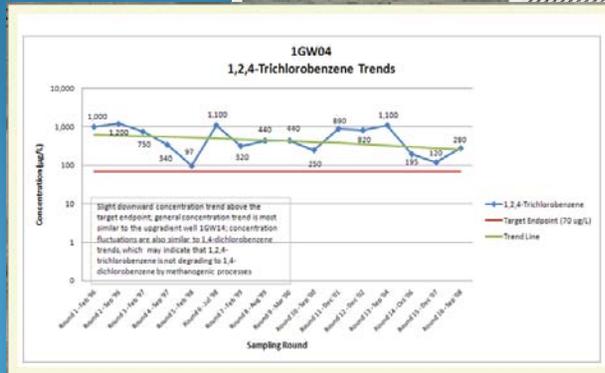
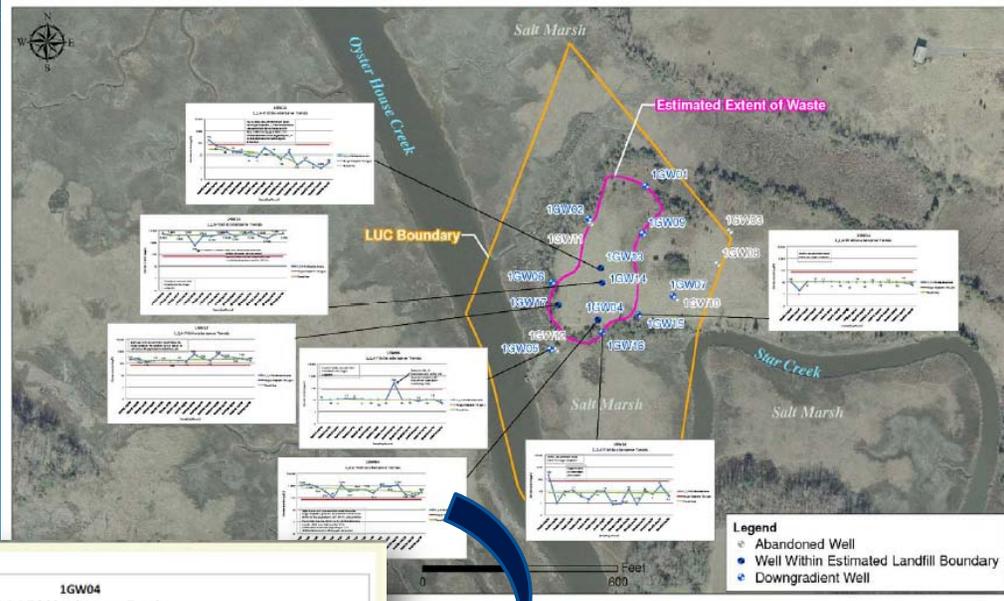
5.2

Trend Analysis – Constituents of Concern (continued)

The trend charts document the changes in concentrations for the graphed parameter. It may not be prudent to evaluate all the constituents to this degree, but for those that are evaluated in this manner, valuable information is communicated. The chart should include an embedded discussion of the results to highlight conclusions drawn from the information graphed.

Examples from (NRTF) Driver Report

FIGURE 7
1,2,4-Trichlorobenzene Trend Graphs - NRTF Driver Site 1, Landfill at Oyster House Creek



Trend Charts should be included to show progress toward meeting site clean up goals. The results of the trend chart should be embedded in the chart to highlight conclusions.



5.3

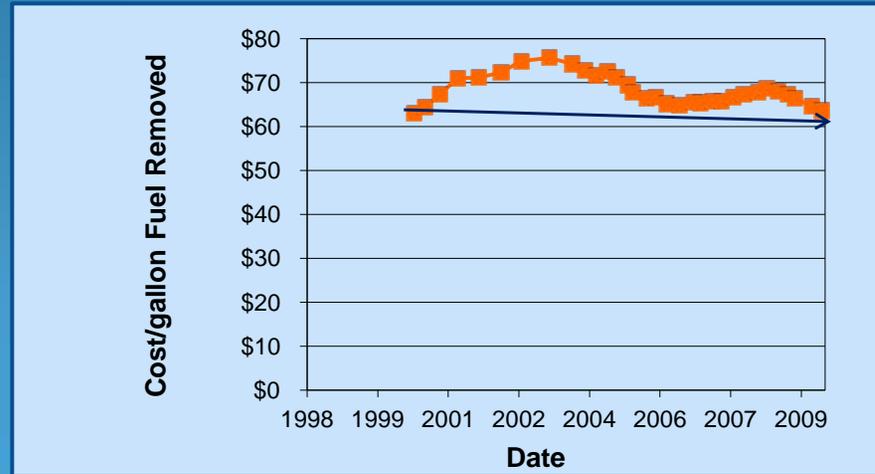
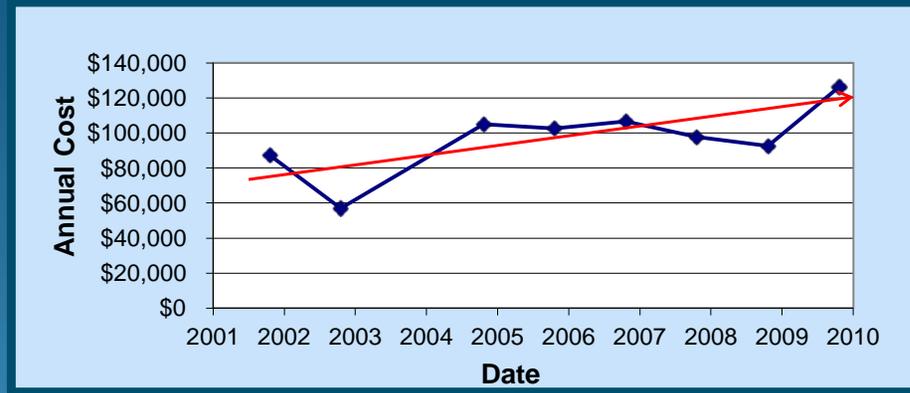


Trend Analysis - Cost

The purpose of this section is to document the cost of the monitoring efforts for this site. This should include a baseline cost that includes developing the initial plan and implementation of the effort. The follow on years should include the cost to gather data and report data as required.

An explanation of significant reductions or increases should be discussed. If historical cost data is not available, arrange for the collection and tracking of current and future actual cost data and begin tracking from this point forward.

Examples of O&M Cost Plots





5.4



Optimization and Site Closeout Progress

The purpose of this section is to clearly state the efforts to date to optimize the remedial efforts at the site.

This section should include an update on the progress made with the most recent round of sampling to reaching the clean up goals. This information should be tied to the overall goal of closing the site.

This section allows for clear documentation of progress so the future actions at the site keep moving towards closeout.

The elements included in this section should support required documentation in the Optimization Module in NORM.

Module pulled from NORM

5. Optimization and Exit Strategy

This section describes recommended optimization steps evaluated for both the groundwater and soil sampling conducted in support of the Site 1 LTM. The optimization strategies were developed in consideration of historical data associated with the site (contaminant distribution, contaminants detected, trends, and concentrations relative to cleanup goals). Optimization efforts have been completed in order to streamline future LTM for collection of only relevant data. Exit strategies have been developed to provide guidance for future decision-making at Site 1.

5.1 Groundwater Sampling Optimization and Exit Strategy

This section describes the recommended optimization steps to be implemented at Site 1. The optimization steps are supported by the exit strategy decision tree (Figure 14).

5.1.1 Analytical Suite

The primary COCs present in groundwater at Site 1 consist of chlorobenzene, chlorophenols, and Aroclor-1260. Of these COCs, two chlorobenzenes (1,2,4-trichlorobenzene), one trichlorophenol (2,4,6-trichlorophenol), and Aroclor-1260 exceeded cleanup levels during Round 16. Bis-2-ethylhexyl phthalate has also exceeded its cleanup levels during previous rounds. In the past, data analysis has included reporting of PCBs. In order to minimize the need for unnecessary data validation and maximize the value of data, it is recommended that only chlorobenzene compounds, chlorophenol compounds, and Aroclor-1260 be analyzed and reported by the laboratory in future rounds.

5.1.2 Monitoring Well Network

The existing monitoring well network consists of twelve wells (1GW01, 1GW02, 1GW03, 1GW04, 1GW05, 1GW06, 1GW07, 1GW08, 1GW09, 1GW10, 1GW11, 1GW12, 1GW13, 1GW14, 1GW15, 1GW16, and 1GW17). Figure 14 shows the recommended monitoring well network to focus sampling to areas beyond the point of release (i.e., outside the waste footprint) and to eliminate monitoring of wells that have exceeded cleanup levels for five or more rounds. These recommendations are intended to maintain protectiveness while minimizing cost. Of the 12 wells sampled, four wells (1GW04, 1GW13, and 1GW17) are located within the footprint of buried waste. Monitoring of wells within the waste footprint is generally not required as part of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Consequently, in accordance with Figure 14, monitoring is not recommended for 1GW04, 1GW13, and 1GW17. During the next round of monitoring, the NRTF Driver team recommended additional monitoring to provide more information on the remaining source strength at the site. Concentrations of chemicals in 1GW01 and 1GW07 have been below cleanup levels for at least five rounds of monitoring. Consequently, it is recommended that monitoring of these wells be discontinued. Therefore, the recommended monitoring for the next round of monitoring consists of 1GW02, 1GW05, 1GW06, 1GW09, 1GW10, 1GW11, 1GW12, 1GW14, 1GW15, 1GW16, and 1GW17, analyzed for the parameters recommended in Section 5.1.1.

Optimization View - Version 4.6.2.24

Round: Phase: Optimization Review Conducted By:

Review End Date: End Date Description:

Review Cost in Dollars: Pot Cost Avoided: Pot Implementation Cost

\$0 \$0 \$0

Act Cost Avoided: Act Implementation Cost

\$0 \$0

Review Description Details:

Recommendations of Review:

Actions Taken on Recommendations:

Points of Contact:

Name	Phone

Save Cancel

Optimization and Site Closeout Progress

This section should document any routine or third party optimization efforts taken and the results of those efforts since the last report was submitted.

Progress towards site closeout/exit strategy for each remedy or parameter should be discussed in detail. Any decisions that goals have been met should be clearly documented.



6



Conclusions

The purpose of this section is to provide a location for the Navy to document conclusions drawn from the data presented in the report.

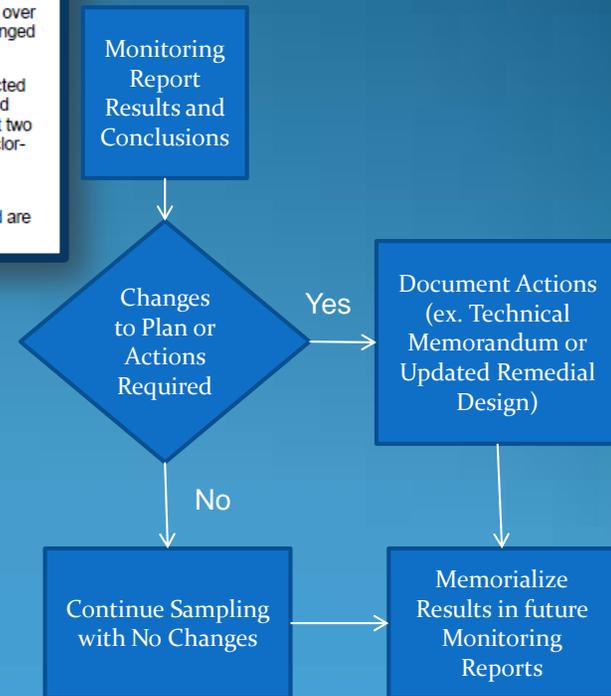
Conclusions should be a concise summary of the information contained in the report.

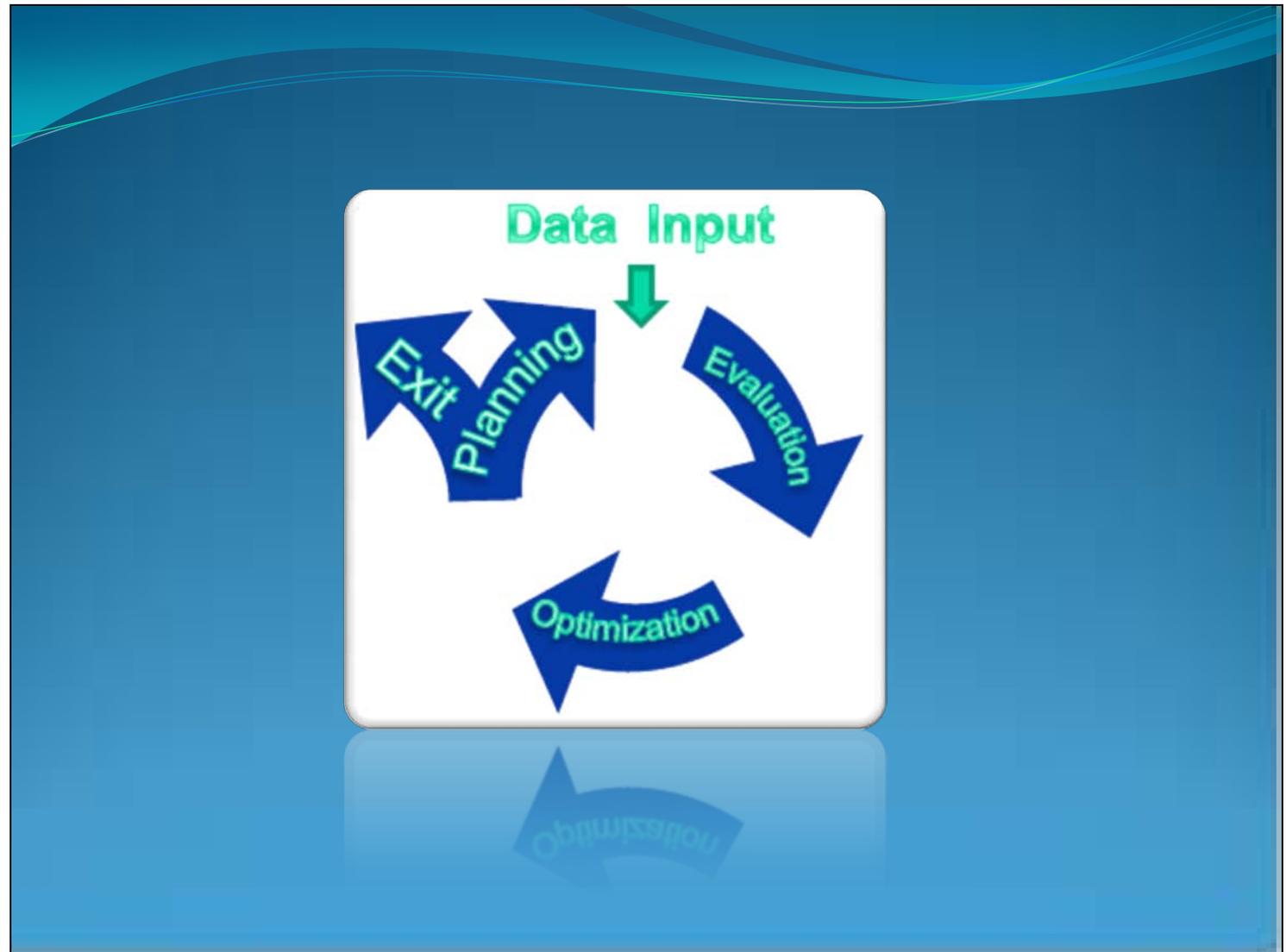
Any changes to the sampling plan or actions taken as a result of the information in the monitoring report should be memorialized in separate documents such as technical memorandums or revised remedial designs. Results of actions and revisions should be discussed in the follow on monitoring reports.

6.1 Conclusions

- The LUCs to prohibit intrusive activities and groundwater use are in place, protective, and will be maintained.
- Nine SVOCs and one PCB (Aroclor-1260) were detected in groundwater during Round 16 LTM. Two chlorobenzenes (1,2,4-trichlorobenzene and 1,4-dichlorobenzene), one trichlorophenol (2,4,6-trichlorophenol), and Aroclor-1260 were detected at concentrations above cleanup levels. Over the course of groundwater monitoring, concentrations of 1,2,4-trichlorobenzene have trended downward in the central portion of the landfill (1GW13), while other locations within the landfill and downgradient have remained generally the same. Concentrations of dichlorobenzenes (1,2; 1,3; and 1,4) have generally remained the same. This trend may be a result of degradation of 1,2,4-trichlorobenzene which degrades to the dichlorobenzene compounds. Concentrations of both dichlorobenzenes and 1,2,4-trichlorobenzene have been within cleanup levels beyond the landfill boundary during the last several rounds of sampling. 2,4,6-Trichlorophenol has been sporadically detected in the samples from 1GW14, and there was one detection from 1GW17 collected during Round 10. Concentrations in the samples from 1GW14 have not increased or decreased notably over time. Concentrations of Aroclor-1260 have been detected in 1GW14 only and have ranged from non-detect to 37 µg/L.
- Over the five rounds of fish tissue collection (from 1996 to 2008), Aroclor-1260 was detected during Round 06 (1998) when the detections were 53J µg/kg and 51J µg/kg (for adult and juvenile mummichugs, respectively). No PCBs were detected in fish tissue during the last two rounds of fish tissue collection (Rounds 13 and 16). However, the detection limit for Aroclor-1260, was above the cleanup level of 50 µg/kg.
- The 12 years of LTM data indicate that the COCs present in the groundwater are not migrating beyond the footprint of the landfill (based on perimeter well concentrations) and are therefore not posing a hazard to receptors in adjacent surface water bodies.

Focus on the Goals





Photos and drawings throughout provided courtesy of the Department of the Navy.