EXHIBIT 3. SITE CHRONOLOGY

Toolkit Tip

List the major site events and relevant dates. Consider using time lines highlighting key milestones for investigations and actions including:

- Initial discovery of problem or contamination
- Addition to National Priorities List (NPL)
- Federal Facilities Agreement signature
- Removal actions
- Remedial Investigations/ Feasibility Studies
- Record of Decision (ROD) signature
- ROD Amendments/ Explanation of Significant Differences
- Remedial Action start and complete
- Final Construction Completion Report
- Previous Five-Year Reviews

SECTION 7

7 Site 12 - Barracks Road Landfill

7.1 Site Chronology

1925-1960s	Wastes (incinerator ash, refuse, scrap wood, explosives-contaminated packaging, and possibly solvents) were reportedly disposed of at this landfill.
1984	IAS
1986-1988	Confirmation Studies Round I and II
1991-1996	RI – Rounds One and Two
1996	FS
1996	PP
April 16, 1997	ROD for soil signed
January 29, 1998	Completed Remedial Actions for demolition of incinerator facilit installation of clay cover, re-grading and erosion control
2012	Draft 2012 LUC RD

7.2 Background

Site 12, the Barracks Road landfill, is located in the eastern portion of WPNSTA Yorktown (Figure 1-1). Site 12 consists of three former disposal areas: Area A, Area B/C, and the Wood/Debris Disposal Area (Figure 7-1).

NOTE For key milestone dates (e.g., ROD signature, site-wide construction complete, previous Five-Year Reviews) consider including an exact date (e.g., April 16, 1997).

SECTION 4

Site 11—Plating Shop

4.1 Site Background and Chronology

Site 11 is located in the eastern portion of the base, near the intersection of Seventh and E Streets (Figure 4-1). The School of Music (Building 3602) and a storage building (Building 3651, formerly the plating shop) are located within the site boundary. Site 11 consisted of the plating shop, an in-ground concrete tank used to neutralize plating solutions, and its associated piping. Between 1964 and 1974, plating baths, acids, and lacquer strippers were disposed of in the plating shop sink that drained to the neutralization tank and eventually into the storm sewer system (Ebasco, 1991). The neutralization tank, piping, and surrounding soil were excavated in 1996. Following excavation, the area was backfilled with clean fill (ITC, 1996).

Degreasing solvents such as TCE and 1,1,1-trichloroethane (TCA) have historically been associated with operations at plating shops, and samples collected at the site indicated a direct release of chlorinated VOCs to subsurface soil and groundwater had occurred.

The ground surface in the vicinity of Site 11 is generally level, approximately 10 ft above msl, and includes a landscaped lawn, an asphalt parking lot, and a concrete drive behind Building 3602. The majority of precipitation is lost through infiltration or evaporation; however some stormwater runoff is collected by man-made stormwater drainage ditches and discharged to the stormwater sewer system.

Geology and Hydrogeology

The surface geology at Site 11 consists of the 20 to 25 ft thick Columbia Formation, which contains the 15 to 20 ft thick unconfined Columbia Aquifer. The Columbia Formation

- 1984 • IAS
- 1986 • RFA
- 1991 • Interim RA
- 1994 • RI/FS
- 1999 • NPL
- 2000 • ERA
- 2002 • Pilot Test
- 2006 • SRI/FS
- 2006 • PRAP
- 2007 • ROD

NOTE In the site chronology be sure to include new pathways (e.g., vapor intrusion) or new contaminants that have been or are being investigated.

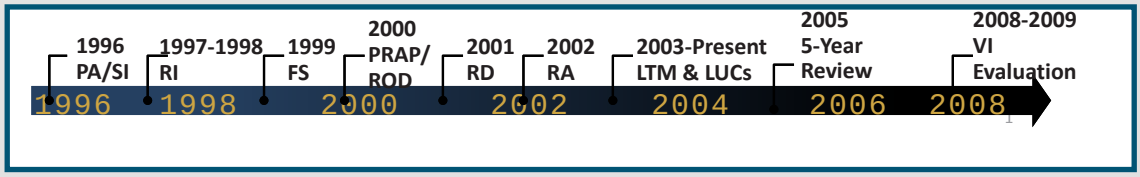


EXHIBIT 4. BACKGROUND

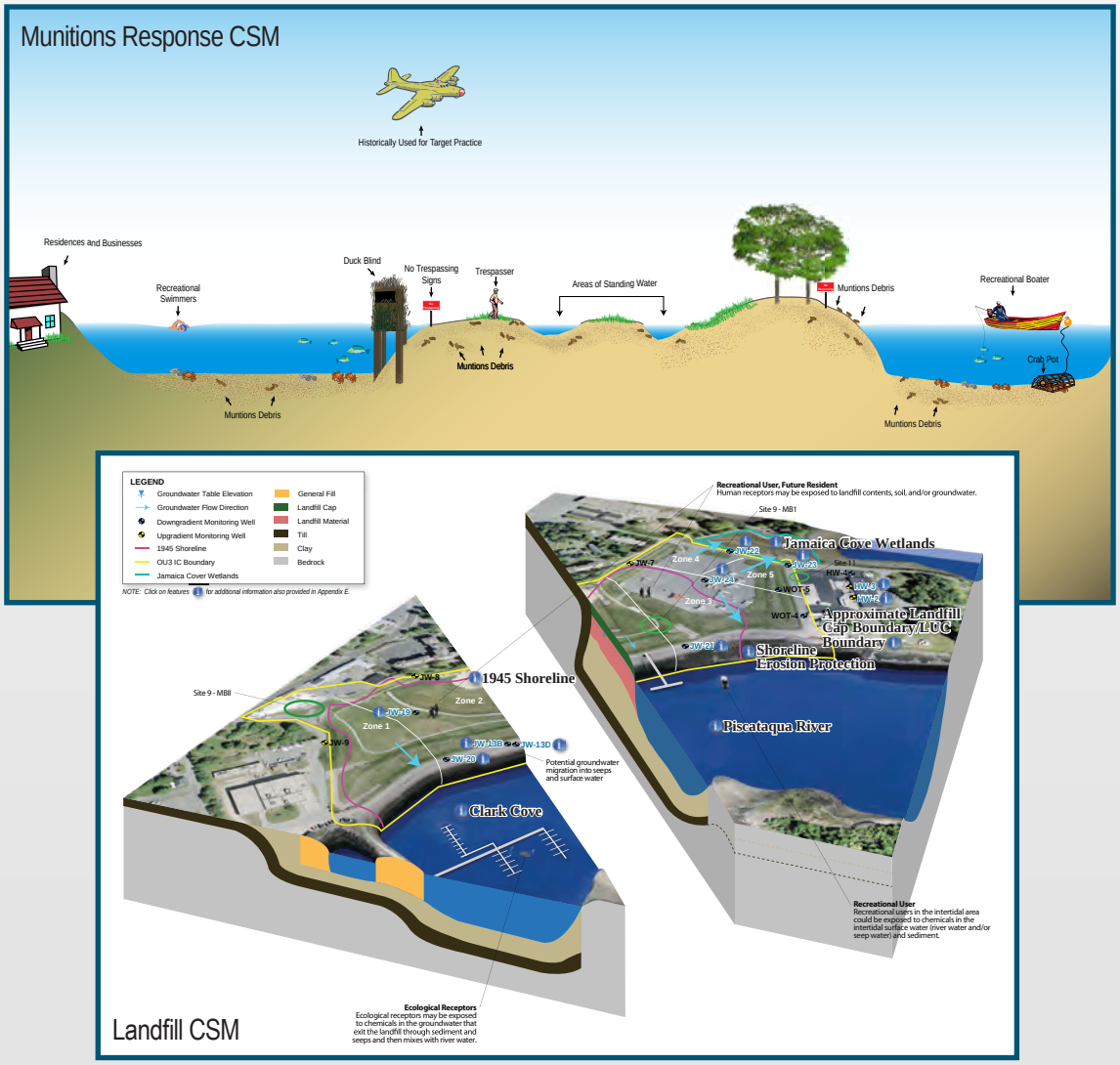
Toolkit Tip

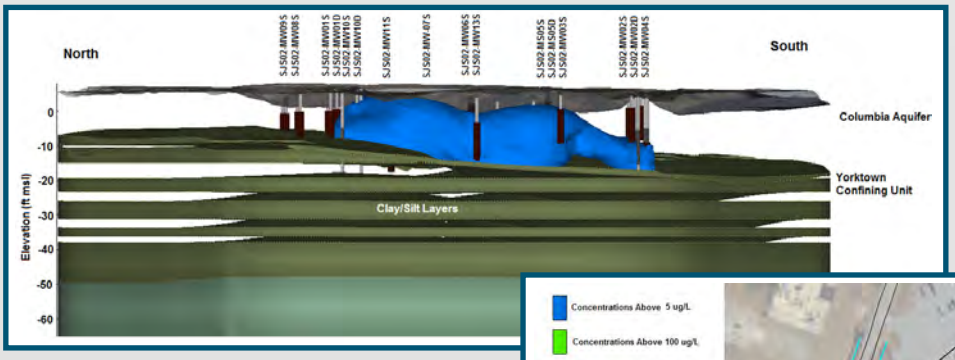
A comprehensive conceptual site model (CSM) can help illustrate the site characteristics at the time of the Record of Decision (ROD) including:

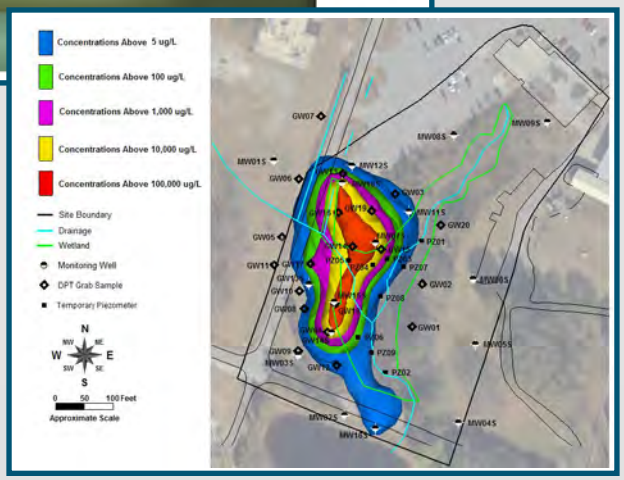
- Site layout and hydrogeologic setting
- Land and resource use
- Source area and contaminated media
- Fate and transport mechanisms
- Potential receptors and exposure pathways

Use the CSM to evaluate whether the remedy is protective of human health and the environment as intended by the ROD.

References or bookmarks that will link you to an appendix with supporting information can be provided if warranted (e.g., boring logs, membrane interface probe data, relevant photos).







Horizontal and Vertical Extent of Groundwater Plume

EXHIBIT 5. REMEDIAL ACTIONS

Toolkit Tip

Concisely present relevant site activities from Record of Decision signature to present. Explain the remedy implementation, operation and maintenance actions, and any changes/problems with remedial components. Provide bookmarks to supporting information such as design drawings, survey plats, and photos of the remedial action (RA).

Summary tables can be used to:

- Spotlight unacceptable risks
- List chemicals of concern
- Demonstrate how the key components of the RA mitigate the risks
- Demonstrate achievement of RA objectives
- Measure the progress towards meeting performance metrics and cleanup levels

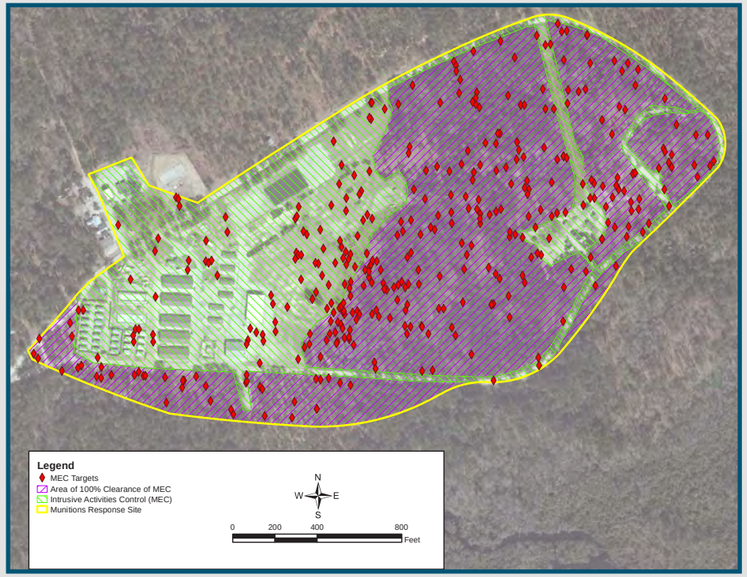
Use graphics of groundwater plumes, land use control boundaries, and trends over time to better demonstrate remedy performance.

OU	Site	Media	Reasonably Anticipated Land Use	COC Requiring Action	Basis for Action	RAO	Remedy Component	Site Closeout Strategy	Performance Metric / Cleanup Level
1	1	Subsurface soil	Residential	Benzene	Potential human health risks from exposure to benzene in subsurface soil	Reduce concentrations of benzene in subsurface soil to below the cleanup level	Excavation	Excavate subsurface soil exceeding cleanup level	0.0073 mg/kg
		Groundwater	Current or potential drinking water resource	Benzene	Potential human health risks from exposure to VOCs in groundwater	Prevent exposure to contaminated groundwater; Prevent future potential use of groundwater until concentrations allow for UU/UE; and Monitor natural attenuation of COCs in groundwater	LTM for MNA and LUCs	Conduct LTM and enforce LUCs until each groundwater COC is at or below its respective cleanup level for four consecutive LTM sampling events	5 µg/L
				TCE					5 µg/L
				cis-1,2-DCE					70 µg/L
				Vinyl chloride					2 µg/L
	7	Surface and subsurface	Industrial and vacant	2.36-inch rockets	Potential explosive hazards	Prevent human exposure to potential explosive hazards	Surface clearance and LUCs to prohibit intrusive activities	Conduct 100% surface clearance and dispose of all MEC or munitions debris and enforce LUCs	Confirmatory visual and geophysical survey identifying no surface anomalies

NOTE This type of table is useful in assessing remedial progress, evaluating the protectiveness of RAs, and identifying whether additional actions are needed to reach or expedite the intended exit strategy.

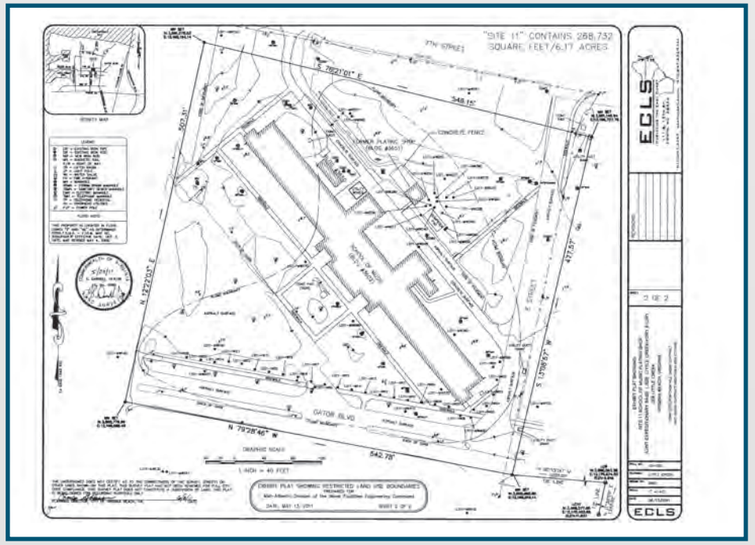
Munitions and Explosives of Concern (MEC)

Controlled Detonation



Location of Munitions and Explosives of Concern (MEC)

Performance monitoring data over time



Land Use Control Survey Plat

Injection Photo

EXHIBIT 6. PROGRESS SINCE LAST FIVE-YEAR REVIEW

Toolkit Tip

Describe the progress toward accomplishing the recommendations and follow-up actions from the last Five-Year Review (FYR). Use a table to highlight the issues, recommendations, follow-up actions, and date of completion. Provide a summary of the results of the implemented actions.

A brief summary of optimization efforts since the last FYR should be documented. This summary should be limited to optimizations that effected the protectiveness of the remedy, significantly impacted the performance, or changed the timeframe for completion.

Consider opportunities for future use of green and sustainable solutions to reduce the environmental footprint and consider the overall net environmental benefit consistent with the Navy's green and sustainable remediation initiatives.

SECTION 6

Progress Since Last Five-Year Review

6.1 Follow-Up Actions Since Last Five-Year Review

The previous Five-Year Review (Tetra Tech, 2007) concluded that the remedy was not functioning as intended by the ROD and required follow up actions to correct significant erosion of the landfill cap system. Additionally, although no current pathway of concern for vapor intrusion has been identified on-site, if buildings are planned for construction in the vicinity of the VOC groundwater plume, the potential for a vapor intrusion pathway will be evaluated and mitigated if needed.

Issue	Recommendation	Follow-Up	Status	Date Completed
Erosion Damage to Cap System	Repair Cap System	Finalized work plan for cap system repair	Completed	March 15, 2008
		Conducted repairs to the cap system	Completed	April 28, 2008
	Update LUC Inspection Program	Updated LUC inspection program (increased to quarterly inspections as opposed to annually)	Completed	June 23, 2008
		Designated site-specific inspection staff to ensure proper inspections are completed	Considered, but not implemented*	Not applicable
Potential for Future Vapor Intrusion Pathway	Evaluate and mitigate vapor intrusion pathway during construction planning	Implemented biannual Base GIS updates to reflect current VOC groundwater plume data for Base Master Planning. All proposed construction projects on-Base go through environmental review.	Re-evaluate during next Five-Year Review	January 15, 2009

*Site-specific inspection lists updated to be more specific and thorough to better communicate required objectives

6.2 Results of Implemented Actions

Semi-annual groundwater LTM is on-going to assess potential migration of the VOC plume. LTM includes groundwater VOC and NAIP sampling from six shallow and deep point-of-compliance downgradient monitoring wells. Three VOCs, (1,1,2,2-PCA, TCE, and VC) have consistently been detected above their respective groundwater standards in wells screened between 30 and 36 ft bgs. Overall, detected VOC concentrations have remained consistent and have not been detected in the deep groundwater samples.

The Site 1 ROD requires annual predictive groundwater modeling to document the likelihood the groundwater plume is impacting Johnson Creek. In order to estimate the concentrations likely to enter Johnson Creek, an analytical model, BIOCHLOR (Aziz et al., 2002) is used as a tool for this prediction. The 2009 BIOCHLOR modeling effort indicates that MNA remains protective of Johnson Creek and that contamination at the site will have naturally attenuated by 2022.

6.3 Optimization

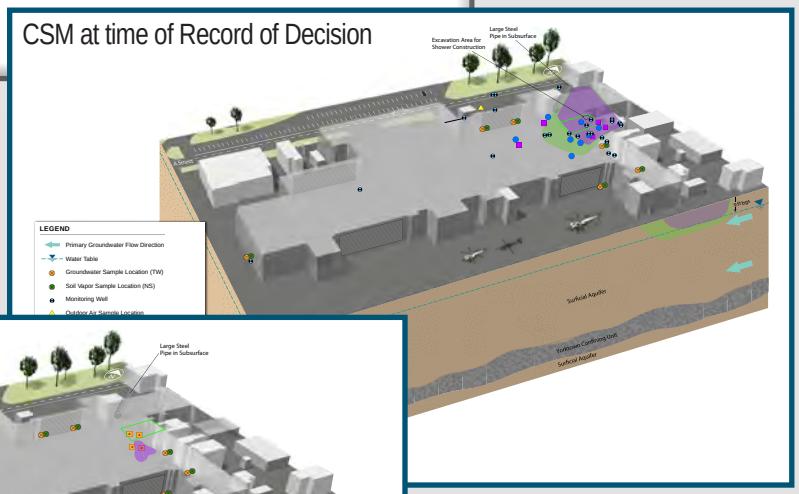
Initial LTM at Site 1 consisted of 12 monitoring wells samples collected twice a year for analysis of VOCs and NAIPs. In September 2008, an LTM Optimization Report (CH2M HILL, 2009) was completed to identify potential efficiencies for the LTM Program. The recommendations included the following:

- Removal of two redundant monitoring wells from the program.
- Reduce sampling frequency to an annual basis.

The LTM plan (CH2MHILL, 2010) has been revised to incorporate these recommendations.

NOTE Be sure to capture new pathway investigations and outcomes (e.g., vapor intrusion).

CSM at time of Record of Decision



CSM at time of FYR

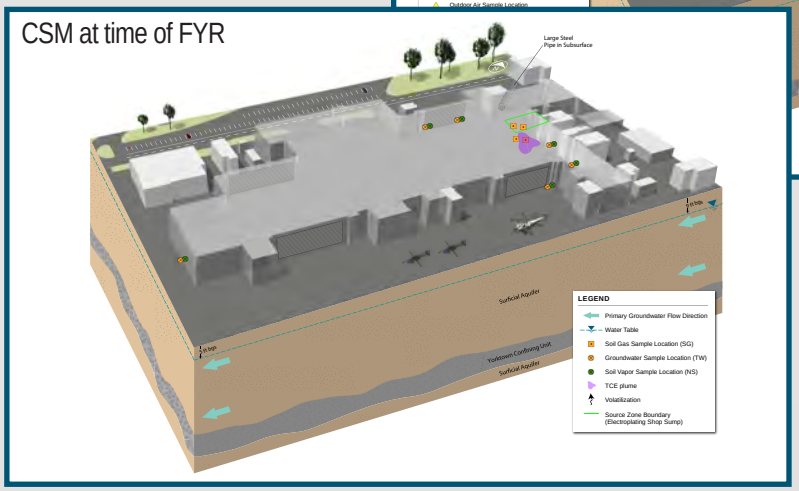


EXHIBIT 7. FIVE-YEAR REVIEW PROCESS

Toolkit Tip

Explain the Five-Year Review (FYR) process, how remedy protectiveness is evaluated, and identify community involvement activities. If a similar process is used for each site, consider consolidating this information into one section and present early in the document. Incorporate bookmarks to key supporting information.

Per *Navy Policy for Conducting FYRs* (June 2011), for ease of tracking and to ensure compliance, conduct your next FYR within five years of the Navy's signature of the previous FYR. The Navy typically conducts installation-wide FYRs on a five year basis, incorporating sites that have implemented a Remedial Action since the last FYR. Based on an installation-wide approach, discussion of the schedule for the next FYR may be applicable in this section, or may be included as a separate section at the end of the report.

SECTION 2

Five-Year Review Process

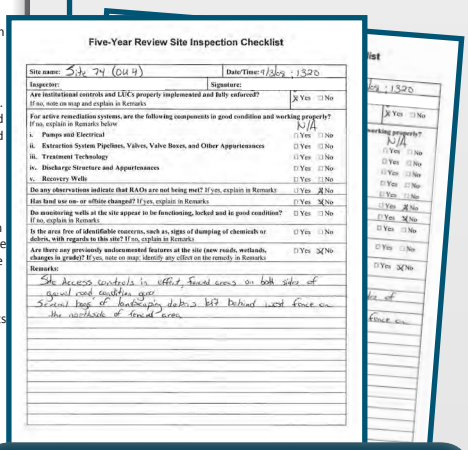
The Five-Year Review for MCB CamLej was conducted in accordance with the *Comprehensive Five-Year Review Guidance* (USEPA, 2001). Remedy protectiveness for the 16 OUs at MCB CamLej was evaluated through document reviews, site inspections, and community involvement activities as described in the subsections below.

2.1 Document Review

The Five-Year Review consisted of a review of site-specific documentation for each OU. First, the ROD for each OU was reviewed to identify the potential risks to human health and the environment, RAOs, selected remedy, and ARARs. The RD was then reviewed to evaluate the design components for the remedy, monitoring requirements, and LUC boundaries. To confirm that the remedies were operational and functional in accordance with the RAOs and RD, and IRACRs were reviewed. Follow-up monitoring reports were also reviewed to assess remedy performance and continued protection of human health and the environment. **Table ES-1** summarizes the data and documents reviewed for each OU.

2.2 Site Inspections

MCB CamLej conducts quarterly site inspections to verify that LUCs such as fencing and signs are still in-place and ensure there are no issues with the Base planning process. The most recent LUC inspection form is included in **Appendix A**. CH2M HILL conducted an inspection of the Five-Year Review sites on September 3 and 4, 2008 (**Appendix B**). On October 21, 2008, representatives of the Navy, MCB CamLej, USEPA, and NCDENR conducted an inspection of the Five-Year Review sites. No issues concerning the protectiveness of remedies were noted.



Five-Year Review Site Inspection Checklist

Site name: Site 74 (OU 4)	Date/Time: 9/3/08 ; 1320
Inspector:	Signature:
Are institutional controls and LECs properly implemented and fully enforced? If no, note on map and explain in Remarks	☒ Yes ☐ No
For active remediation systems, are the following components in good condition and working properly? If no, explain in Remarks below	N/A
i. Pumps and Electrical	☐ Yes ☐ No
ii. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances	☐ Yes ☐ No
iii. Treatment Technology	☐ Yes ☐ No
iv. Discharge Structure and Appurtenances	☐ Yes ☐ No
v. Recovery Wells	☐ Yes ☐ No
Do any observations indicate that RAOs are not being met? If yes, explain in Remarks	☐ Yes ☒ No
Has land use on- or offsite changed? If yes, explain in Remarks	☐ Yes ☒ No
Do monitoring wells at the site appear to be functioning, locked and in good condition? If no, explain in Remarks	☐ Yes ☐ No
Is the area free of identifiable concerns, such as, signs of dumping of chemicals or debris, with regards to this site? If no, explain in Remarks	☐ Yes ☐ No
Are there any previously undocumented features at the site (new roads, wetlands, changes in grade)? If yes, note on map; Identify any effect on the remedy in Remarks	☐ Yes ☒ No
Remarks: Site access controls in place, fencing exists on both sides of gravel road entrance gate. Several bags of landscaping debris left behind just fence on the northwest of fenced area.	

NOTE Include inspection checklists in an appendix to the FYR.

2.3 Community Involvement

The Base has taken a proactive approach to site cleanup by reaching out to the local community through the RAB. The RAB was created in 1995 and is made up of members of the community, civic and business organizations, and civilian employees. The RAB meets quarterly, and provides tours, onsite demonstrations of new technologies, and informative talks. The IRP hosts a public web site where information is posted to enhance information exchange between the Base and community: http://go.usa.gov/jZi. Access to the website is available at the Onslow County Library. Community relations activities are documented in the AR, maintained by a NAVFAC Atlantic, 6506 Hampton Boulevard, Norfolk, Virginia 23508-1278, (757) 322-8005.

Activities to involve the community in the Five-Year Review process were initiated with a notification published in October 2008 in local newspapers (*Roto Vue, The Globe,* and *The Jacksonville Daily News*) that announced that the Five-Year Review process was occurring at MCB CamLej. The community was also informed of the initiation of the Five-Year Review at a RAB meeting on October 21, 2008. When the Five-Year Review Report has been finalized, a notice will be sent to these newspapers indicating the results and that the report is available to the public.

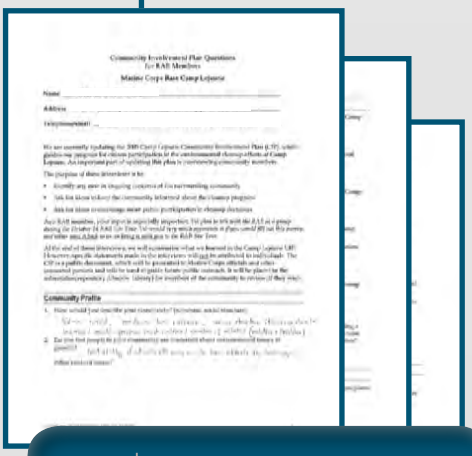
As MCB CamLej's mission grew, the Base identified the need to encourage community input and solicited requests for new members. As a result, five new members have joined the RAB. The Base also planned a site tour with the RAB and is updating the CIP.

2.4 Interviews

Concurrent with the Five-Year Review, an update to the CIP was initiated. Questionnaires (**Appendix C**) were mailed to the RAB for input and available at a site tour in October 2009. In-person interviews were conducted with community members in December 2009 and the results will be documented in the CIP in 2010. In general, the overall impression of IRP and remedial actions at MCB CamLej is positive.

2.5 Next Five-Year Review

The next Five-Year Review for MCB CamLej is due in 2015.



Community Involvement Plan Questions for RAB Members

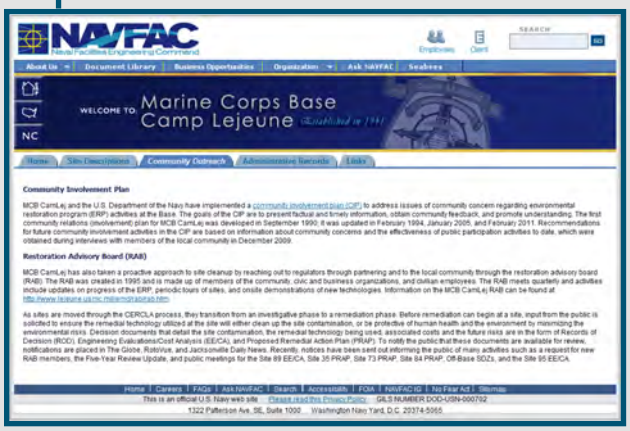
Marine Corps Base Camp Lejeune

Name

Address

Telephone/email

Community Profile



NAVFAC Naval Facilities Engineering Command

WELCOME TO Marine Corps Base Camp Lejeune

Community Involvement Plan

Restoration Advisory Board (RAB)

NOTE Include community interviews in an appendix in the FYR.

NOTE To consolidate the site interview and community involvement activities, consider conducting your Community Involvement Plan update at the same time as your FYR.

Final

Community Involvement Plan Update

Marine Corps Base Camp Lejeune

Jacksonville, North Carolina

NAVFAC

Prepared for

Department of the Navy

Naval Facilities Engineering Command

Mid-Atlantic

February 2011

Prepared by

CH2MHILL

EXHIBIT 8. TECHNICAL ASSESSMENT

Toolkit Tip

The technical assessment should provide support in preparation for choosing a protectiveness statement. The remedial action objectives (RAOs) link the risk drivers with the remedial action; therefore, it is important to relate back to the RAOs when answering the technical assessment questions.

The answers to each of the three questions will be the basis for your protectiveness statement. Consider using tables, maps, and diagrams to better depict this information, for example:

- Changes in parent and daughter product concentrations over time
- Concentration trends over time and estimated time to achieve RAOs
- Lines of evidence for natural attenuation
- Land use control inspection and interview results
- Comparison to expected operations and maintenance (O&M) costs
- Changes in assumptions (e.g., toxicity data, cleanup levels, new pathways, remedial time frames, etc.) made during the decision making process

SECTION 7

Technical Assessment

A. Is the remedy functioning as intended by the decision document? Yes. Based on the review of documents, MNA results, ARARs, risk assumptions, site inspections, and O&M costs it is concluded the Site 1 remedy is functioning as designed. The results from the 2012 Annual LTM Report (CH2M HILL, 2012) indicate that parent VOC concentrations (PCE and TCE) are decreasing (**Table 7-1** and **Figure 7-1**) while daughter compounds (cis-1,2-DCE and VC) are increasing (**Table 7-1**). NAIP data is available on **Table 7-2** and suggests groundwater is characterized by reducing conditions suitable for anaerobic biodegradation of VOCs. O&M costs have been comparable to those estimated in the ROD. LUCs are in-place to restrict land and aquifer use and prohibit intrusive activities below the water table (**Figure 7-2**).

TABLE 7-1. BASELINE AND CURRENT COC CONCENTRATIONS

VOCs (µg/L)	Baseline (06/14/06)	Current (01/12/12)	Cleanup Level (MCLs)
PCE	650	17	5
TCE	300	50	5
Cis-1,2-DCE	270	430	70
Vinyl chloride	10	22	2
1,1-DCE	11	20	7

FIGURE 7-1. PCE AND TCE CONCENTRATIONS AT MW12

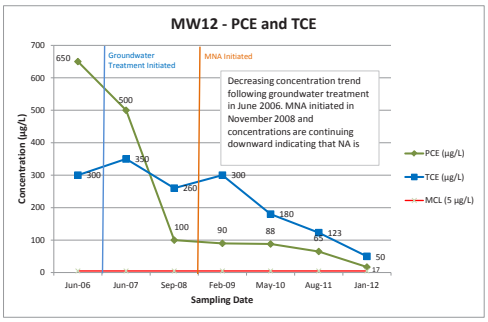


FIGURE 7-2. GROUNDWATER VOC PLUME AND LUCS

B. Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid? No. Cleanup levels are the federal MCLs and have been revised since signature of the ROD (**Table 7-2**).

C. Has any other information come to light that could call into question the protectiveness of the remedy? No additional information has been obtained that would affect the protectiveness of the remedy.

7-1

NOTE Use graphics to demonstrate remedial action progress and effectiveness of LUCs.

NOTE A summary of O&M costs should be provided to identify whether O&M is proceeding as planned within the last five years. If historical cost information is not available, either rough order of magnitude estimates and/or a footnote explanation should be included. Tracking long-term costs is useful for identifying potential remedy problems and the need for additional optimization efforts. Any optimization efforts evaluated and/or implemented should be captured in the Navy's Normalization of Data (NORM) database.