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7 February 1990

Mr. Herb Padro
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Naval Facilities Engineering Command
Southwest Division
1220 Pacific Highway
San Diego, CA 92132-5190

**SUBJECT: Contract N68711-89-D-9296
Navy CLEAN - Southwest Division
Contract Task Order #0018 Revised Implementation Plan
Marine Corps Air Station, El Toro, Santa Ana, California**

Dear Mr. Padro:

Enclosed please find the Jacobs Revised Implementation Plan (IP) for development of a comprehensive Remedial Investigation/Feasibility Study (RI/FS) Work Plan for the Marine Corps Air Station, El Toro, Santa Ana, California. This Plan was prepared in response to the Scope of Work for Contract Task Order (CTO) #0018 and reflects the agreements reached during discussions on 30 January 90 and 1 February 90.

We have developed the enclosed schedule using the SOW schedule of submittals and the anticipated IP approval date. As shown in the enclosed schedule, we plan to submit the preliminary draft documents for each task (except Task 1 which is a draft summary report and Task 7 which is a copy of each document proposed for inclusion in the AR) as follows:

| | |
|--------|-------------|
| Task 1 | 14 March 90 |
| Task 2 | 11 May 90 |
| Task 3 | 11 May 90 |
| Task 4 | 11 May 90 |
| Task 5 | 11 May 90 |
| Task 6 | 12 April 90 |
| Task 7 | 11 June 90 |

This schedule is based on receiving Navy approval of this IP by 12 February 90.

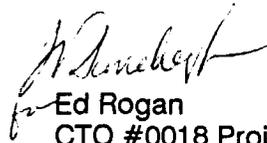
The Certificate of Current Cost or Pricing Data is being executed by Jacobs Management in Pasadena, and will be submitted by separate correspondence.

Please contact Phil Stassi to set up any further meetings to discuss the enclosures. We are available to meet with you immediately upon your receipt of this IP and discuss any of the specifics enclosed.

Sincerely,



Philip J. Stassi
CLEAN Program Manager



Ed Rogan
CTO #0018 Project Manager

PJS/jh
L0154/90/S
Enclosures

cc: J. Pawlisch - Code 018C
J. Cortez - Code 1812.JC
T. Briggs - JEG/Dvr
R. Bearden - JEG/Abq
File - Chron
File - PMO
File - PAS
CTO Notebook

**UNITED STATES NAVY
NAVAL FACILITIES ENGINEERING COMMAND
SOUTHWEST DIVISION
COMPREHENSIVE LONG TERM ENVIRONMENTAL ACTION NAVY (CLEAN)**

**REVISED
IMPLEMENTATION PLAN
CTO #0018
WORK PLAN FOR A REMEDIAL
INVESTIGATION/FEASIBILITY STUDY AT THE
MARINE CORPS AIR STATION, EL TORO
SANTA ANA, CALIFORNIA**

**PREPARED FOR
UNITED STATES NAVY
SOUTHWEST DIVISION
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**PREPARED BY
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Lincoln, David, Observational Method in Site Investigation and Remediation,
CH2M Hill Tech Transfer Topics, 1 December 89.

1.0 INTRODUCTION

On 27 November 89 the Department of the Navy, Naval Facilities Engineering Command, Southwest Division (Navy), issued Contract Task Order (CTO) #0018 to the Jacobs Engineering Group Inc. This Implementation Plan (IP) responds to the CTO requirement. This IP for the MCAS El Toro RI/FS Work Plan and supplemental plans has been prepared by the Jacobs Team in response to the SOW for CTO #0018 under the Comprehensive Long-term Environmental Action Navy (CLEAN) program, Contract N68711-89-D-9296.

This IP outlines the work to be performed under each task in the Scope of Work (SOW) dated 16 November 89 for CTO #0018. This IP describes the tasks necessary to develop a Work Plan for the conduct of a Remedial Investigation/Feasibility Study (RI/FS) at the Marine Corps Air Station (MCAS) El Toro, Santa Ana, California (Figure 1). The RI/FS Work Plan is an important document to allow the Navy to review the scope and commit funds to the RI/FS effort and for the PjM to plan and execute the project. In addition, it allows for state and other regulatory agencies to comment on the scope and methodologies proposed. In addition to the RI/FS Work Plan the SOW requires the preparation of Sampling and Analysis Plan (SAP), site specific Health and Safety Plan, Site Management Plan, review and update of the Administrative Record, and revision of a Community Relations Plan (CRP).

In May 1988, the Naval Energy and Environmental Support Activity (NEESA) released their Initial Assessment Study (IAS) of the Marine Corps Air Station, El Toro, California. The purpose of the IAS was to identify and assess sites posing a potential threat to human health or the environment due to contamination from past operations involving the use, handling, or disposal of hazardous materials. Based on information from various records, aerial photographs, and personnel interviews, a total of 17 potentially contaminated sites were identified in the IAS. The sites are:

- Site 1 Explosive Ordnance Disposal Range - Two 100-foot diameter pits used for the disposal of sulfur trioxide chlorosulfonic acid (FS smoke).
- Site 2 Magazine Road Landfill - Approximately 1,000,000 cubic yards of wastes including oils, solvents, paint residue, transformers, household refuse, municipal solid waste, and others.
- Site 3 Original Landfill - Approximately 163,500 to 243,000 cubic yards of waste material, similar to that at Site 2, that was burned prior to burial to reduce volume.
- Site 4 Ferrocene Spill - Approximately five gallons of ferrocene in a hydrocarbon carrier was spilled during an overflow incident.
- Site 5 Perimeter Road Landfill - Approximately 50,000 to 60,000 cubic yards of waste material, similar to that at Site 2 with the exception of transformers.
- Site 6 Drop Tank Drainage Area, No. 1 - An estimated 1,400 gallons of JP-5 and 300 gallons of lubricating oils were released here due to drop tank rinsing and leakage.

- Site 7 Drop Tank Drainage Area, No. 2- An estimated 23,460 gallons of JP-5 were released here due to drop tank rinsing, dust control, and a spill.
- Site 8 DPDO Storage Yard - Several gallons of transformer oil was spilled here and subsequently excavated for off-site disposal.
- Site 9 Crash Crew Pit, No. 1 - Approximately 8,170 gallons of AVGAS, 4,080 gallons of JP-5, and 120 gallons of crankcase oil have been released to the soil during crash crew training activities.
- Site 10 Petroleum Disposal Area - Approximately 52,000 gallons of petroleum wastes were sprayed over an area of approximately 960,000 square feet.
- Site 11 Transformer Storage Area - A 30 by 30 foot concrete pad used for transformer storage where approximately 60 gallons of transformer oil leaked and flowed onto the soil.
- Site 12 Sludge Drying Beds - Approximately 880 cubic yards of secondary wastewater treatment plant sludge was spread in this area for dewatering.
- Site 13 Oil Change Area - Approximately one quarter acre site where approximately 7,000 gallons of waste crankcase oil was disposed of. The soil was later scraped into a pile for disposal.
- Site 14 Battery Acid Disposal Area - Approximately 210 gallons of battery acids, oily wastes, and paint wastes were released to the soil.
- Site 15 Suspended Fuel Tanks - Approximately 500 gallons of diesel fuel is reported to have been spilled on the soil in this area.
- Site 16 Crash Crew Pit, No. 2 - Two pits used during training exercises in which approximately 27,400 gallons of JP-5, AVGAS, hydraulic fluid, and crankcase oil have been released to the soil.
- Site 17 Communication Station Landfill - The discharge point for a 1,000-gallon vacuum truck. Wastes were largely cooking grease but waste oils and fuel were also reported to have been disposed of at this site.

The IAS concluded that 9 of the identified sites warranted confirmation studies. These included Sites 1, 2, 3, 5, 9, 11, 14, 16, and 17. In addition, Site 4 was recommended for remedial measures.

Subsequent to the completion of the IAS and following negotiations with federal, state, and local agencies, it was determined that two additional sites should be investigated. These sites are:

- Site 18 Perimeter Investigation -- was added to evaluate whether trichloroethene (TCE) contamination observed in three off-station agricultural wells was a result of past waste disposal practices at the station.
- Site 19 ACER Site -- the site of an early 1986 failure of an aboveground, 20,000-gallon-capacity fuel bladder that reportedly released an estimated 15,000 gallons of fuel onto the ground.

It is the intention of Jacobs, as required in the CTO, to reconsider each of these 19 sites (Figure 1-1) during the evaluations conducted during the execution of the IP.

1.1 Objective

The objective of this IP is to present the technical approach, cost estimate, and schedule for the development of the RI/FS Work Plan, SAP, site specific Health and Safety Plan, revised CRP, Site Management Plan, and an updated Administrative File. The Work Plan will be prepared in strict accordance with CERCLA/SARA requirements, the latest EPA and Navy Installation Restoration (IR) guidelines, and applicable or relevant and appropriate State and local regulatory agency guidance.

The purpose of performing these specified tasks is to acquire sufficient information so that risks to human health and the environment from the contaminated sites at the MCAS El Toro can be estimated and remedial strategies evaluated. This approach is based on initial review of background documents, a site visit and discussions with the Navy Remedial Project Manager (RPM), Mr. Larry Nuzum.

1.2 Project Organization

Jacobs has identified Mr. Edward Rogan as the Project Manager for this CTO. Additional project support and lead technical personnel are identified in Section 4.0, Cost Estimate.

2.0 TECHNICAL APPROACH

In accordance with the SOW outlined in CTO #0018 Jacobs will prepare the RI/FS Work Plan, a SAP, a site specific Health and Safety Plan, a Site Management Plan, an updated Administrative File, and revise the CRP. Each task is described in detail below.

2.1 Task 1 - Background Review

The purpose of the background review is to summarize the current situation, identify data deficiencies, and facilitate the development of the RI/FS work plan. Readily available background information on the MCAS El Toro will be compiled and reviewed during this phase. The Navy RPM has already provided Jacobs with several site-specific documents. Conversations with the RPM indicate that the documents received constitute the majority of the information available through the Navy on the site. Approximately one four-drawer file cabinet, one two-drawer file cabinet, and 6 linear feet of shelved documents remain to be reviewed at the MCAS El Toro offices. Other sources of information are anticipated to include the files of the Regional Water Quality Control Board (RWQCB), Santa Ana District, the EPA, and the U. S. Geological Survey. Work will be conducted in accordance with the latest EPA, state of California, RWQCB, Navy Installation Restoration Program regulations and guidance. To facilitate the background review and the future development of base maps for the site, the Navy will be responsible for providing Jacobs with reproducible copies of site topographic maps and available construction drawings collected as part of this background review exercise.

Specific attention will be focused on data relating to the varieties and quantities of hazardous wastes disposed of, used, and historically stored at the site to aid in further characterization of the nature and extent of contamination. The results of previous sampling events will be summarized in terms of physical and chemical characteristics, such as the contaminants identified and their respective concentrations. Compiled information will include demographic and land use information as well as geology, hydrology, hydrogeology, meteorology, toxicology and ecology. Data deficiencies will be identified and the Work Plan focused to fill critical data needs. If sites are identified which appear to pose an imminent threat to human health or the environment these sites will be evaluated for potential removal actions described under Section 2.2.3.

Each of the 17 disposal sites identified in the Initial Assessment Study and the two subsequently identified sites will be evaluated to assess whether it merits further study through the RI/FS. In consultation with the RPM and installation personnel, a determination will be made regarding which sites to include under the succeeding investigations.

As a deliverable to this task Jacobs will prepare a Summary Report which describes the work undertaken to date at the MCAS El Toro with respect to the RI/FS and IR program. As has been directed in the CTO #018 Project Scope, this report will include a list of specific sites which are proposed to be investigated under the RI/FS and their rationale for their inclusion or exclusion. A draft of this report will be delivered to the RPM 30 calendar days following approval of the IP. It is anticipated that the format of the summary report would be suitable for insertion as a section in the RI/FS Work Plan. Five copies of the Draft Summary Report will be submitted. The Final Summary Report will be delivered 14 days following receipt of government comments. Five copies of the Final Summary Report will be provided to the RPM.

2.2 Task 2 - RI/FS Work Plan

The RI/FS Work Plan will describe the procedures and programs necessary to further characterize the nature and extent of contamination present at the sites identified at the MCAS El Toro. The Work Plan will address the specific sites currently identified at the MCAS El Toro, as they are currently understood. The observational method of investigation (discussed in Appendix C) may be proposed in the Work Plan to allow for the need to phase the investigations and potentially break out operable units. The Work Plan will incorporate and expand on the work outlined in the Site Inspection Plan of Action, prepared by James M. Montgomery Consulting Engineers, dated August 1988. It will also describe the procedures necessary to develop, screen and evaluate potential remedial action alternatives. The Work Plan will identify the staff and the approximate level of effort required to perform the activities described. It will inform the Navy of potential conflicts, unrealistic schedule demands and issues of concern to the affected communities. The Work Plan will include descriptions of the assumptions made for each site so that the Navy will be able to identify the rationale behind the proposed investigation and study approach.

Initial efforts associated with the RI/FS Work Plan will involve continued data acquisition and review as well as site orientation of investigation team. It is intended that this RI/FS Work Plan will complement the concurrent off station investigations Work Plan.

Concurrent with the development of the RI/FS Work Plan, and integral to ensuring that it is appropriately focused, the following seven tasks will be completed and the results documented within the RI/FS Work Plan.

2.2.1 Monitor Well Inventory

The existing on site monitoring wells and supply wells will be assessed to evaluate their status, condition and usability. Assessment for usability will be made through a review of well logs and completion details. A site visit will confirm the well location and accessibility in the field. Criteria for usability will be developed with the concurrence of the Navy RPM and are expected to include documentation of acceptable well drilling and installation techniques, construction with suitable materials, suitable screen length, annular seal, surface seal and protection. It is anticipated that some wells may be determined as suitable for non-critical data such as water levels while others will be suitable for more critical parameters such as hazardous constituent sampling.

2.2.2 Preliminary Baseline Risk Assessment

Jacobs will prepare a preliminary Baseline Risk Assessment (RA) for the hazardous waste sites located at MCAS El Toro. This exercise will involve a limited evaluation of the potential adverse effects or risks to human health and the environment from these sites in the absence of remedial or removal actions.

The preparation of the Final BRA will be a task within the RI and will be completed by the end of the RI.

2.2.3 Removal Action Evaluation

The need for removal actions on the site will be evaluated. The criteria for assessing if a removal action is necessary or appropriate depends upon whether there is a threat to public health or the environment. Specific factors which would be taken into consideration include: actual or potential exposure of humans or the environment to hazardous substances, actual or potential contamination of drinking water supplies, hazardous substances, pollutants or contaminants in drums or other bulk containers which pose a threat of release, high levels of hazardous substances in soils at or near the surface that may migrate. Removal actions are typically restricted to an expenditure of \$2,000,000 over a time frame of one year. Removal actions which will be considered include site security measures, drainage control, covering or capping contaminated smudges or soils, treatment to retard migration, excavation, removal of drums or other bulk containers, and provision of an alternate water supply.

2.2.4 Preliminary ARARs Analysis

A preliminary list of state, federal and local ARARs will be compiled. The list will focus on chemical specific and location specific ARARs. Response to or addressing action specific ARARs is typically waived by the agencies until later in the RI/FS process. A formal assessment as to whether the rule or regulation is applicable under the law or relevant and appropriate will be made by the Technical Review Committee (TRC). The final ARARs analysis will be conducted under the RI/FS and will be included as an appendix to the RI/FS report.

2.2.5 Community Relations Plan

The RI/FS Work Plan will include, as a task, technical support of the implementation of the CRP described in Section 2.5. The implementation of the CRP will include as a minimum the preparation of information sheets and/or attendance at public meetings.

2.2.6 Evaluate Potential Remedial Actions

Background information will be evaluated and a conceptual understanding of the site will be developed. Potential remedial action objectives will be identified for each contaminated medium and a preliminary range of remedial actions developed. This will consist of a general classification of potential remedial actions based on the expected routes of exposure and identified receptors. Although this is not meant to replace the more detailed identification and screening of remedial action alternatives that will be evaluated during the RI/FS it will help to focus the data gathering efforts so they support likely remedial actions. The preliminary list of remedial actions will include the SARA mandate to address treatment which significantly reduces the toxicity, mobility and volume of waste; containment with little or no treatment; and, of course, the no action alternative.

The Work Plan will describe the methodologies to evaluate and compare the remedial action technologies under consideration. The remedial actions developed will be subject to screening during the RI/FS based on effectiveness, implementability and cost.

2.2.7 Treatability Evaluation

Based on the identification of potentially applicable remedial technologies, an evaluation as to whether treatability studies should be conducted under the RI/FS will be made, if possible. The decision process for determining if a treatability evaluation is necessary consists of the following steps: determining data needs, reviewing existing data to determine if they are sufficient to evaluate the alternatives and proposing treatability testing if available information is not sufficient.

2.2.8 Deliverables

Three versions of the RI/FS Work Plan will be provided for Task 2: a Preliminary Draft, Draft and Final. The RI/FS Work Plan will include a description of the procedures and programs necessary to characterize the nature and extent of contamination at the sites. It will contain the proposed methodology to develop, screen and evaluate remedial action alternatives. The results of the preliminary baseline risk assessment will be included within the Work Plan. It will also contain an executive summary as well as a summary listing of monitoring and analytical requirements by site. As part of the Work Plan the preparation of the proposed plan and the Draft Record of Decision document will be specified as late FS tasks. The Preliminary Draft RI/FS Work Plan will be delivered within 90 days of IP approval. Three copies will be provided to the RPM and 3 copies to the MCAS EI Toro. The Draft RI/FS Work Plan will be delivered within 21 days of receipt of Navy and MCAS EI Toro comments, assuming the comments do not require extensive Work Plan revisions. Five copies will be provided to the RPM and 15 copies the MCAS EI Toro. The Final Work Plan will be delivered within 21 days of RPM comments and direction to finalize the report, assuming the comments do not require extensive Work Plan revisions. Five copies will be provided to the RPM and 15 copies the MCAS EI Toro. In addition to the copies required above, an unbound, camera-ready copy of the Draft and the Final deliverables will be provided to the MCAS EI Toro.

2.3 Task 3 - Sampling and Analysis Plan

Jacobs will prepare the documents necessary to complete a SAP in accordance with federal, state and local guidance. The SAP consists of two parts: the Quality Assurance Project Plan (QAPP) and the Field Sampling Plan (FSP). These documents will be submitted as separate deliverables, consistent with the Preliminary Draft, Draft, and Final versions discussed above.

2.3.1 Quality Assurance Project Plan (QAPP)

Data quality objectives (DQOs) will be addressed early in the QAPP process. The required data quality level for the investigation will be assessed and verified with the RPM. Once DQOs are established, a Navy approved, CLP laboratory will be identified for sample analysis. The QAPP will describe the policy, organization and functional activities necessary to achieve the DQOs. It will describe the procedures which will be used to document and report precision, accuracy, representativeness, completeness and comparability of environmental measurements. As much as practical, Jacobs' previously prepared standard operating procedures will be utilized in the QAPP. SOPs which are presently available are listed on Table 1. Based on EPA guidance the QAPP will have each of the required 16 elements. The regional EPA office will be contacted to determine if certain portions of the QAPP documentation, if any, have been standardized for this region.

Depending on the agreed upon DQOs the QAPP may require additional items such as use of a close support lab, use of a non-CLP lab, and use of non-standard analytical or sampling procedures. It is intended that the QAPP will be general enough to use in off station investigations.

The Preliminary Draft QAPP will be delivered within 90 days from approval of the IP. Three copies will be provided to the RPM and 3 copies to the MCAS El Toro. The Draft QAPP incorporating government comments will be delivered within 21 days from receipt of comments assuming major revisions are not required. Five copies will be provided to the RPM and 15 copies the MCAS El Toro. The Final QAPP will be delivered within 21 days from receipt of comments assuming major revisions are not required. Five copies will be provided to the RPM and 15 copies the MCAS El Toro. In addition to the copies required above, an unbound, camera-ready copy of the Draft and Final deliverables will be provided to the MCAS El Toro.

2.3.2 Field Sampling Plan (FSP)

The Field Sampling Plan will address the objectives of the sampling effort, the rationale for the sample locations, number of samples, and analytical parameters. Site maps depicting the sample locations will be included. The FSP will describe the sample collection techniques, disposal of contaminated materials, equipment decontamination, sample containers, sample preservation, sample shipment, sample documentation, and quality assurance/quality control. Specifics regarding sample blanks, duplicates, splits and spikes will be described. Where data needs overlap with the QAPP they will not be reiterated but rather referenced as being contained in the QAPP. The QAPP and FSP, when used together, will be complete enough so that qualified hazardous waste samplers, unfamiliar with the site, could conduct the sampling effort.

The Preliminary Draft FSP will be delivered within 90 days from approval of the IP. Three copies will be provided to the RPM and 3 copies to the MCAS El Toro. The Draft FSP incorporating government comments will be delivered within 21 days from receipt of comments assuming major revisions are not required. Five copies will be provided to the RPM and 15 copies the MCAS El Toro. The Final FSP will be delivered within 21 days from receipt of comments assuming major revisions are not required. Five copies will be provided to the RPM and 15 copies the MCAS El Toro. In addition to the copies required above, an unbound, camera-ready copy of the Draft and Final deliverables will be provided to the MCAS El Toro.

TABLE 1
Standard Operating Procedures For
The Navy CLEAN Contract

| SOP NUMBER | TITLE |
|---------------|--|
| 1.0 | ADMINISTRATION |
| 2.0 | HEALTH AND SAFETY TRAINING |
| 3.0 | REPORTING AND RECORDKEEPING |
| 4.0 | MEDICAL PROGRAM |
| 5.0 | SITE SAFETY PLAN |
| 6.0 | GENERAL HEALTH AND SAFETY PRACTICES |
| 7.0 | SURVEY AND RECONNAISSANCE |
| 8.0 | LEVELS OF PROTECTION |
| 9.0 | WORK ZONES |
| 10.0 | PERSONNEL DECONTAMINATION |
| 11.0 | FIELD LOGBOOK/PHOTOGRAPHS |
| 12.0 | FIELD MEASUREMENT OF TEMPERATURE |
| 13.0 | FIELD MEASUREMENT OF pH |
| 14.0 | FIELD MEASUREMENT OF SPECIFIC CONDUCTANCE |
| 15.0 | FIELD MEASUREMENT OF ORGANIC VAPORS |
| 16.0 | FIELD MEASUREMENT OF RADIATION |
| 17.0 | FIELD MEASUREMENT OF SAMPLE LOCATIONS |
| 18.0 | SAMPLING PLAN |
| 19.0 | SOLIDS |
| 20.0 | SOILS |
| 21.0 | SMUDGES AND SEDIMENTS |
| 22.0 | BULK MATERIALS |
| 23.0 | SURFACE WATERS |
| 24.0 | CONTAINERIZED LIQUIDS |
| 25.0 | GROUNDWATER |
| 26.0 | FIELD DECONTAMINATION PROCEDURES FOR EQUIPMENT USED IN GROUND WATER DATA COLLECTION |
| 27.0 | FIELD FILTRATION OF GROUNDWATER SAMPLES FOR DISSOLVED METALS ANALYSIS |
| 28.0 | SAMPLE PRESERVATION AND ANALYSES METHODS |
| 29.0 | CLP SAMPLE CONTAINER REQUIREMENTS |
| 30.0 | SAMPLE DOCUMENTATION |
| 31.0 | SAMPLE PACKAGING AND SHIPMENT |
| 32.0 | FIELD CLASSIFICATION AND DESCRIPTION OF SOILS |
| 33.0 | IN-SITE HYDRAULIC CONDUCTIVITY DETERMINATION |
| 34.0 | INSTALLATION/SERVICING OF TENSIMETERS AND MEASUREMENT OF SOIL WATER POTENTIAL |
| 35.0 | SOIL WATER SAMPLER INSTALLATION AND USE |

TABLE 1 (Continued)
Standard Operating Procedures For
The Navy CLEAN Contract (continued)

| SOP NUMBER | TITLE |
|---------------|--|
| 36.0 | MONITOR WELL INSTALLATION |
| 37.0 | WELL DEVELOPMENT |
| 38.0 | FIELD MEASUREMENT OF STATIC WATER LEVELS AND TOTAL DEPTH IN GROUND WATER MONITORING WELLS |
| 39.0 | FIELD MEASUREMENT OF IMMISCIBLE COMPONENTS IN GROUNDWATER MONITORING WELLS |
| 40.0 | AQUIFER PUMPING TESTS |
| 41.0 | SLUG TESTING |
| 42.0 | PACKER TESTING |
| 43.0 | GEOPHYSICAL TECHNIQUES |
| 44.0 | SOIL GAS SAMPLING |
| 45.0 | HEADSPACE ANALYSIS FOR VOLATILE ORGANICS IN SOILS: FIELD METHOD |

2.4 Task 4 - Site-Specific Health and Safety Plan

A site Health and Safety Plan will be prepared which establishes policies and procedures to protect workers and the public from potential hazards posed by each site. The purpose of the plan is to provide information about the site being investigated, evaluate the hazards present, establish personal protective measures for personnel assigned to the operation and to outline emergency action procedures. The plan is prepared by the Project Manager (PjM) or by the Site Safety Officer (SSO) and is submitted to the Jacobs CLEAN Health and Safety Manager for approval.

The following documents will be used as guidance in preparing the Health and Safety Plan:

- o EPA Standard Operating Safety Guidelines, completed November 1984
- o NIOSH/OSHA/USCG/EPA Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, completed October 1985
- o Technical Method for Investigating Sites Containing Hazardous Substances, prepared by the EPA in 1981 as part of the National Contingency Plan
- o Applicable Occupational Safety and Health Agency (OSHA) regulations
- o Recommendations from the National Institute of Occupational Safety and Health (NIOSH), the American Conference of Governmental Industrial Hygienists (ACGIH), the Practices for Respiratory Protection by the American National Standards Institute (ANSI Z88.2).

The Health and Safety Plan will also conform to:

- o FAR Clause 52.236.13, Accident Prevention
- o Applicable CAL/OSHA Regulations
- o U.S. Department of Labor OSHA Standards for General Industry (29 CFR 1910.120), Interim Final Rule; and (29 CFR 1926) Construction Industry standards

The Preliminary Draft Health and Safety Plan will be delivered within 90 days from approval of the IP. Three copies will be provided to the RPM and 3 copies to the MCAS El Toro. The Draft Health and Safety Plan incorporating government comments will be delivered within 21 days from receipt of comments assuming major revisions are not required. Five copies will be provided to the RPM and 15 copies the MCAS El Toro. The Final Health and Safety Plan will be delivered within 21 days from receipt of comments assuming major revisions are not required. Five copies will be provided to the RPM and 15 copies the MCAS El Toro. In addition to the copies required above, an unbound, camera-ready copy of the Draft and Final deliverables will be provided to the MCAS El Toro.

2.5 Task 5 - Revise/Incorporate a Community Relations Plan (CRP)

Jacobs will revise the CRP presently being prepared by others under a separate contract. It will describe how the community will be kept informed of project planning

and field activities, and how and when the community would be involved in project decisions during the RI/FS phase. This CRP will be revised in close consultation with, and with guidance from, MCAS El Toro personnel or their designees and will include the RI/FS schedule developed under CTO #018. In addition to EPA, state and local regulatory agency, and Navy guidance, the following guidance documents will be followed:

- o "Community Relations in Superfund, A Handbook," Interim Version, U.S. Environmental Protection Agency, June 1988.
- o "Installation Restoration Public Affairs Plan," Department of Navy, Office of Information, 26 January 1989.

The CRP will include a schedule of Technical Review Committee (TRC) members and of key project milestones requiring TRC meetings.

The Preliminary Draft CRP will be delivered within 90 days from receipt of the existing CRP from the government. Three copies will be provided to the RPM and 3 copies to the MCAS El Toro. The Draft CRP incorporating government comments will be delivered within 21 days from receipt of comments assuming major revisions are not required. Five copies will be provided to the RPM and 15 copies the MCAS El Toro. The Final CRP will be delivered within 21 days from receipt of comments assuming major revisions are not required. Five copies will be provided to the RPM and 15 copies the MCAS El Toro. In addition to the copies required above, an unbound, camera-ready copy of the Draft and Final deliverables will be provided to the MCAS El Toro.

2.6 Task 6 - Site Management Plan

The Site Management Plan (a project overview) will present an overview of the schedule, interrelationships and integration of the RI/FS tasks specified under this CTO. It will be prepared under the assumption that the site will be included on the NPL in the near future. The purpose of the Site Management Plan is to organize the approach to the RI/FS to maximize the usefulness of the data that is generated. It is also intended to bring together the major elements of the RI/FS investigation to provide an overview of the overall program for upper management and others. As there are multiple tasks which are to be performed simultaneously, particular attention will be focused to avoid duplication of effort. A presentation of a cost and time effective approach for achieving IR program goals will be provided, possibly including a discussion of operable units. The Site Management Plan will be used as a tool to help work progress according to priorities and objectives established for the completion of the RI/FS. Review of Preliminary Draft and Draft reports by the Navy and regulatory agencies will be highlighted on Gantt charts. Activities that are on a critical path to the completion of the RI/FS effort will be clearly depicted on the Gantt charts.

The Preliminary Draft Site Management Plan will be delivered within 60 Days from approval of the IP. The plan will include an executive summary section. Three copies will be provided to the RPM and 3 copies to the MCAS El Toro. The Draft Site Management Plan incorporating government comments will be delivered within 21 days from receipt of comments assuming major revisions are not required. Five copies will be provided to the RPM and 15 copies to the MCAS El Toro. The Final Site Management Plan will be delivered within 21 days from receipt of comments assuming

major revisions are not required. Five copies will be provided to the RPM and 15 copies to the MCAS El Toro. In addition to the copies required above, an unbound, camera-ready copy of the Draft and Final deliverables will be provided to the MCAS El Toro.

2.7 Task 7 - Review and Update the Administrative File

Although the SOW requests the compilation of an Administrative Record, based on discussions with the RPM an Administrative File is expected. Documents, maps and photographs pertinent to the IRP at the site will be compiled. The RPM has already provided Jacobs with some of the key reports developed for the site. An up-to-date copy of the Administrative File will be kept at a local library, to be specified by MCAS El Toro. Files available at the MCAS El Toro, EPA and the Santa Ana RWQCB will also be reviewed. Reports, data and correspondence which relate to the actions taken or contemplated at the site will be copied during the execution of the IP for inclusion in the site files. Within 120 days a relatively complete file will be established for review by the RPM.

The purpose of the Administrative File is to provide a compilation of documents that were considered or relied upon to select the response actions. The contents of the record should be able to demonstrate the rationality of the response decision. It must include documentation of public participation and be adequate for judicial review. The record should include information in support of the decision, information in opposition to the decision and justification for all statements in the ROD including facts, analysis of facts, policy and legal analysis, comments, response to comments, decision documents, QA/QC'd documents, chain of custody forms, data summary sheets, and an index.

The Administrative File (as opposed to the AR) is an ongoing collection of documents that the RPM anticipates will eventually constitute the Administrative Record. The index to the file will be on a computerized data base management format that is reviewed and approved by the RPM. While selecting the software to use Jacobs will include an evaluation of the Paradox system as this is the system that the Navy currently employs. Relevant documents compiled, screened and approved by the RPM will be numbered and placed in the Administrative File. New documents will be added to the file as they are generated. The cost of this task was estimated based on the amount of documents received to date and the report that approximately one four-drawer file cabinet, one two-drawer file cabinet, and 6 linear feet of shelved documents remain to be reviewed at the MCAS El Toro offices.

2.8 Task 8 - Meetings, Progress Reports

Jacobs personnel will attend meetings as needed to keep Southwest Division personnel, the MCAS El Toro personnel and regulatory agency personnel informed as to the status of the project. For cost estimating purposes, it is assumed that one meeting per month will be required. Jacobs will provide minutes of meetings attended within seven days of meeting occurrence. Jacobs personnel will also attend meetings of the Technical Review Committee and provide minutes of the meetings to the RPM and the MCAS El Toro. Following approval of the IP a kick off meeting will be scheduled to clarify project implementation. Internal meetings of the Jacobs team are anticipated to include coordination and scheduling meetings and "brainstorming" sessions to develop innovative solutions to site and project problems. Some monthly meetings are expected to coincide with planned deliverables. This will allow for an informal presentation of the material being delivered.

Two copies of monthly progress reports will be provided to the RPM and the MCAS EI Toro for the duration of this CTO as outlined in the CLEAN contract.

3.0 SCHEDULE

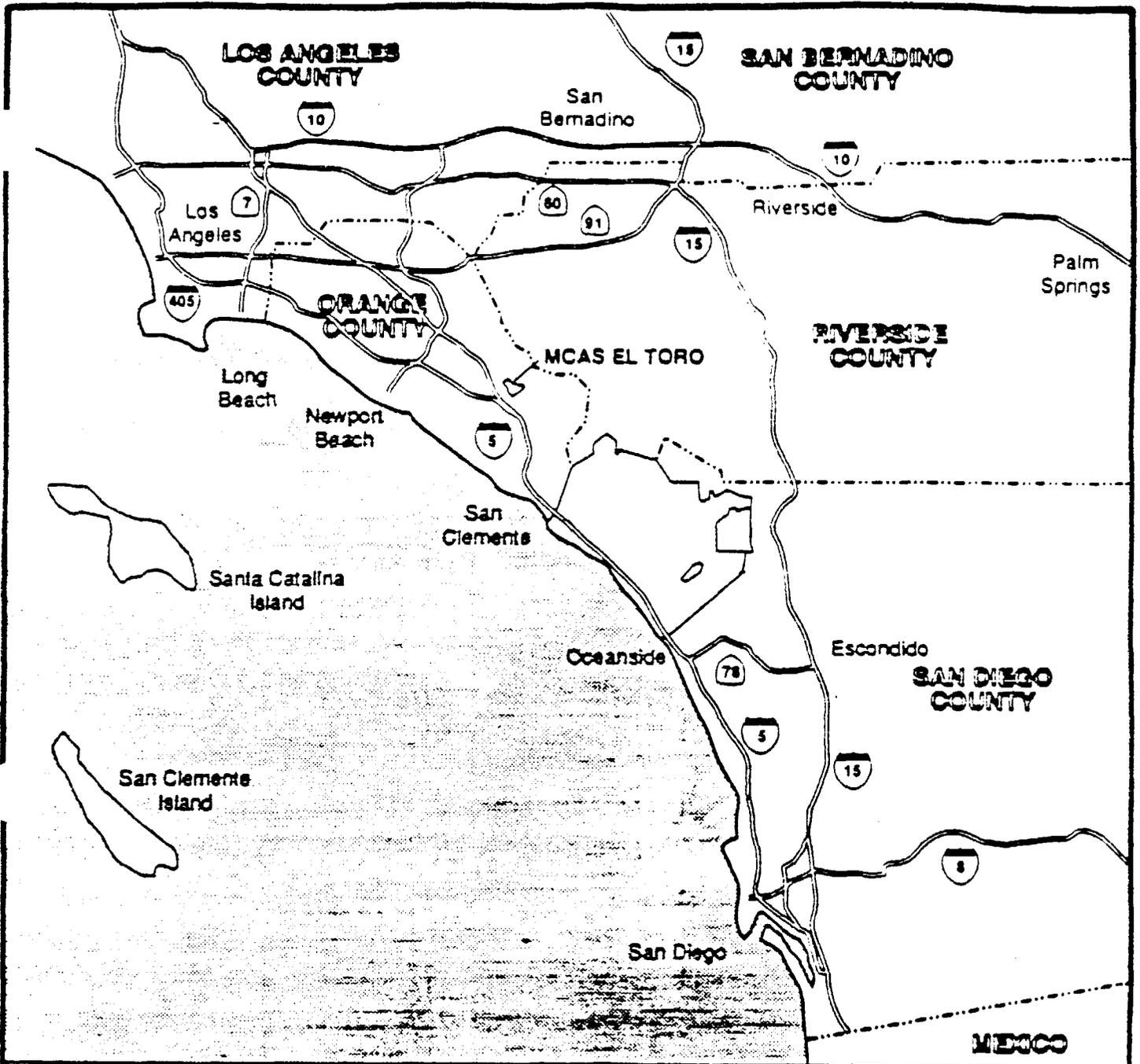
Appendix A identifies each of the activities necessary to complete the CTO. The schedule shows the start and finish dates with applicable logical ties. Using the IP approval date as a starting point, the schedule calls for the delivery of all plans/reports in accordance with the requirements specified in the CTO. Navy review times were developed based upon the anticipated length and complexity of the deliverable and discussions with the RPM. Thirty days will be allowed for Navy review of preliminary drafts and 45 days will be allowed for Navy, TRC, and regulatory review of drafts. This schedule may be adjusted subject to the reviewers schedules/availability. The schedule calls for delivery of Draft and Final reports within 21 days from receipt of comments. If comments require extensive revisions, additional time may be required for Jacobs to respond.

4.0 COST

The cost estimate is provided in Appendix B. It identifies lead technical personnel and functional code personnel by functional code category, contract rate category, hours and amount required to complete CTO #0018. Additionally, anticipated specialty subcontractor costs, travel expenses and other direct costs are provided in the enclosed Exhibits.

The Navy's budget, provided in CTO #0018 is \$142,298. The Jacobs estimated cost, is \$167,548 which is about 18% over the Navy's authorized budget. The Jacobs budget was created by developing the detailed activities and the associated budget necessary to accomplish each activity. A summary of this cost estimate is provided in Appendix B, Schedule A1. The schedule and associated budget for each activity provides a high level of detail for review by the Navy.

FIGURE(S)



Source: U.S. Navy. MCAS Tustin Master Plan, Existing Conditions Report. April 1988.

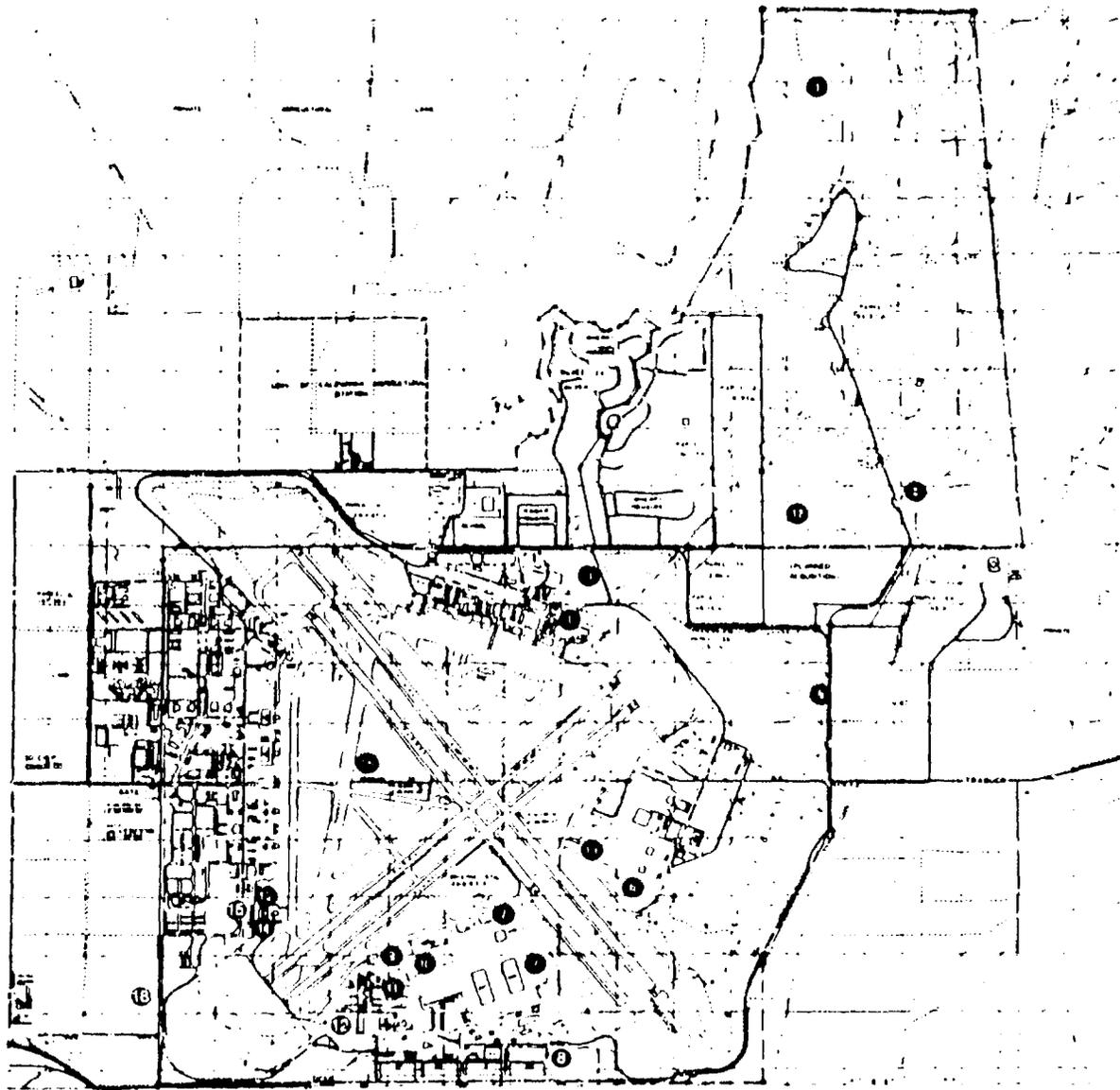


SCALE IN MILES
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INSTALLATION RESTORATION PROGRAM
MARINE CORPS AIR STATIONS
TUSTIN AND EL TORO, CALIFORNIA

FIGURE 1
VICINITY MAP



| SITE NO. | DESCRIPTION |
|----------|---|
| 1 | EXPLOSIVE ORDNANCE DISPOSAL (EOD) RANGE |
| 2 | MAGAZINE ROAD LANDFILL |
| 3 | ORIGINAL LANDFILL |
| 5 | PERIMETER ROAD LANDFILL |
| 6 | DROP TANK DRAINAGE AREA NO. 1 |
| 7 | DROP TANK DRAINAGE AREA NO. 2 (NORTH AREA ONLY) |
| 9 | CRASH CREW PIT NO. 1 |
| 10 | PETROLEUM DISPOSAL AREA |
| 11 | TRANSFER STORAGE AREA |
| 13 | OIL CHANGE AREA |
| 14 | BATTERY ACID DISPOSAL AREA |
| 16 | CRASH CREW PIT NO. 2 |
| 17 | COMMUNICATION STATION LANDFILL |
| 4 | FERROCENE SPILL AREA Δ |
| 10 | ACER SITE Δ |
| 8 | DPDO Storage Yard * |
| 12 | Sludge Drying Beds * |
| 15 | Suspended Fuel Tanks * |
| 18 | Perimeter Investigation * |

Δ REVISED 5/89
 * Revised 1/90

INSTALLATION RESTORATION PROGRAM
 MARINE CORPS AIR STATIONS
 TUSTIN AND EL TORO, CALIFORNIA

LEGEND
 ● SITE NUMBER AND LOCATION



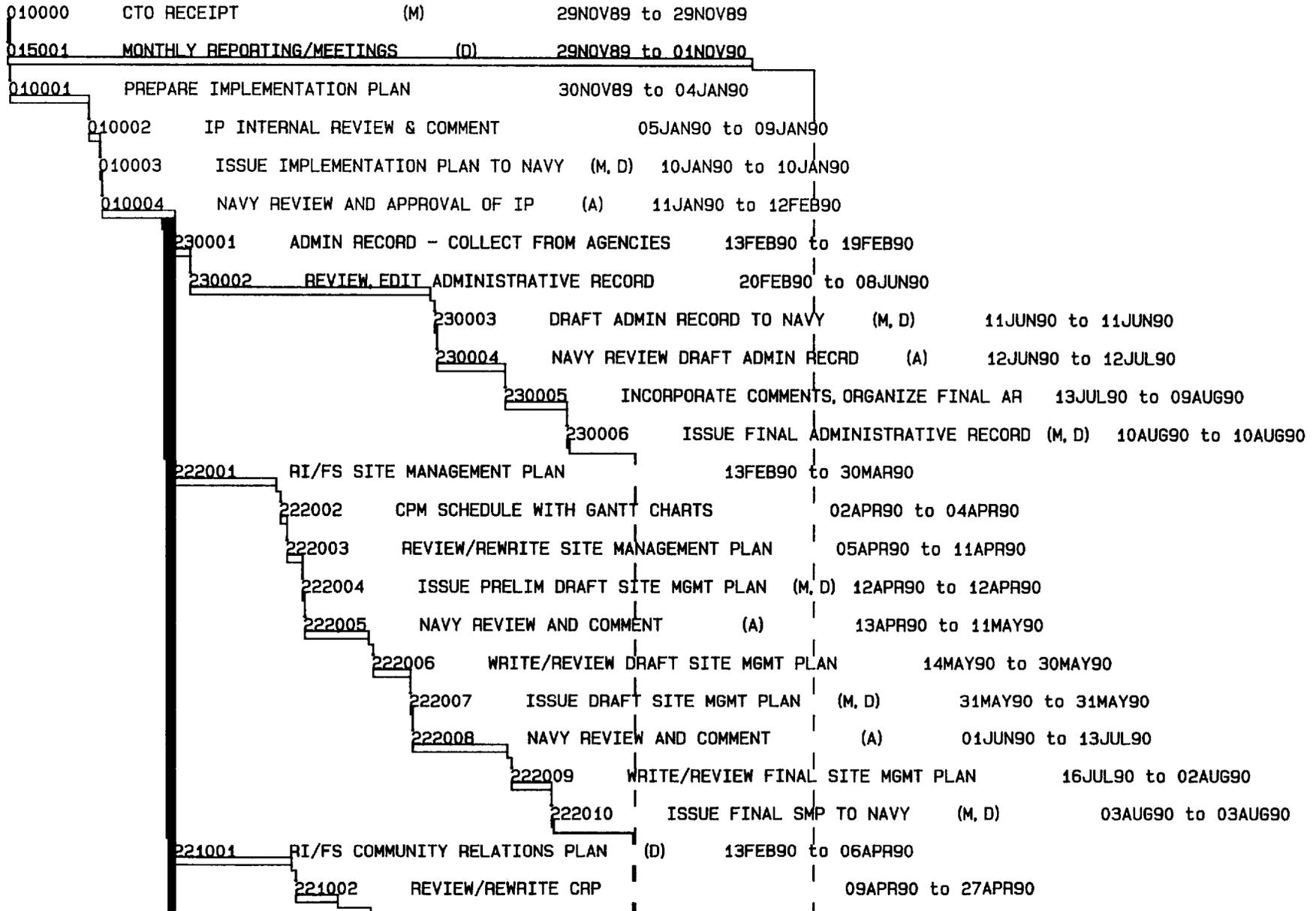
FIGURE 1-1
 VERIFICATION STEP STUDY SITES
 MCAS EL TORO, CALIFORNIA

APPENDIX A

RI/FS WORK PLAN - MCAS EL TORO , CA

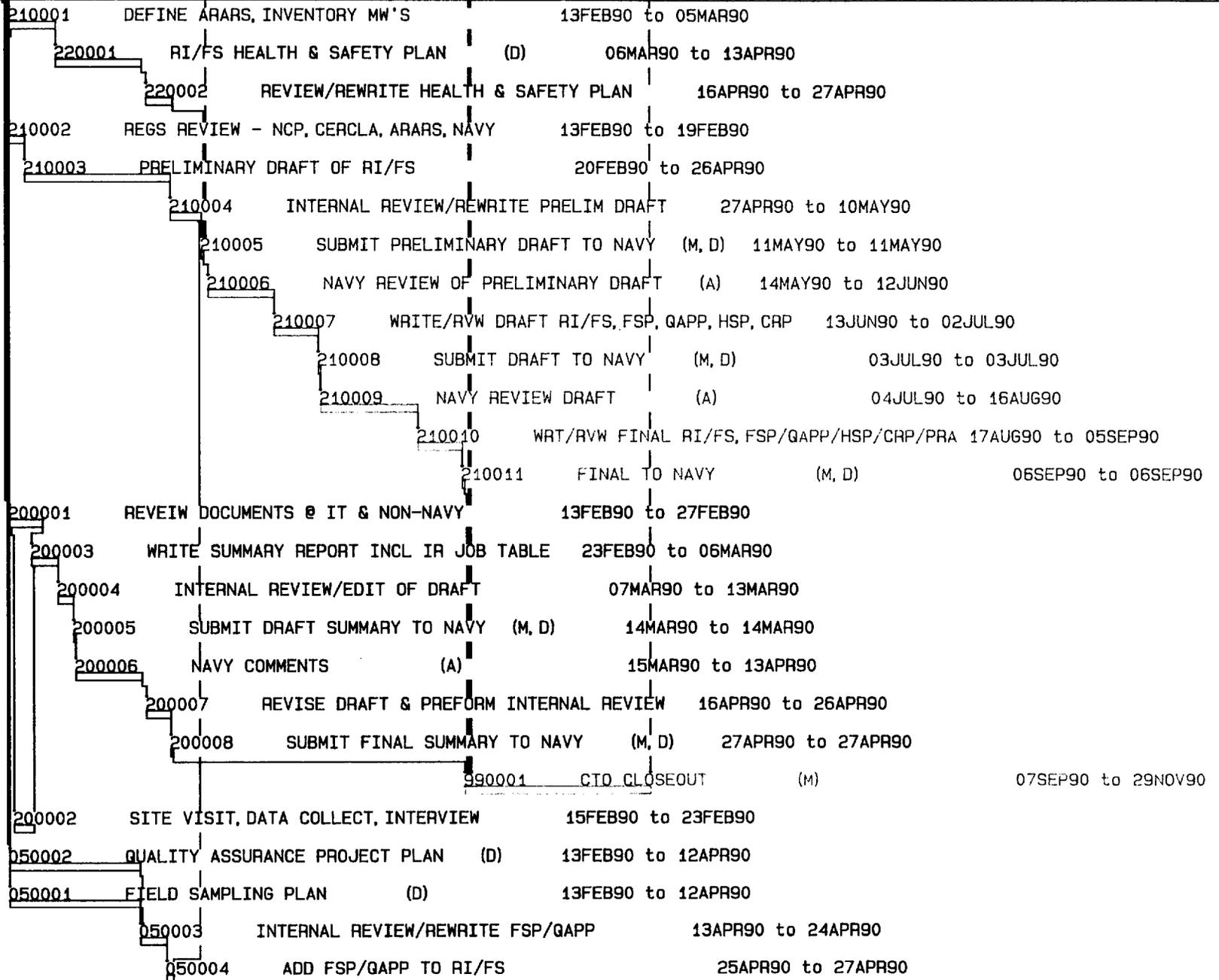
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|
| 89 | | | | | | | | | | | | 90 | | | | | | | | | | | | 91 | | | | | | | | | | | | | | | | | |
| NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AU | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AU | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AU |

A-1



RI/FS WORK PLAN - MCAS EL TORO, CA

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 89 | | | | | | | | | | | | 90 | | | | | | | | | | | | 91 | | | | | | | | | | | | | |
| NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |



A-2

: ACTES

ACTIVITY LISTING by ACTIVITY NUMBER

REPORT DATE: 5FEB90

PROJECT: CT0018

RI/FS WORK PLAN - MCAS EL TORO , CA

TIME NOW:01NOV89

| ACTIVITY | REM ORIG DUR DUR | DESCRIPTION | CODE 1 | CODE 2 | EARLY START | EARLY FINISH | LATE START | LATE FINISH | TOTAL FLOAT |
|----------|---------------------|--|--------|--------|----------------|-----------------|---------------|----------------|----------------|
| 010000 | 1 | 1 CTO RECEIPT | 010 | | 29NOV89 | 29NOV89 | 29NOV89 | 29NOV89 | 0 |
| 010001 | 26 | 26 PREPARE IMPLEMENTATION PLAN | 010 | | 30NOV89 | 04JAN90 | 30NOV89 | 04JAN90 | 0 |
| 010002 | 3 | 3 IP INTERNAL REVIEW & COMMENT | 010 | | 05JAN90 | 09JAN90 | 05JAN90 | 09JAN90 | 0 |
| 010003 | 1 | 1 ISSUE IMPLEMENTATION PLAN TO NAVY | 010 | | 10JAN90 | 10JAN90 | 10JAN90 | 10JAN90 | 0 |
| 010004 | 23 | 23 NAVY REVIEW AND APPROVAL OF IP | 010 | | 11JAN90 | 12FEB90 | 11JAN90 | 12FEB90 | 0 |
| 015001 | 242 | 242 MONTHLY REPORTING/MEETINGS | 015 | | 29NOV89 | 01NOV90 | 27DEC89 | 29NOV90 | 20 |
| 050001 | 43 | 43 FIELD SAMPLING PLAN | 050 | | 13FEB90 | 12APR90 | 26FEB90 | 25APR90 | 9 |
| 050002 | 43 | 43 QUALITY ASSURANCE PROJECT PLAN | 050 | | 13FEB90 | 12APR90 | 26FEB90 | 25APR90 | 9 |
| 050003 | 8 | 8 INTERNAL REVIEW/REWRITE FSP/QAPP | 050 | | 13APR90 | 24APR90 | 26APR90 | 07MAY90 | 9 |
| 050004 | 3 | 3 ADD FSP/QAPP TO RI/FS | 050 | | 25APR90 | 27APR90 | 08MAY90 | 10MAY90 | 9 |
| 200001 | 11 | 11 REVEIW DOCUMENTS @ IT & NON-NAVY | 200 | | 13FEB90 | 27FEB90 | 25JUN90 | 09JUL90 | 94 |
| 200002 | 7 | 7 SITE VISIT,DATA COLLECT,INTERVIEW | 200 | | 15FEB90 | 23FEB90 | 03JUL90 | 11JUL90 | 98 |
| 200003 | 8 | 8 WRITE SUMMARY REPORT INCL IR JOB TABLE | 200 | | 23FEB90 | 06MAR90 | 05JUL90 | 16JUL90 | 94 |
| 200004 | 5 | 5 INTERNAL REVIEW/EDIT OF DRAFT | 200 | | 07MAR90 | 13MAR90 | 17JUL90 | 23JUL90 | 94 |
| 200005 | 1 | 1 SUBMIT DRAFT SUMMARY TO NAVY | 200 | | 14MAR90 | 14MAR90 | 24JUL90 | 24JUL90 | 94 |
| 200006 | 22 | 22 NAVY COMMENTS | 200 | | 15MAR90 | 13APR90 | 25JUL90 | 23AUG90 | 94 |
| 200007 | 9 | 9 REVISE DRAFT & PREFORM INTERNAL REVIEW | 200 | | 16APR90 | 26APR90 | 24AUG90 | 05SEP90 | 94 |
| 200008 | 1 | 1 SUBMIT FINAL SUMMARY TO NAVY | 200 | | 27APR90 | 27APR90 | 06SEP90 | 06SEP90 | 94 |
| 210001 | 15 | 15 DEFINE ARARS,INVENTORY MW'S | 210 | | 13FEB90 | 05MAR90 | 13FEB90 | 05MAR90 | 0 |
| 210002 | 5 | 5 REGS REVIEW - NCP,CERCLA,ARARS,NAVY | 210 | | 13FEB90 | 19FEB90 | 13FEB90 | 19FEB90 | 0 |
| 210003 | 48 | 48 PRELIMINARY DRAFT OF RI/FS | 210 | | 20FEB90 | 26APR90 | 20FEB90 | 26APR90 | 0 |
| 210004 | 10 | 10 INTERNAL REVIEW/REWRITE PRELIM DRAFT | 210 | | 27APR90 | 10MAY90 | 27APR90 | 10MAY90 | 0 |
| 210005 | 1 | 1 SUBMIT PRELIMINARY DRAFT TO NAVY | 210 | | 11MAY90 | 11MAY90 | 11MAY90 | 11MAY90 | 0 |
| 210006 | 22 | 22 NAVY REVIEW OF PRELIMINARY DRAFT | 210 | | 14MAY90 | 12JUN90 | 14MAY90 | 12JUN90 | 0 |
| 210007 | 14 | 14 WRITE/RVW DRAFT RI/FS,FSP,QAPP,HSP,CRP | 210 | | 13JUN90 | 02JUL90 | 13JUN90 | 02JUL90 | 0 |
| 210008 | 1 | 1 SUBMIT DRAFT TO NAVY | 210 | | 03JUL90 | 03JUL90 | 03JUL90 | 03JUL90 | 0 |
| 210009 | 32 | 32 NAVY REVIEW DRAFT | 210 | | 04JUL90 | 16AUG90 | 04JUL90 | 16AUG90 | 0 |
| 210010 | 14 | 14 WRT/RVW FINAL RI/FS,FSP/QAPP/HSP/CRP/PRA | 210 | | 17AUG90 | 05SEP90 | 17AUG90 | 05SEP90 | 0 |
| 210011 | 1 | 1 FINAL TO NAVY | 210 | | 06SEP90 | 06SEP90 | 06SEP90 | 06SEP90 | 0 |
| 220001 | 29 | 29 RI/FS HEALTH & SAFETY PLAN | 220 | | 06MAR90 | 13APR90 | 19MAR90 | 26APR90 | 9 |
| 220002 | 10 | 10 REVIEW/REWRITE HEALTH & SAFETY PLAN | 220 | | 16APR90 | 27APR90 | 27APR90 | 10MAY90 | 9 |
| 220003 | 39 | 39 RI/FS COMMUNITY RELATIONS PLAN | 221 | | 13FEB90 | 06APR90 | 26FEB90 | 19APR90 | 9 |
| 220004 | 15 | 15 REVIEW/REWRITE CRP | 221 | | 09APR90 | 27APR90 | 20APR90 | 10MAY90 | 9 |
| 220005 | 34 | 34 RI/FS SITE MANAGEMENT PLAN | 222 | | 13FEB90 | 30MAR90 | 19MAR90 | 03MAY90 | 24 |

ACTES

ACTIVITY LISTING by ACTIVITY NUMBER

REPORT DATE: 5FEB90

PROJECT: CT0018

RI/FS WORK PLAN - MCAS EL TORO , CA

TIME NOW:01NOV89

| ACTIVITY | REM DUR | ORIG DUR | DESCRIPTION | CODE 1 | CODE 2 | EARLY START | EARLY FINISH | LATE START | LATE FINISH | TOTAL FLOAT |
|----------|------------|-------------|---|--------|--------|----------------|-----------------|---------------|----------------|----------------|
| 222002 | 3 | 3 | CPM SCHEDULE WITH GANTT CHARTS | 222 | | 02APR90 | 04APR90 | 04MAY90 | 08MAY90 | 24 |
| 222003 | 5 | 5 | REVIEW/REWRITE SITE MANAGEMENT PLAN | 222 | | 05APR90 | 11APR90 | 09MAY90 | 15MAY90 | 24 |
| 222004 | 1 | 1 | ISSUE PRELIM DRAFT SITE MGMT PLAN | 222 | | 12APR90 | 12APR90 | 16MAY90 | 16MAY90 | 24 |
| 222005 | 21 | 21 | NAVY REVIEW AND COMMENT | 222 | | 13APR90 | 11MAY90 | 17MAY90 | 14JUN90 | 24 |
| 222006 | 13 | 13 | WRITE/REVIEW DRAFT SITE MGMT PLAN | 222 | | 14MAY90 | 30MAY90 | 15JUN90 | 03JUL90 | 24 |
| 222007 | 1 | 1 | ISSUE DRAFT SITE MGMT PLAN | 222 | | 31MAY90 | 31MAY90 | 04JUL90 | 04JUL90 | 24 |
| 222008 | 31 | 31 | NAVY REVIEW AND COMMENT | 222 | | 01JUN90 | 13JUL90 | 05JUL90 | 16AUG90 | 24 |
| 222009 | 14 | 14 | WRITE/REVIEW FINAL SITE MGMT PLAN | 222 | | 16JUL90 | 02AUG90 | 17AUG90 | 05SEP90 | 24 |
| 222010 | 1 | 1 | ISSUE FINAL SMP TO NAVY | 222 | | 03AUG90 | 03AUG90 | 06SEP90 | 06SEP90 | 24 |
| 230001 | 5 | 5 | ADMIN RECORD - COLLECT FROM AGENCIES | 230 | | 13FEB90 | 19FEB90 | 12MAR90 | 16MAR90 | 19 |
| 230002 | 79 | 79 | REVIEW,EDIT ADMINISTRATIVE RECORD | 230 | | 20FEB90 | 08JUN90 | 19MAR90 | 05JUL90 | 19 |
| 230003 | 1 | 1 | DRAFT ADMIN RECORD TO NAVY | 230 | | 11JUN90 | 11JUN90 | 06JUL90 | 06JUL90 | 19 |
| 230004 | 23 | 23 | NAVY REVIEW DRAFT ADMIN RECRD | 230 | | 12JUN90 | 12JUL90 | 09JUL90 | 08AUG90 | 19 |
| | 20 | 20 | INCORPORATE COMMENTS,ORGANIZE FINAL AR | 230 | | 13JUL90 | 09AUG90 | 09AUG90 | 05SEP90 | 19 |
| 230006 | 1 | 1 | ISSUE FINAL ADMINISTRATIVE RECORD | 230 | | 10AUG90 | 10AUG90 | 06SEP90 | 06SEP90 | 19 |
| 990001 | 60 | 60 | CTO CLOSEOUT | 990 | | 07SEP90 | 29NOV90 | 07SEP90 | 29NOV90 | 0 |

ACTRELS

PREDECESSOR and SUCCESSOR REPORT

REPORT DATE: 5FEB90

PROJECT: CT0018

RI/FS WORK PLAN - MCAS EL TORO , CA

TIME NOW:01NOV89

| PRECEEDING | | | | SUCCEEDING | | | | | |
|------------|------|-----|--|---------------------------------------|-------------|----------|----------|----------------------|-------------|
| ACTIVITY | TYPE | LAG | DESCRIPTION | ACTIVITY | DESCRIPTION | ACTIVITY | TYPE | LAG | DESCRIPTION |
| *START* | | | => 010000 CTO RECEIPT | => 010001 FS 0 PREPARE IMPLEMENTATION | | | | | |
| | | | | 015001 SS 0 MONTHLY REPORTING/MEETI | | | | | |
| 010000 | FS | 0 | CTO RECEIPT => 010001 PREPARE IMPLEMENTATION PLAN | => 010002 | FS | 0 | IP | INTERNAL REVIEW & CO | |
| 010001 | FS | 0 | PREPARE IMPLEMENTATION => 010002 IP INTERNAL REVIEW & COMMENT | => 010003 | FS | 0 | ISSUE | IMPLEMENTATION PL | |
| 010002 | FS | 0 | IP INTERNAL REVIEW & CO => 010003 ISSUE IMPLEMENTATION PLAN TO N | => 010004 | FS | 0 | NAVY | REVIEW AND APPROVA | |
| 010003 | FS | 0 | ISSUE IMPLEMENTATION PL => 010004 NAVY REVIEW AND APPROVAL OF IP | => 050001 | FS | 0 | FIELD | SAMPLING PLAN | |
| | | | | 050002 | FS | 0 | QUALITY | ASSURANCE PROJE | |
| | | | | 200001 | FS | 0 | REVEIW | DOCUMENTS @ IT & | |
| | | | | 210001 | FS | 0 | DEFINE | ARARS,INVENTORY | |
| | | | | 221001 | FS | 0 | RI/FS | COMMUNITY RELATIO | |
| | | | | 222001 | FS | 0 | RI/FS | SITE MANAGEMENT P | |
| | | | | 230001 | FS | 0 | ADMIN | RECORD - COLLECT | |
| 010000 | SS | 0 | CTO RECEIPT => 015001 MONTHLY REPORTING/MEETINGS | => 990001 | FF | 0 | CTO | CLOSEOUT | |
| | FS | 0 | NAVY REVIEW AND APPROVA => 050001 FIELD SAMPLING PLAN | => 050003 | FS | 0 | INTERNAL | REVIEW/REWRITE | |
| 010004 | FS | 0 | NAVY REVIEW AND APPROVA => 050002 QUALITY ASSURANCE PROJECT PLAN | => 050003 | FS | 0 | INTERNAL | REVIEW/REWRITE | |
| 050001 | FS | 0 | FIELD SAMPLING PLAN => 050003 INTERNAL REVIEW/REWRITE FSP/QA | => 050004 | FS | 0 | ADD | FSP/QAPP TO RI/FS | |
| 050002 | FS | 0 | QUALITY ASSURANCE PROJE | | | | | | |
| 50003 | FS | 0 | INTERNAL REVIEW/REWRITE => 050004 ADD FSP/QAPP TO RI/FS | => 210004 | FF | 0 | INTERNAL | REVIEW/REWRITE | |
| 10004 | FS | 0 | NAVY REVIEW AND APPROVA => 200001 REVEIW DOCUMENTS @ IT & NON-NA | => 200002 | SS | 2 | SITE | VISIT,DATA COLLECT | |
| | | | | 200003 | FS | -3 | WRITE | SUMMARY REPORT IN | |
| 200001 | SS | 2 | REVEIW DOCUMENTS @ IT & => 200002 SITE VISIT,DATA COLLECT,INTERV | => 200003 | FS | -5 | WRITE | SUMMARY REPORT IN | |
| 200001 | FS | -3 | REVEIW DOCUMENTS @ IT & => 200003 WRITE SUMMARY REPORT INCL IR J | => 200004 | FS | 0 | INTERNAL | REVIEW/EDIT OF | |
| 200002 | FS | -5 | SITE VISIT,DATA COLLECT | | | | | | |
| 00003 | FS | 0 | WRITE SUMMARY REPORT IN => 200004 INTERNAL REVIEW/EDIT OF DRAFT | => 200005 | FS | 0 | SUBMIT | DRAFT SUMMARY TO | |
| 00004 | FS | 0 | INTERNAL REVIEW/EDIT OF => 200005 SUBMIT DRAFT SUMMARY TO NAVY | => 200006 | FS | 0 | NAVY | COMMENTS | |
| 200005 | FS | 0 | SUBMIT DRAFT SUMMARY TO => 200006 NAVY COMMENTS | => 200007 | FS | 0 | REVISE | DRAFT & PREFORM | |
| 00006 | FS | 0 | NAVY COMMENTS => 200007 REVISE DRAFT & PREFORM INTERNA | => 200008 | FS | 0 | SUBMIT | FINAL SUMMARY TO | |
| 200006 | FS | 0 | REVISE DRAFT & PREFORM => 200008 SUBMIT FINAL SUMMARY TO NAVY | => 990001 | FS | 0 | CTO | CLOSEOUT | |

ACTRELS

PREDECESSOR and SUCCESSOR REPORT

REPORT DATE: 5FEB90

PROJECT: CT0018

RI/FS WORK PLAN - MCAS EL TORO , CA

TIME NOW:01NOV89

| PRECEEDING | | | | SUCCEEDING | | | | | |
|------------|------|-----|-------------------------|------------|--------------------------------|-----------|------|-----|-------------------------|
| ACTIVITY | TYPE | LAG | DESCRIPTION | ACTIVITY | DESCRIPTION | ACTIVITY | TYPE | LAG | DESCRIPTION |
| J10004 | FS | 0 | NAVY REVIEW AND APPROVA | => 210001 | DEFINE ARARS,INVENTORY MW'S | => 210002 | SS | 0 | REGS REVIEW - NCP,CERCL |
| | | | | | | 220001 | FS | 0 | RI/FS HEALTH & SAFETY P |
| 210001 | SS | 0 | DEFINE ARARS,INVENTORY | => 210002 | REGS REVIEW - NCP,CERCLA,ARARS | => 210003 | FS | 0 | PRELIMINARY DRAFT OF RI |
| 210002 | FS | 0 | REGS REVIEW - NCP,CERCL | => 210003 | PRELIMINARY DRAFT OF RI/FS | => 210004 | FS | 0 | INTERNAL REVIEW/REWRITE |
| 210003 | FS | 0 | PRELIMINARY DRAFT OF RI | => 210004 | INTERNAL REVIEW/REWRITE PRELIM | => 210005 | FS | 0 | SUBMIT PRELIMINARY DRAF |
| 050004 | FF | 0 | ADD FSP/QAPP TO RI/FS | | | | | | |
| 210004 | FS | 0 | INTERNAL REVIEW/REWRITE | => 210005 | SUBMIT PRELIMINARY DRAFT TO NA | => 210006 | FS | 0 | NAVY REVIEW OF PRELIMIN |
| 220002 | FS | 0 | REVIEW/REWRITE HEALTH & | | | | | | |
| 221002 | FS | 0 | REVIEW/REWRITE CRP | | | | | | |
| 210005 | FS | 0 | SUBMIT PRELIMINARY DRAF | => 210006 | NAVY REVIEW OF PRELIMINARY DRA | => 210007 | FS | 0 | WRITE/RVW DRAFT RI/FS,F |
| 210006 | FS | 0 | NAVY REVIEW OF PRELIMIN | => 210007 | WRITE/RVW DRAFT RI/FS,FSP,QAPP | => 210008 | FS | 0 | SUBMIT DRAFT TO NAVY |
| 210007 | FS | 0 | WRITE/RVW DRAFT RI/FS,F | => 210008 | SUBMIT DRAFT TO NAVY | => 210009 | FS | 0 | NAVY REVIEW DRAFT |
| | FS | 0 | SUBMIT DRAFT TO NAVY | => 210009 | NAVY REVIEW DRAFT | => 210010 | FS | 0 | WRT/RVW FINAL RI/FS,FSP |
| 210009 | FS | 0 | NAVY REVIEW DRAFT | => 210010 | WRT/RVW FINAL RI/FS,FSP/QAPP/H | => 210011 | FS | 0 | FINAL TO NAVY |
| 210010 | FS | 0 | WRT/RVW FINAL RI/FS,FSP | => 210011 | FINAL TO NAVY | => 990001 | FS | 0 | CTO CLOSEOUT |
| 210001 | FS | 0 | DEFINE ARARS,INVENTORY | => 220001 | RI/FS HEALTH & SAFETY PLAN | => 220002 | FS | 0 | REVIEW/REWRITE HEALTH & |
| 220001 | FS | 0 | RI/FS HEALTH & SAFETY P | => 220002 | REVIEW/REWRITE HEALTH & SAFETY | => 210005 | FS | 0 | SUBMIT PRELIMINARY DRAF |
| J10004 | FS | 0 | NAVY REVIEW AND APPROVA | => 221001 | RI/FS COMMUNITY RELATIONS PLAN | => 221002 | FS | 0 | REVIEW/REWRITE CRP |
| 221001 | FS | 0 | RI/FS COMMUNITY RELATIO | => 221002 | REVIEW/REWRITE CRP | => 210005 | FS | 0 | SUBMIT PRELIMINARY DRAF |
| 010004 | FS | 0 | NAVY REVIEW AND APPROVA | => 222001 | RI/FS SITE MANAGEMENT PLAN | => 222002 | FS | 0 | CPM SCHEDULE WITH GANTT |
| 222001 | FS | 0 | RI/FS SITE MANAGEMENT P | => 222002 | CPM SCHEDULE WITH GANTT CHARTS | => 222003 | FS | 0 | REVIEW/REWRITE SITE MAN |
| 222002 | FS | 0 | CPM SCHEDULE WITH GANTT | => 222003 | REVIEW/REWRITE SITE MANAGEMENT | => 222004 | FS | 0 | ISSUE PRELIM DRAFT SITE |
| 222003 | FS | 0 | REVIEW/REWRITE SITE MAN | => 222004 | ISSUE PRELIM DRAFT SITE MGMT P | => 222005 | FS | 0 | NAVY REVIEW AND COMMENT |
| 222004 | FS | 0 | ISSUE PRELIM DRAFT SITE | => 222005 | NAVY REVIEW AND COMMENT | => 222006 | FS | 0 | WRITE/REVIEW DRAFT SITE |
| 222005 | FS | 0 | NAVY REVIEW AND COMMENT | => 222006 | WRITE/REVIEW DRAFT SITE MGMT P | => 222007 | FS | 0 | ISSUE DRAFT SITE MGMT P |
| 222006 | FS | 0 | WRITE/REVIEW DRAFT SITE | => 222007 | ISSUE DRAFT SITE MGMT PLAN | => 222008 | FS | 0 | NAVY REVIEW AND COMMENT |

ACTRELS

PREDECESSOR and SUCCESSOR REPORT

REPORT DATE: 5FEB90

PROJECT: CT0018

RI/FS WORK PLAN - MCAS EL TORO , CA

TIME NOW:01NOV89

| PRECEEDING | | | SUCCEEDING | | | | |
|------------|------|------------------------------|------------|-----------------------------------|----------|------------------------------|------------------------------|
| ACTIVITY | TYPE | LAG DESCRIPTION | ACTIVITY | DESCRIPTION | ACTIVITY | TYPE | LAG DESCRIPTION |
| 222007 | FS | 0 ISSUE DRAFT SITE MGMT P => | 222008 | NAVY REVIEW AND COMMENT | => | 222009 | FS 0 WRITE/REVIEW FINAL SITE |
| 222008 | FS | 0 NAVY REVIEW AND COMMENT => | 222009 | WRITE/REVIEW FINAL SITE MGMT P => | 222010 | FS 0 ISSUE FINAL SMP TO NAVY | |
| 222009 | FS | 0 WRITE/REVIEW FINAL SITE => | 222010 | ISSUE FINAL SMP TO NAVY | => | 990001 | FS 0 CTO CLOSEOUT |
| 010004 | FS | 0 NAVY REVIEW AND APPROVA => | 230001 | ADMIN RECORD - COLLECT FROM AG => | 230002 | FS 0 REVIEW,EDIT ADMINISTRAT | |
| 230001 | FS | 0 ADMIN RECORD - COLLECT => | 230002 | REVIEW,EDIT ADMINISTRATIVE REC => | 230003 | FS 0 DRAFT ADMIN RECORD TO N | |
| 230002 | FS | 0 REVIEW,EDIT ADMINISTRAT => | 230003 | DRAFT ADMIN RECORD TO NAVY => | 230004 | FS 0 NAVY REVIEW DRAFT ADMIN | |
| 230003 | FS | 0 DRAFT ADMIN RECORD TO N => | 230004 | NAVY REVIEW DRAFT ADMIN RECRD => | 230005 | FS 0 INCORPORATE COMMENTS,OR | |
| 230004 | FS | 0 NAVY REVIEW DRAFT ADMIN => | 230005 | INCORPORATE COMMENTS,ORGANIZE => | 230006 | FS 0 ISSUE FINAL ADMINISTRAT | |
| 230005 | FS | 0 INCORPORATE COMMENTS,OR => | 230006 | ISSUE FINAL ADMINISTRATIVE REC => | 990001 | FS 0 CTO CLOSEOUT | |
| | FS | 0 SUBMIT FINAL SUMMARY TO => | 990001 | CTO CLOSEOUT | => | *FINISH* | |
| | FF | 0 MONTHLY REPORTING/MEETI | | | | | |
| 210011 | FS | 0 FINAL TO NAVY | | | | | |
| 222010 | FS | 0 ISSUE FINAL SMP TO NAVY | | | | | |
| 230006 | FS | 0 ISSUE FINAL ADMINISTRAT | | | | | |

OPEN-PLAN REPORT KEN1 FOR NETWORK CTO018
 WORK PLAN - MCAS EL TORO , PROJECT MILESTONE TARGET REPORT WORKPACKAGE SCHEDULE

PAGE: 1
 RUN DATE: 07FEB90
 DATA DATE: 01NOV89

| ACTIVITY IDENTIFIER | ACTIVITY DESCRIPTION | ORIG DUR | REM DUR | WORKING START | FINISH | TREND START | BASELINE FINISH | VARN. | IMPOSED DATE | RESOURCE TYPE | MH | DOLLARS |
|---------------------|-----------------------------------|----------|---------|---------------|---------|-------------|-----------------|-------|---------------|---------------|-------|---------|
| M 010-000 | CTO RECEIPT | 1 | | 29NOV89 | 29NOV89 | EMPTY | EMPTY | 19823 | Start 29NOV89 | | 0 | 0 |
| 010-001 | PREPARE IMPLEMENTATION PLAN | 26 | | 30NOV89 | 04JAN90 | EMPTY | EMPTY | 19797 | | IP | 60 | 3136 |
| | | | | | | | | | | PG | 40 | 2980 |
| | | | | | | | | | | IN | 5 | 137 |
| | | | | | | | | | | P4 | 20 | 1666 |
| | | | | | | | | | | SP | 16 | 732 |
| | | | | | | | | | | P3 | 12 | 706 |
| | | | | | | | | | | EE | 12 | 463 |
| 010-002 | IP INTERNAL REVIEW & COMMENT | 3 | | 05JAN90 | 09JAN90 | EMPTY | EMPTY | 19794 | | P4 | 4 | 333 |
| A,D 010-003 | ISSUE IMPLEMENTATION PLAN TO NAVY | 1 | | 10JAN90 | 10JAN90 | EMPTY | EMPTY | 19793 | | | 0 | 0 |
| A 010-004 | NAVY REVIEW AND APPROVAL OF IP | 23 | | 11JAN90 | 12FEB90 | EMPTY | EMPTY | 19770 | | | 0 | 0 |
| D 015-001 | MONTHLY REPORTING/MEETINGS | 242 | | 29NOV89 | 01NOV90 | EMPTY | EMPTY | 19582 | | P4 | 69 | 5746 |
| | | | | | | | | | | P3 | 60 | 3532 |
| | | | | | | | | | | IN | 18 | 493 |
| | | | | | | | | | | OI | 36 | 1575 |
| | | | | | | | | | | SP | 30 | 1373 |
| | | | | | | | | | | AC | 12 | 368 |
| | | | | | | | | | | OD | .0000 | 1474 |
| | | | | | | | | | | RI | .0000 | 5841 |
| | | | | | | | | | | C3 | .0000 | 5182 |
| | | | | | | | | | | Q1 | .0000 | 270 |
| | | | | | | | | | | C1 | .0000 | 270 |
| D 050-001 | FIELD SAMPLING PLAN | 43 | | 13FEB90 | 12APR90 | EMPTY | EMPTY | 19727 | | (51) P3 | 46 | 2708 |
| | | | | | | | | | | (203) IP | 183 | 9565 |
| | | | | | | | | | | (76) IN | 69 | 1891 |
| D 050-002 | QUALITY ASSURANCE PROJECT PLAN | 43 | | 13FEB90 | 12APR90 | EMPTY | EMPTY | 19727 | | P3 | 5 | 294 |
| | | | | | | | | | | (93) IP | 82 | 4286 |
| | | | | | | | | | | IN | 21 | 576 |
| 050-003 | INTERNAL REVIEW/REWRITE FSP/QAPP | 8 | | 13APR90 | 24APR90 | EMPTY | EMPTY | 19719 | | P3 | 8 | 471 |
| | | | | | | | | | | IP | 45 | 2352 |
| | | | | | | | | | | IN | 16 | 439 |
| | | | | | | | | | | P4 | 21 | 1749 |
| | | | | | | | | | | QA | 21 | 1253 |
| 050-004 | ADD FSP/QAPP TO RI/FS | 3 | | 25APR90 | 27APR90 | EMPTY | EMPTY | 19716 | | | 0 | 0 |
| 200-001 | REVEIW DOCUMENTS @ IT & NON-NAVY | 11 | | 13FEB90 | 27FEB90 | EMPTY | EMPTY | 19759 | | P3 | 6 | 353 |
| | | | | | | | | | | IP | 46 | 2404 |
| | | | | | | | | | | RI | .0000 | 50 |
| 200-002 | SITE VISIT,DATA COLLECT,INTERVIEW | 7 | | 15FEB90 | 23FEB90 | EMPTY | EMPTY | 19761 | | IP | 45 | 2352 |

notes Milestone D Denotes Deliverables A Denotes Navy/Agency Action Required

| ACTIVITY IDENTIFIER | ACTIVITY DESCRIPTION | ORIG DUR | REM DUR | WORKING START | FINISH | TREND START | BASELINE FINISH | VARN. | IMPOSED DATE | RESOURCE TYPE | MH | DOLLARS |
|---------------------|--|----------|---------|---------------|---------|-------------|-----------------|-------|--------------|---------------|-----|---------|
| 200-003 | WRITE SUMMARY REPORT INCL IR JOB TABLE | 8 | | 23FEB90 | 06MAR90 | EMPTY | EMPTY | 19754 | | P3 | 8 | 471 |
| | | | | | | | | | | IP | 40 | 2091 |
| | | | | | | | | | | IN | 10 | 274 |
| 200-004 | INTERNAL REVIEW/EDIT OF DRAFT | 5 | | 07MAR90 | 13MAR90 | EMPTY | EMPTY | 19749 | | P3 | 2 | 118 |
| | | | | | | | | | | IP | 6 | 314 |
| | | | | | | | | | | IN | 2 | 55 |
| | | | | | | | | | | P4 | 8 | 666 |
| 1,D 200-005 | SUBMIT DRAFT SUMMARY TO NAVY | 1 | | 14MAR90 | 14MAR90 | EMPTY | EMPTY | 19748 | | | 0 | 0 |
| A 200-006 | NAVY COMMENTS | 22 | | 15MAR90 | 13APR90 | EMPTY | EMPTY | 19726 | | | 0 | 0 |
| 200-007 | REVISE DRAFT & PREFORM INTERNAL REVIEW | 9 | | 16APR90 | 26APR90 | EMPTY | EMPTY | 19717 | | P3 | 1 | 59 |
| | | | | | | | | | | IP | 4 | 209 |
| | | | | | | | | | | IN | 1 | 27 |
| 1,D 200-008 | SUBMIT FINAL SUMMARY TO NAVY | 1 | | 27APR90 | 27APR90 | EMPTY | EMPTY | 19716 | | | 0 | 0 |
| 210-001 | DEFINE ARARS, INVENTORY MW'S | 15 | | 13FEB90 | 05MAR90 | EMPTY | EMPTY | 19755 | (EE 75) → | P2 | 46 | 2265 |
| | | | | | | | | | | P4 | 4 | 333 |
| | | | | | | | | | | (R) P3 | 16 | 942 |
| 210-002 | REGS REVIEW - NCP, CERCLA, ARARS, NAVY | 5 | | 13FEB90 | 19FEB90 | EMPTY | EMPTY | 19765 | | P4 | 2 | 167 |
| | | | | | | | | | | P3 | 6 | 353 |
| 210-003 | PRELIMINARY DRAFT OF RI/FS | 48 | | 20FEB90 | 26APR90 | EMPTY | EMPTY | 19717 | | P4 | 9 | 749 |
| | | | | | | | | | (174) | P3 | 157 | 9243 |
| | | | | | | | | | | T1 | 9 | 252 |
| | | | | | | | | | | IY | 37 | 1078 |
| | | | | | | | | | | WP | 30 | 638 |
| | | | | | | | | | (215) | EE | 20 | 772 |
| 210-004 | INTERNAL REVIEW/REWRITE PRELIM DRAFT | 10 | | 27APR90 | 10MAY90 | EMPTY | EMPTY | 19707 | | P3 | 10 | 589 |
| | | | | | | | | | | T1 | 1 | 28 |
| | | | | | | | | | (62) | EE | 16 | 618 |
| | | | | | | | | | (76) | IO | 80 | 4362 |
| 1,D 210-005 | SUBMIT PRELIMINARY DRAFT TO NAVY | 1 | | 11MAY90 | 11MAY90 | EMPTY | EMPTY | 19706 | | | 0 | 0 |
| A 210-006 | NAVY REVIEW OF PRELIMINARY DRAFT | 22 | | 14MAY90 | 12JUN90 | EMPTY | EMPTY | 19684 | | | 0 | 0 |
| 210-007 | WRITE/RVW DRAFT RI/FS, FSP, QAPP, HSP, CRP | 14 | | 13JUN90 | 02JUL90 | EMPTY | EMPTY | 19670 | | P3 | 10 | 589 |
| | | | | | | | | | | T1 | 1 | 28 |
| | | | | | | | | | | IY | 2 | 58 |
| | | | | | | | | | (EE 62) → | IO | 96 | 5234 |
| 1,D 210-008 | SUBMIT DRAFT TO NAVY | 1 | | 03JUL90 | 03JUL90 | EMPTY | EMPTY | 19669 | | WP | 10 | 213 |
| | | | | | | | | | | | 0 | 0 |

notes Milestone D Denotes Deliverables A Denotes Navy/Agency Action Required

| ACTIVITY IDENTIFIER | ACTIVITY DESCRIPTION | ORIG DUR | REM DUR | WORKING START | FINISH | TREND START | BASELINE FINISH | VARN. | IMPOSED DATE | RESOURCE TYPE | MH | DOLLARS | |
|---------------------|-------------------------------------|----------|---------|---------------|---------|-------------|-----------------|-------|--------------|---------------|-------|---------|-----|
| A 210-009 | NAVY REVIEW DRAFT | 32 | | 04JUL90 | 16AUG90 | EMPTY | EMPTY | 19637 | | | 0 | 0 | |
| 210-010 | WRT/RVW FINAL | 14 | | 17AUG90 | 05SEP90 | EMPTY | EMPTY | 19623 | | P3 | 3 | 177 | |
| | RI/FS,FSP/QAPP/HSP/CRP/PRA | | | | | | | | | IY | 1 | 29 | |
| | | | | | | | | | (EE AG) → | IO | 27 | 1472 | |
| | | | | | | | | | | WP | 8 | 170 | |
| M,D 210-011 | FINAL TO NAVY | 1 | | 06SEP90 | 06SEP90 | EMPTY | EMPTY | 19622 | | | 0 | 0 | |
| D 220-001 | RI/FS HEALTH & SAFETY PLAN | 29 | | 06MAR90 | 13APR90 | EMPTY | EMPTY | 19726 | | P3 | 11 | 648 | |
| | | | | | | | | | | IJ | 55 | 3528 | |
| | | | | | | | | | | IN | 17 | 466 | |
| | | | | | | | | | | IO | 14 | 763 | |
| 220-002 | REVIEW/REWRITE HEALTH & SAFETY PLAN | 10 | | 16APR90 | 27APR90 | EMPTY | EMPTY | 19716 | | P3 | 3 | 177 | |
| | | | | | | | | | | IJ | 11 | 706 | |
| | | | | | | | | | | IN | 6 | 164 | |
| | | | | | | | | | (PJ 3) → | P4 | 3 | 250 | |
| D 221-001 | RI/FS COMMUNITY RELATIONS PLAN | 39 | | 13FEB90 | 06APR90 | EMPTY | EMPTY | 19731 | | (EE 17) → | P3 | 4 | 235 |
| | | | | | | | | | (I B A) → | IP | 8 | 418 | |
| | | | | | | | | | | IN | 3 | 82 | |
| | | | | | | | | | | SS | .0000 | 1500 | |
| | | | | | | | | | | IK | 3 | 198 | |
| -002 | REVIEW/REWRITE CRP | 15 | | 09APR90 | 27APR90 | EMPTY | EMPTY | 19716 | | P3 | 2 | 118 | |
| | | | | | | | | | | IP | 4 | 209 | |
| | | | | | | | | | (EE 2) → | IN | 1 | 27 | |
| | | | | | | | | | (PJ 1) → | P4 | 1 | 83 | |
| 222-001 | RI/FS SITE MANAGEMENT PLAN | 34 | | 13FEB90 | 30MAR90 | EMPTY | EMPTY | 19736 | | P4 | 3 | 250 | |
| | | | | | | | | | | P3 | 19 | 1119 | |
| | | | | | | | | | | T1 | 6 | 168 | |
| 222-002 | CPM SCHEDULE WITH GANTT CHARTS | 3 | | 02APR90 | 04APR90 | EMPTY | EMPTY | 19733 | | P4 | 13 | 1083 | |
| | | | | | | | | | | P3 | 58 | 3415 | |
| | | | | | | | | | | T1 | 5 | 140 | |
| | | | | | | | | | | SP | 38 | 1740 | |
| 222-003 | REVIEW/REWRITE SITE MANAGEMENT PLAN | 5 | | 05APR90 | 11APR90 | EMPTY | EMPTY | 19728 | | P4 | 3 | 250 | |
| | | | | | | | | | | P3 | 13 | 765 | |
| | | | | | | | | | | T1 | 3 | 84 | |
| | | | | | | | | | (EE 13) → | SP | 13 | 595 | |
| | | | | | | | | | | PJ | 2 | 129 | |
| M,D 222-004 | ISSUE PRELIM DRAFT SITE MGMT PLAN | 1 | | 12APR90 | 12APR90 | EMPTY | EMPTY | 19727 | | | 0 | 0 | |
| A 222-005 | NAVY REVIEW AND COMMENT | 21 | | 13APR90 | 11MAY90 | EMPTY | EMPTY | 19706 | | | 0 | 0 | |
| 222-006 | WRITE/REVIEW DRAFT SITE MGMT PLAN | 13 | | 14MAY90 | 30MAY90 | EMPTY | EMPTY | 19693 | | P4 | 3 | 250 | |
| | | | | | | | | | | P3 | 13 | 765 | |
| | | | | | | | | | | T1 | 3 | 84 | |
| | | | | | | | | | | SP | 13 | 595 | |
| | | | | | | | | | | EE | 3 | 116 | |

M denotes Milestone D Denotes Deliverables A Denotes Navy/Agency Action Required

OPEN-PLAN REPORT KEN1 FOR NETWORK CTO018

PAGE: 4

11/FS WORK PLAN - MCAS EL TORO , PROJECT MILESTONE TARGET REPORT WORKPACKAGE SCHEDULE

RUN DATE: 07FEB90

DATA DATE: 01NOV89

| ACTIVITY IDENTIFIER | ACTIVITY DESCRIPTION | ORIG DUR | REM DUR | WORKING START | FINISH | TREND START | BASELINE FINISH | VAR. | IMPOSED DATE | RESOURCE TYPE | MH | DOLLARS |
|---------------------|--|----------|---------|---------------|---------|-------------|-----------------|-------|--------------|---------------|-------|---------|
| M,D 222-007 | ISSUE DRAFT SITE MGMT PLAN | 1 | | 31MAY90 | 31MAY90 | EMPTY | EMPTY | 19692 | | | 0 | 0 |
| A 222-008 | NAVY REVIEW AND COMMENT | 31 | | 01JUN90 | 13JUL90 | EMPTY | EMPTY | 19661 | | | 0 | 0 |
| 222-009 | WRITE/REVIEW FINAL SITE MGMT PLAN | 14 | | 16JUL90 | 02AUG90 | EMPTY | EMPTY | 19647 | | P4 | 3 | 250 |
| | | | | | | | | | | P3 | 13 | 765 |
| | | | | | | | | | | T1 | 3 | 84 |
| | | | | | | | | | | EE | 3 | 116 |
| | | | | | | | | | | SP | 13 | 595 |
| M,D 222-010 | ISSUE FINAL SMP TO NAVY | 1 | | 03AUG90 | 03AUG90 | EMPTY | EMPTY | 19646 | | | 0 | 0 |
| 230-001 | ADMIN RECORD - COLLECT FROM AGENCIES | 5 | | 13FEB90 | 19FEB90 | EMPTY | EMPTY | 19765 | | P4 | 8 | 666 |
| | | | | | | | | | | P3 | 24 | 1413 |
| | | | | | | | | | | QI | .0000 | 531 |
| | | | | | | | | | | C1 | .0000 | 531 |
| 230-002 | REVIEW,EDIT ADMINISTRATIVE RECORD | 79 | | 20FEB90 | 08JUN90 | EMPTY | EMPTY | 19686 | | P4 | 10 | 833 |
| | | | | | | | | | | (80) P3 | 72 | 4239 |
| | | | | | | | | | | T1 | 20 | 560 |
| | | | | | | | | | | PJ | 2 | 129 |
| | | | | | | | | | | EE | 6 | 232 |
| M,D 230-003 | DRAFT ADMIN RECORD TO NAVY | 1 | | 11JUN90 | 11JUN90 | EMPTY | EMPTY | 19685 | | | 0 | 0 |
| -004 | NAVY REVIEW DRAFT ADMIN RECD | 23 | | 12JUN90 | 12JUL90 | EMPTY | EMPTY | 19662 | | | 0 | 0 |
| -005 | INCORPORATE COMMENTS,ORGANIZE FINAL AR | 20 | | 13JUL90 | 09AUG90 | EMPTY | EMPTY | 19642 | | P4 | 8 | 666 |
| | | | | | | | | | | (55) P3 | 50 | 2944 |
| | | | | | | | | | | (56) T1 | 50 | 1399 |
| | | | | | | | | | | PJ | 1 | 65 |
| | | | | | | | | | | EE | 4 | 154 |
| M,D 230-006 | ISSUE FINAL ADMINISTRATIVE RECORD | 1 | | 10AUG90 | 10AUG90 | EMPTY | EMPTY | 19641 | | | 0 | 0 |
| M 990-001 | CTO CLOSEOUT | 60 | | 07SEP90 | 29NOV90 | EMPTY | EMPTY | 19562 | | SP | 4 | 183 |
| | | | | | | | | | | P3 | 3 | 177 |
| | | | | | | | | | | IN | 2 | 55 |
| | | | | | | | | | | OI | 2 | 88 |

M denotes Milestone

D Denotes Deliverables

A Denotes Navy/Agency Action Required

LEGEND FOR WORK PACKAGE SCHEDULE

| RESOURCE TYPE | DESCRIPTION |
|------------------|------------------------------|
| AC | ACCOUNTING |
| C1 | CH TRAVEL COST |
| C3 | CH OTHER DIRECT COST |
| CA | CONTRACT ADMINISTRATION |
| EE | ENVIRONMENTAL ENGINEERING |
| IB | IT - MANAGER OF PROJECTS |
| IJ | IT - SAFETY |
| IK | IT - CONTRACT ADMINISTRATION |
| IN | IT - WORD PROCESSOR |
| IO | IT - SPEC WRITER |
| IP | IT - GEOLOGIST |
| IY | IT - PROJECT DRAFTING |
| OD | OTHER DIRECT COSTS |
| OI | IT - ACCOUNTING |
| P3 | CH PROFESSIONAL LEVEL 3 |
| P4 | CH PROFESSIONAL LEVEL 4 |
| PC | PROJECT CONTROLS |
| PG | IT - PROJECT MANAGER |
| PJ | PROJECT MANAGER |
| PM | PROGRAM MANAGER |
| QA | QUALITY ASSURANCE |
| QI | IT - TRAVEL |
| RI | IT - ODC'S |
| SP | COST/SCHEDULING/PLANNING |
| SS | SPECIALTY SUBCONTRACTOR |
| T1 | CH TECHNICIAN LEVEL 1 |
| WP | WORD PROCESSOR |

APPENDIX B

SCHEDULE A
SUMMARY OF COSTS BY TASK
CTO# 0018 RI/FS WORK PLAN - MCAS EL TORO ,CA

| ACTIVITY NUMBER | TASK NAME | TASK MANHOURS | | | TASK DOLLARS | |
|-----------------|--------------------------------|---------------|-------|-------|--------------|---------|
| ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 010 | IMPLEMENTATION PLAN | 200 | 169 | 164 | \$ 12,154 | 9,560 |
| 015 | MONTHLY REPORTING,MEETINGS | 276 | 225 | 252 | \$ 31,848 | 17,219 |
| 050 | SAMPLING AND ANALYSIS PLAN | 418 | 517 | 350 | \$ 30,819 | 18,685 |
| 200 | RECORD REVIEW | 256 | 179 | 228 | \$ 11,426 | 14,449 |
| 210 | RI/FS WORK PLAN | 731 | 601 | 545 | \$ 36,469 | 33,708 |
| 220 | RI/FS HEALTH & SAFETY PLAN | 120 | 120 | 80 | \$ 8,109 | 3,649 |
| 221 (189) | RI/FS COMMUNITY RELATIONS PLAN | 26 | 26 | 210 | \$ 3,308 | 12,025 |
| 222 | RI/FS SITE MANAGEMENT PLAN | 280 | 246 | 240 | \$ 15,735 | 13,144 |
| 230 | RI/FS ADMINISTRATIVE RECORD | 380 | 255 | 380 | \$ 17,091 | 19,914 |
| 990 | CTO CLOSE-OUT | | 11 | | \$ 589 | 0 |
| TOTALS | | 2,971 | 2,349 | 2,449 | \$ 167,548 | 142,298 |

NAVY CLEAN PROJECT

JACOBS ENGINEERING GROUP INC.

CONTRACT NO. N68711-89-D-9296

CONTRACT TASK ORDER: 0018

RI/FS WORK PLAN - MCAS EL TORO ,CA

SCHEDULE B
 JACOBS ENGINEERING COSTS
 -->TOTAL COSTS<--

| PMO | CONTRACT RATE CATEGORY | RES CODE | FUNCTIONAL CATEGORY | TOTAL HOURS | RATE | TOTAL COST |
|----------------|---|----------|---------------------------|-------------|---------|------------|
| ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| | PROGRAM MANAGER | PM | PMO | 0 | 48.8810 | 0 |
| | CONTRACTS ADMIN MANAGER | CA | PMO | 0 | 30.0510 | 0 |
| | PROJECT CONTROLS MANAGER | PC | PMO | 0 | 37.1010 | 0 |
| | ----- | ----- | ----- | ----- | ----- | ----- |
| | SUBTOTAL PMO | | | 0 | \$ | 0 |
| LEAD TECHNICAL | ----- | ----- | ----- | ----- | ----- | ----- |
| | PROJECT MANAGER | PJ | | 5 | 35.1700 | 176 |
| | ACCOUNTING | AC | ACCOUNTING | 12 | 16.7030 | 200 |
| | ENVIRONMENTAL ENGINEER | EE | ENVIRONMENTAL ENGINEER | 64 | 21.0500 | 1,347 |
| | QUALITY ASSURANCE MANAGER | QA | QUALITY ASSURANCE MANAGER | 21 | 32.5325 | 683 |
| | SCHEDULING/PLANNING | SP | SCHEDULING/PLANNING | 127 | 24.9625 | 3,170 |
| | WORD PROCESSOR | WP | WORD PROCESSOR | 48 | 11.6000 | 557 |
| | ----- | ----- | ----- | ----- | ----- | ----- |
| | SUBTOTAL CTO | | | 277 | \$ | 6,133 |
| | TOTAL JEG LABOR | | | 277 | \$ | 6,133 |
| | JEG FRINGE BENEFITS | | | | \$ | 1,657 |
| | JEG G & A | | | | \$ | 3,459 |
| | SPECIALTY SUBCONTRACTOR (EXHIBIT 1-SCH B) | | | | \$ | 1,500 |
| | ODC COST (EXHIBIT 2-SCH B) | | | | \$ | 1,474 |
| | TRAVEL COST (EXHIBIT 3-SCH B) NON FEE BEARING | | | | \$ | 0 |
| | ----- | ----- | ----- | ----- | ----- | ----- |
| | TOTAL JEG COST CONTRACT TASK ORDER: 0018 | | | 277 | \$ | 14,223 |
| | SUMMARY OF TOTAL COSTS: | | | | | |
| | TOTAL JEG COST (SCHEDULE B) | | | 277 | \$ | 14,223 |
| | TOTAL IT COST (SCHEDULE C) | | | 1,098 | \$ | 67,744 |
| | TOTAL CH2MHILL COST (SCHEDULE D) | | | 974 | \$ | 70,495 |
| | AWARD FEE | | | N/A | \$ | 15,086 |
| | TOTAL COSTS: | | | ----- | ----- | ----- |
| | RI/FS WORK PLAN - MCAS EL TORO ,CA | | | 2,349 | \$ | 167,548 |
| | ----- | | | ----- | ----- | ----- |

JACOBS ENGINEERING GROUP, INC.
EXHIBIT 1 TO SCHEDULE B
SPECIALTY SUB-CONTRACTORS
CTO# 0018 R1/FS WORK PLAN - MCAS EL TORO ,CA

GRISBY GRAVES COMM. RELATIONS \$ 1,500

TOTAL COST \$ 1,500

JACOBS ENGINEERING GROUP, INC.

EXHIBIT 2 TO SCHEDULE B

OTHER DIRECT COSTS

CTO# 0018 R1/FS WORK PLAN - MCAS EL TORO ,CA

| | | | |
|----------------------------|-----------|----------------|--------|
| REPRODUCTION | 277 HOURS | @ \$ 1.96/hour | \$ 543 |
| MAINFRAME COMPUTER | 277 HOURS | @ \$ 0.99/hour | \$ 274 |
| TELEPHONE / COMMUNICATIONS | 277 HOURS | @ \$ 1.18/hour | \$ 327 |
| POSTAGE / FREIGHT | 277 HOURS | @ \$ 1.19/hour | \$ 330 |

| | | | |
|-------------|--|--|----------|
| TOTAL ODC'S | | | \$ 1,474 |
| | | | ===== |

JACOBS ENGINEERING GROUP, INC.

EXHIBIT 3 TO SCHEDULE B

TRAVEL EXPENSES

CTO# 0018 RI/FS WORK PLAN - MCAS EL TORO ,CA

 0 TRIP(S) FROM: TO:
 0 PERSON(S) DATE: DURATION:
 ID#: 010001 PURPOSE:

 0 AIRFARE @ \$ 0/Each \$ 0
 0 DAYS CAR RENTAL @ \$ 0/Day \$ 0
 0 DAYS HOTEL @ \$ 0/Day \$ 0
 0 DAYS PER DIEM @ \$ 0/Day \$ 0
 0 MILES @ \$ 0.00/Mile \$ 0

 TOTAL TRIP \$ 0

 0 TRIP(S) FROM: TO:
 0 PERSON(S) DATE: DURATION:
 ID#: 210004 PURPOSE:

 0 AIRFARE @ \$ 0/Each \$ 0
 0 DAYS CAR RENTAL @ \$ 0/Day \$ 0
 0 DAYS HOTEL @ \$ 0/Day \$ 0
 0 DAYS PER DIEM @ \$ 0/Day \$ 0
 0 MILES @ \$ 0.00/Mile \$ 0

 TOTAL TRIP \$ 0

 TOTAL TRAVEL COSTS FOR JACOBS ENGINEERING GROUP, INC. \$ 0
 CTO# 0018 RI/FS WORK PLAN - MCAS EL TORO ,CA

NAVY CLEAN PROJECT

JACOBS ENGINEERING GROUP INC.

CONTRACT NO. N68711-89-D-9296

CONTRACT TASK ORDER: 0018

RI/FS WORK PLAN - MCAS EL TORO ,CA

SCHEDULE C

-->INTERNATIONAL TECHNOLOGY CORP.<--

| CONTRACT RATE CATEGORY | RES CODE | FUNCTIONAL CATEGORY | TOTAL HOURS | RATE | TOTAL COST |
|---|----------|-------------------------|-------------|---------|------------|
| PMO | | | | | |
| MANAGER OF TECH PLANNING/ QC | TP | PMO | 0 | 35.0600 | 0 |
| SUBTOTAL PMO | | | 0 | \$ | 0 |
| LEAD TECHNICAL | | | | | |
| MANAGER OF PROJECTS | IB | | 0 | 34.6600 | 0 |
| SAFETY | IJ | SAFETY | 66 | 24.4800 | 1,616 |
| CONTRACT ADMINISTRATION | IK | CONTRACT ADMINISTRATION | 3 | 25.1900 | 76 |
| WORD PROCESSOR | IN | WORD PROCESSOR | 171 | 10.4600 | 1,789 |
| SPEC WRITER | IO | SPEC WRITER | 217 | 20.8100 | 4,516 |
| GEOLOGIST | IP | GEOLOGIST | 523 | 19.9500 | 10,434 |
| PROJECT DRAFTING | IY | PROJECT DRAFTING | 40 | 11.1200 | 445 |
| ACCOUNTING | OI | ACCOUNTING | 38 | 16.7000 | 635 |
| PROJECT MANAGER | PG | PROJECT MANAGER | 40 | 28.4400 | 1,138 |
| SUBTOTAL CTO | | | 1,098 | \$ | 20,649 |
| TOTAL IT CORP. LABOR | | | 1,098 | \$ | 20,649 |
| PMO OVERHEAD @ 112% | | | | \$ | 0 |
| CTO OVERHEAD @ 130% | | | | \$ | 26,844 |
| SUBTOTAL IT LABOR/OVERHEAD | | | 1,098 | \$ | 47,493 |
| SPECIALTY SUBCONTRACTOR (EXHIBIT 1-SCH C) | | | | \$ | 0 |
| ODC COST (EXHIBIT 2-SCH C) | | | | \$ | 5,841 |
| TRAVEL COST (EXHIBIT 3-SCH C) NON FEE BEARING | | | | \$ | 801 |
| SUBTOTAL DIRECT COSTS | | | | \$ | 54,135 |
| G & A @ 12.95% | | | | \$ | 7,010 |
| SUBTOTAL IT DIRECT/G&A COST | | | | \$ | 61,146 |
| AWARD FEE (10%) | | | | \$ | 6,034 |
| FCCOM(OH) @ .02233 | | | | \$ | 461 |
| FCCOM(G&A) @ .0019 | | | | \$ | 103 |
| TOTAL COSTS: | | | | | |
| RI/FS WORK PLAN - MCAS EL TORO ,CA | | | | \$ | 67,744 |

INTERNATIONAL TECHNOLOGY CORP.

EXHIBIT 2 TO SCHEDULE C

OTHER DIRECT COSTS

CTO# 0018 RI/FS WORK PLAN - MCAS EL TORO ,CA

| | | | |
|----------------------------|-------------|----------------|----------|
| REPRODUCTION | 1,098 HOURS | @ \$ 1.96/hour | \$ 2,152 |
| MAINFRAME COMPUTER | 1,098 HOURS | @ \$ 0.99/hour | \$ 1,087 |
| TELEPHONE / COMMUNICATIONS | 1,098 HOURS | @ \$ 1.18/hour | \$ 1,296 |
| POSTAGE / FREIGHT | 1,098 HOURS | @ \$ 1.19/hour | \$ 1,307 |

TOTAL ODC'S \$ 5,841
=====

INTERNATIONAL TECHNOLOGY CORP.

EXHIBIT 3 TO SCHEDULE C

TRAVEL EXPENSES

CTO# 0018 RI/FS WORK PLAN - MCAS EL TORO ,CA

6 TRIP(S) FROM: IRVINE,CA TO: SAN DIEGO,CA
1 PERSON(S) DATE: TBD DURATION: 1
ID#: 015001 PURPOSE: MONTHLY PROGRESS MEETING

0 AIRFARE @ \$ 0/Each \$ 0
6 DAYS CAR RENTAL @ \$ 45/Day \$ 270
0 DAYS HOTEL @ \$ 0/Day \$ 0
0 DAYS PER DIEM @ \$ 0/Day \$ 0
0 MILES @ \$ 0.00/Mile \$ 0

TOTAL TRIP \$ 270

1 TRIP(S) FROM: IRVINE ,CA TO: SAN FRANCISCO ,CA
1 PERSON(S) DATE: TBD DURATION: 2
ID#: 230001 PURPOSE: COLLECT EXISTING EPA DOCUMENTS

1 AIRFARE @ \$ 306/Each \$ 306
2 DAYS CAR RENTAL @ \$ 45/Day \$ 90
1 DAYS HOTEL @ \$ 67/Day \$ 67
2 DAYS PER DIEM @ \$ 34/Day \$ 68
0 MILES @ \$ 0.00/Mile \$ 0

TOTAL TRIP \$ 531

TOTAL TRAVEL COSTS FOR INTERNATIONAL TECHNOLOGY CORP. \$ 801
CTO# 0018 RI/FS WORK PLAN - MCAS EL TORO ,CA

NAVY CLEAN PROJECT

JACOBS ENGINEERING GROUP INC.

CONTRACT NO. N68711-89-D-9296

CONTRACT TASK ORDER: 0018

RI/FS WORK PLAN - MCAS EL TORO ,CA

SCHEDULE D
-->CH2MHILL<--

| LEAD TECHNICAL | CONTRACT RATE CATEGORY | RES CODE | FUNCTIONAL CATEGORY | TOTAL HOURS | RATE | TOTAL COST |
|----------------|---|-------------|------------------------|----------------|---------|---------------|
| ED ROGAN | PROFESSIONAL 4 | P4 | PROJECT MANAGER | 192 | 30.9400 | 5,940 |
| | PROFESSIONAL 2 | P2 | PROFESSIONAL 2 | 46 | 18.5200 | 852 |
| | PROFESSIONAL 3 | P3 | PROFESSIONAL 3 | 635 | 21.9700 | 13,951 |
| | TECHNITION 1 | T1 | TECHNITION 1 | 101 | 10.3600 | 1,046 |
| | SUBTOTAL TECHNICAL | | | 974 | \$ | 21,789 |
| | TOTAL CH2MHILL LABOR | | | 974 | \$ | 21,789 |
| | COMPOSITE INDIRECT RATE @ 167% | | | | \$ | 36,388 |
| | SPECIALTY SUBCONTRACTOR (EXHIBIT 1-SCH D) | | | | \$ | 0 |
| | ODC COST (EXHIBIT 2-SCH D) | | | | \$ | 5,182 |
| | TRAVEL COST (EXHIBIT 3-SCH D) NON FEE BEARING | | | | \$ | 801 |
| | FIXED FEE @ 3% | | | | \$ | 1,901 |
| | AWARD FEE @ 7% | | | | \$ | 4,435 |
| | TOTAL COSTS: | | | | | ----- |
| | RI/FS WORK PLAN - MCAS EL TORO ,CA | | | | \$ | 70,495 |
| | | | | | | ===== |

CH2MHILL
EXHIBIT 2 TO SCHEDULE D
OTHER DIRECT COSTS
CTO# 0018 RI/FS WORK PLAN - MCAS EL TORO ,CA

| | | | |
|----------------------------|-----------|----------------|----------|
| REPRODUCTION | 974 HOURS | @ \$ 1.96/hour | \$ 1,909 |
| MAINFRAME COMPUTER | 974 HOURS | @ \$ 0.99/hour | \$ 964 |
| TELEPHONE / COMMUNICATIONS | 974 HOURS | @ \$ 1.18/hour | \$ 1,149 |
| POSTAGE / FREIGHT | 974 HOURS | @ \$ 1.19/hour | \$ 1,159 |

TOTAL ODC'S \$ 5,182
=====

CH2MHILL
EXHIBIT 3 TO SCHEDULE D
TRAVEL EXPENSES

CTO# 0018 RI/FS WORK PLAN - MCAS EL TORO ,CA

6 TRIP(S) FROM: SANTA ANA,CA TO: SAN DIEGO,CA
1 PERSON(S) DATE: TBD DURATION: 1
ID#: 015001 PURPOSE: MONTHLY PROGRESS MEETING

0 AIRFARE @ \$ 0/Each \$ 0
6 DAYS CAR RENTAL @ \$ 45/Day \$ 270
0 DAYS HOTEL @ \$ 0/Day \$ 0
0 DAYS PER DIEM @ \$ 0/Day \$ 0
0 MILES @ \$ 0.00/Mile \$ 0

TOTAL TRIP \$ 270

1 TRIP(S) FROM: SANTA ANA ,CA TO: SAN FRANCISCO,CA
1 PERSON(S) DATE: TBD DURATION: 2
ID#: 230001 PURPOSE: COLLECT EXISTING EPA DOCUMENTS

1 AIRFARE @ \$ 306/Each \$ 306
2 DAYS CAR RENTAL @ \$ 45/Day \$ 90
1 DAYS HOTEL @ \$ 67/Day \$ 67
2 DAYS PER DIEM @ \$ 34/Day \$ 68
0 MILES @ \$ 0.00/Mile \$ 0

TOTAL TRIP \$ 531

TOTAL TRAVEL COSTS FOR CH2MHILL \$ 801
CTO# 0018 RI/FS WORK PLAN - MCAS EL TORO ,CA

APPENDIX C

WASTE MANAGEMENT AND INDUSTRIAL PROCESS TECH TRANSFER TOPICS

CH2M HILL

Author: David Lincoln/SEA

Editor: Greg Peterson/CVO

December 1, 1989

Observational Method in Site Investigation and Remediation

Uncertainty is a major technical and societal issue for hazardous waste site investigation and remediation, beginning with site characterization. From a technical perspective, the subsurface environment presents very substantial uncertainty. It is a heterogeneous, complex environment in which small subsurface features or changes in geologic conditions can have substantial impacts on water and chemical movement. Major uncertainties also plague source characterization, assessment of chemical fate and transport in the environment, assessment of exposure risks and health effects, and remedial action performance.

Taken together, these factors make uncertainty an inherent feature of hazardous waste sites. The consequences of this uncertainty for the traditional engineering paradigm of study, design, build should be considered early in remediation. For example:

- It is generally assumed that more study will reduce uncertainty. But it has not been fully recognized to date that the marginal value of further study at hazardous waste sites declines rapidly. At some point, more study does not lead to better information.
- The implicit goal has been to design the "ultimate remedy" that can be "walked away from" following construction. But it will not be possible in most cases to walk away from a waste site. No matter what the chosen alternative, continued monitoring will be required.

Origins of the Observational Method

Karl Terzaghi, a soil mechanics engineer, first developed systematic procedures for engineering under conditions of uncertainty. He called these procedures the "observational," "experimental," or "learn-as-you-go" method. Geotechnical engineers have used the observational method for many years to work with the physical uncertainties in soils and foundations problems.

R.B. Peck summarized the key elements in the practice of the observational method:

- a. Exploration sufficient to establish at least the general nature, pattern, and properties of the deposits, but not necessarily in detail.
- b. Assessment of the most probable conditions and the most unfavorable conceivable deviations from these conditions.
- c. Establishment of the design based on a working hypothesis of behavior anticipated under the most probable conditions.

- d. Selection of quantities to be observed as construction proceeds and calculation of their anticipated values on the basis of the working hypothesis.
- e. Calculation of values of the same quantities under the most unfavorable conditions compatible with the available data concerning the subsurface conditions.
- f. Selection in advance of a course of action or modification of design for every foreseeable significant deviation of the observational findings from those predicated on the basis of the working hypothesis.
- g. Measurement of quantities to be observed and evaluation of actual conditions.
- h. Modification of design to suit actual conditions.

The observational method is not applicable if a design cannot be altered during construction. It also should not be applied if the monitoring and response to one of the potential deviations costs more than a more conservative design.

The nature and complexity of the work will determine the degree to which all of these elements are included. Some engineering projects have been initiated with the observational method, and it has been used on others as the only way out of a current situation (e.g., construction has started and some unexpected event has occurred).

Failures of the Observational Method

Failures of the observational method can occur under several conditions. Each condition is discussed below.

Failure to anticipate unfavorable conditions. This failure will leave a project without a course of action identified in advance, and there may be no available response to the current situation. A corollary of this is that the observational method should not be started if a contingency plan cannot be identified for all potential and significant deviations.

Failure to choose and interpret the correct quantities to observe. If the measured quantity does not address what is of real concern, then it may fail to give appropriate warnings. The results of the observations must also be reliable. (Peck explicitly suggests that whoever plans the monitoring program should have substantial field experience.) The field results must be examined promptly, and the field team should not feel compelled to wait for a fully documented report to be prepared. The results must be

presented in a thoughtful manner, reflecting on potentially significant events, not just filling in a table.

Failure to consider the influence of progressive failure. Progressive failures may be relatively small and undetected until something snaps and a massive failure occurs.

Incorporating the Observational Method

The observational method fundamentally recognizes that uncertainty is present and uses a structured approach to determine the appropriateness of the design as it is being implemented. It requires planning for potential unfavorable conditions and potential design modifications.

Figure 1 outlines the issues that need to be added to the traditional waste site investigation and remediation process to incorporate the observational method. It is important to understand, however, that there is no "cookbook method" for the application.

The observational method offers distinct benefits in the timely and effective implementation of waste site remediation in the presence of substantial uncertainty. The key contributions, through the method's explicit recognition of uncertainty, are:

- Remedial design based on most probable site conditions

- Identification of reasonable deviations from those conditions
- Identification of parameters to observe to detect deviations during remediation
- Preparation of contingency plans for each deviation. The observational method offers the potential, on a case-by-case basis, to reduce time and cost, as well as to decrease the risks associated with remediation.

Several CH2M HILL papers and projects have included the observational method. Our process is evolving with each application, and additional internal contacts for the method are being developed.

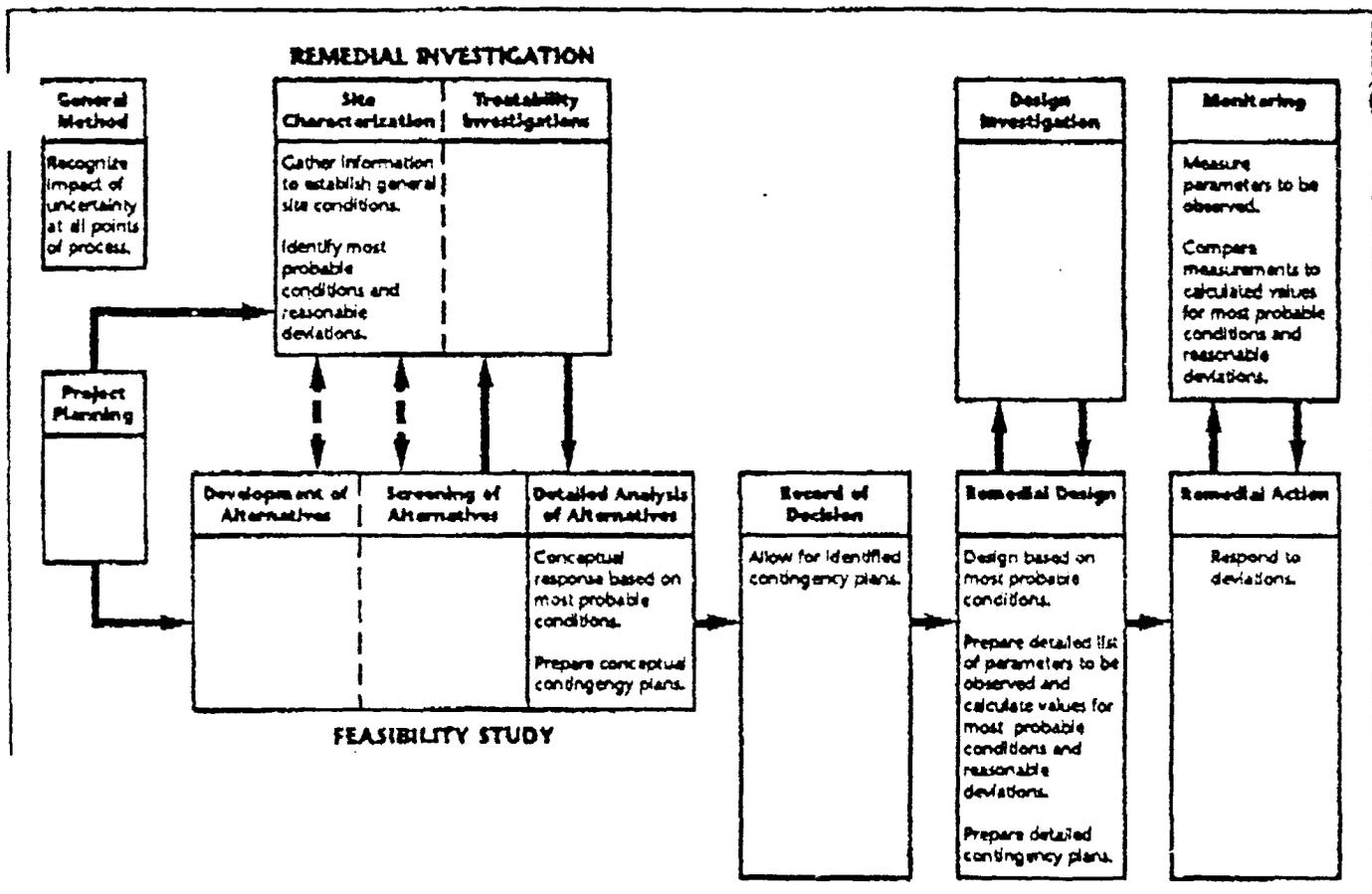


Figure 1
Issues Added to the Investigation and Remediation Process to Implement the Observational Method