File: 541.460.000n
C.G.

312 0

THE MEMPHIS DEPOT
TENNESSEE

ADMINISTRATIVE RECORD
COVER SHEET

AR File Number 312

TECHNICAL MEMORANDUM **CH2MHILL**

Field Sampling Plan for Additional Groundwater Investigations

PREPARED FOR: Dorothy Richards/CEHNC
Shawn Phillips/DDSP-FE
Jordan English/TDEC
Ramon Torres/EPA Region IV

PREPARED BY: Greg Underberg/ORO

COPIES: Dan Marion/ATL
Mike Harris/ATL

DATE: May 8, 1998

Introduction

Previous well installation and groundwater sampling activities through 1993 indicated the presence of organic and inorganic constituents exceeding levels of concern in groundwater primarily at Dunn Field, but also at other locations within the Main Installation (MI) at DDMT. In January and February of 1996, DDMT expanded the groundwater monitoring network with additional wells to evaluate the extent of contamination west of Dunn Field and to confirm the groundwater flow directions across the MI. An interim groundwater extraction system is currently being installed at Dunn Field to remediate the offsite groundwater plume resulting from historical disposal operations at Dunn Field. A groundwater monitoring program at DDMT has been conducted since the spring of 1997. Groundwater characterization results have been reported in the *Groundwater Characterization Data Report* (CH2M HILL, 1997) and *Groundwater Monitoring Reports* for June and September, 1997.

The purpose of this memorandum is to identify additional groundwater monitoring data needed to complete groundwater characterization, primarily at the MI. Additional groundwater data collection is necessary to satisfy the following objectives:

- Monitor the hydraulic and chemical characteristics of groundwater as it flows offsite from the MI.
- Evaluate the extent of the VOC plumes in the southeast and southwest sections of the facility.
- Monitor the hydraulic and chemical characteristics of groundwater flowing in a southwest direction from Dunn Field.
- Confirm the extent of VOC contamination north and northwest of Dunn Field.

Groundwater Characterization and Monitoring Strategy

The general hydrogeology of the DDMT area and groundwater flow conditions across Dunn Field and the MI are described in the *Generic Remedial Investigation/Feasibility Study Work Plan* (CH2M HILL, 1995) and the *Groundwater Characterization Data Report* (CH2M HILL, 1997). As discussed in Section 1.3.2 of the *Groundwater Characterization Data Report*, groundwater flow in the Fluvial Aquifer is controlled primarily by the orientation of the erosional paleosurface of the upper clay in the Jackson Formation/Upper Claiborne Group. This clay serves as the base of the uppermost, unconfined Fluvial Aquifer. Groundwater generally follows the slope of this clay unit. As shown in the potentiometric surface presented in Figure 1, a prominent feature of the Fluvial Aquifer flow system at DDMT is a generally northwest-southeast trending depression in the clay surface located in the northwest portion of the MI. The depressed clay surface may result from either an erosional surface in the clay or a sand lens within the clay that comprises the Cockfield Formation of the Upper Claiborne Group. Groundwater flow directions across the MI and the southern portion of Dunn Field are controlled by this feature.

It has not been determined if the depressed clay and potentiometric surface result from a "window" or gap in the Jackson Formation/Upper Claiborne Group clay that allows direct hydraulic connection between the Fluvial Aquifer and the underlying, generally confined sand aquifer. Based on a review of regional stratigraphic information discussed in Section 1.3.2 of the *Groundwater Characterization Data Report*, it has also not been determined that the underlying confined sand is the Memphis Sand, the water supply aquifer for the City of Memphis, or a different sand within the Cook Mountain Formation. The strategy for groundwater protection at the DDMT MI and Dunn Field will presume the conservative assumption that the depressed potentiometric surface results from a direct hydrologic connection between the Fluvial Aquifer and the Memphis Sand. Groundwater flowing into this feature will be presumed to be flowing into the Memphis Sand where it can be transported west approximately 1.5 miles to the Allen Wellfield, a series of Memphis Sand pumping wells that supply the City of Memphis.

Areas of groundwater contamination in the southwest and southeastern areas are approximately 3,000 and 4,500 ft, respectively, from the estimated location of the northwest trending feature discussed above. Groundwater velocities across the MI area have been estimated to range from 0.6 to 2.1 ft/day [see Section 3.1 of the *Quarterly Groundwater Monitoring Report* (CH2M HILL, September, 1997)]. Therefore, ranges of groundwater travel times from the southwest and southeast areas are approximately 3.9 to 13.7 and 5.8 to 20 years, respectively.

Groundwater from the Fluvial Aquifer is not used for human consumption in the Memphis area. Fluvial groundwater beneath Dunn Field and the MI is not expected to be used for industrial or potable purposes; therefore, exposure to the Fluvial Aquifer groundwater from future activities at DDMT is not expected. The focus of the MI groundwater strategy will be on evaluating and monitoring potential groundwater contaminant fluxes from the MI. The proposed groundwater monitoring strategy on the MI consists of two primary components:

1. Groundwater quality monitoring surrounding the erosional paleosurface of the confining unit clay in the northwest and north-central areas of the MI will be used to establish chemical migration pathways and to evaluate these pathways

as they relate to the presumed hydraulic connection with the Memphis Sand Aquifer.

2. Delineation of the extent, particularly offsite, of VOC groundwater contamination in the southeast and southwest areas of the MI. Additional corrective measures, if necessary, will be addressed in the MI Remedial Investigation/Feasibility Study.

The groundwater protection strategy for Dunn Field also centers on protection of the quality of groundwater flowing into the clay feature. Removal of contaminated groundwater near the Dunn Field source areas is already being implemented. Additional groundwater monitoring points will need to be established to close up gaps in the existing monitoring well network downgradient of Dunn Field. Groundwater constituents of concern will be monitored in offsite wells to evaluate the effectiveness of the groundwater removal system.

Additional Groundwater Monitoring Activities

To implement the groundwater monitoring strategy discussed in the previous section, additional groundwater monitoring wells will be installed. The wells will be monitored for groundwater quality parameters and water levels. During the installation of the wells the lithology of the confining clay unit will be determined as well as the configuration of the erosional paleosurface. Conceptually, it is expected that the erosional paleosurface is a hydraulic boundary that controls the access and movement of groundwater at DDMT.

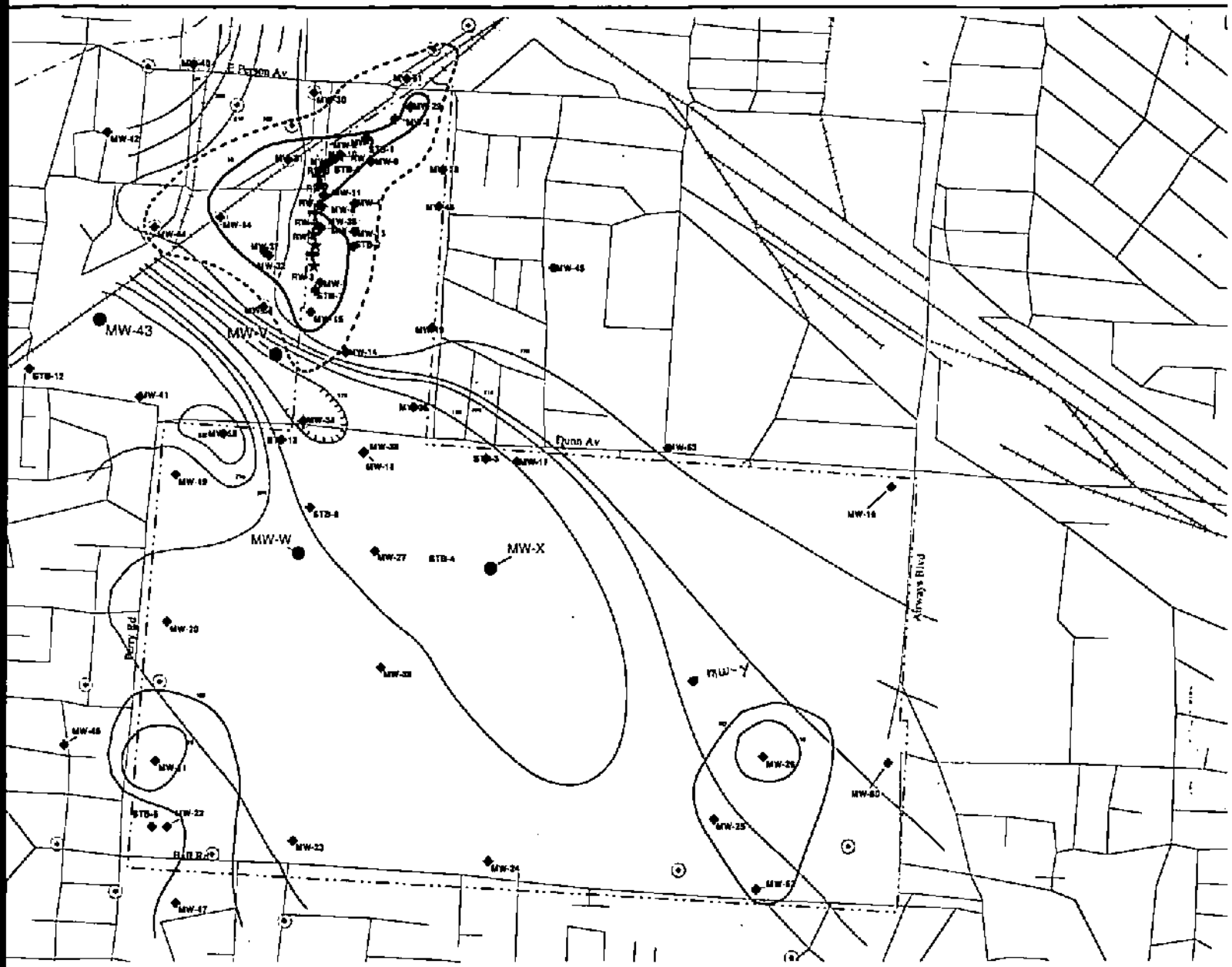
An evaluation of push technology to obtain groundwater grab samples is currently being scheduled. DDMT has previously been considered an inappropriate site for push technology due to the depth to groundwater (over 80 ft) and the unconsolidated sands comprising the Fluvial Aquifer. However, a local vendor has indicated that advances in the technology and larger push rigs have improved the likelihood of success. If this technique is successful, push technology is proposed to obtain VOC groundwater samples to delineate VOC plumes in the southeast and southwest portions of the MI and confirm the extent of groundwater contamination downgradient of Dunn Field. If push technology is not successful, additional wells may be installed south and southwest of the southwestern groundwater plume.

Additional groundwater characterization is proposed in Table 1 and located on Figure 1. Figure 1 also identifies soil test borings (STB locations) which do not provide water quality or water level information, but do provide a clay configuration control point.

Table 1. Additional Groundwater Characterization		
Description	**Purpose**	**Comments**
Install Well MW-W at the base of the Fluvial Aquifer.	Monitor groundwater flow from the western and southwestern portion of the MI towards the potentiometric depression. The well will also provide additional groundwater flow data and resolution of the top of clay configuration.	Groundwater quality monitoring between the southwest portion of the MI and the potentiometric depression is only occurring at MW-39. Well MW-27 is completed in a perched zone above the base of the Fluvial Aquifer and therefore is not representative of Fluvial Aquifer conditions.
Install Well MW-X at the base of the Fluvial Aquifer.	Monitor groundwater flow from the eastern and northeastern portion of the MI towards the potentiometric depression. The well will also provide additional groundwater flow data and resolution of the top of clay configuration.	This location will delineate the eastern extent of the clay feature and provide groundwater quality and level control for the northeastern portion of the MI.
Install Well MW-Y at the base of the Fluvial Aquifer.	Monitor groundwater flow from the southeastern portion of the MI towards the potentiometric depression. The well will also provide additional groundwater flow data and resolution of the top of clay configuration.	This location will delineate the southeastern extent of the clay feature and provide groundwater quality and level control for the southeastern portion of the MI.
Install Well MW-V at the base of the Fluvial Aquifer.	Provide an additional groundwater monitoring point between well MW-34 (located in the clay depression) and wells MW-14/15/33 located upgradient of the depression. Evaluate if trace VOC concentrations at MW-34 are from the plume detected at MW-15 or the MI. Provide an additional water level and quality monitoring point for the performance of the extraction system.	MW-15 contains VOCS in concentrations up to 300 ug/l. MW-33 has been free of VOC contamination. Wells MW-14 and -34 contains trace (<5 ug/L) concentrations.
Abandon existing well MW-43 and install a replacement to the base of the Fluvial Aquifer.	MW-43 was drilled but completed above the base of the Fluvial Aquifer. Control on the top of the clay surface is needed here to confirm the alignment of the clay feature. Groundwater quality data is needed to evaluate potential contaminant fluxes to offsite receptors. Water level data is needed to confirm the flow directions.	A well should be located between MW-44 and MW-41. MW-43 is currently placed in the only area with access.
Push sampling at the southwest portion of the MI.	Evaluate the extent of the PCE plume where there is inadequate well placement. Particular area of concern is offsite south of MW-47 and potentially southwest of MW-21.	Routine sampling at MW-47 shows PCE concentrations ranging from 4 to 23 ug/L. Potential for offsite plume migrating onsite. Well south of MW-47 may be needed for additional water level control.
Push sampling at the southeast portion of the MI.	Confirm that the PCE plume does not extend sidegradient between MW-50 and MW-51. Evaluate the northwestern extent between MW-26 and the clay feature.	Trace concentrations of PCE (<5ug/L) at MW-26 and MW-52 delineate southern and southwestern edges of plume.

Table 1. Additional Groundwater Characterization

Description	Purpose	Comments
Push sampling north of Dunn Field	Evaluate potential offsite sources for trace concentrations of TCE in MW-51. Confirm the location of the TCE plume non-detect line between MW-31 and MW-40. Confirm that there is no VOC transport between MW-40 and MW-42.	September 1997 groundwater quality data indicates continued migration of VOCs to areas north of Dunn Field.



LEGEND

- ALLUVIAL AQUIFER WELL/BOREHOLE
- GROUNDWATER EXTRACTION WELL
- CHEMICAL MONITORING WELL
- POTENTIAL PIEZOMETER LOCATION
- PROPOSED GEOPROBE LOCATION
- PROPOSED NEW WELL LOCATION
- POTENTIOMETRIC SURFACE (FT MSL)
- TCE CONCENTRATION (UG/L)
- PCE CONCENTRATION (UG/L)

FIGURE 1
Proposed Additional Groundwater Sampling
DEFENSE DEPOT, MEMPHIS TENNESS

FINAL PAGE

ADMINISTRATIVE RECORD

FINAL PAGE

FINAL PAGE

ADMINISTRATIVE RECORD

FINAL PAGE