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REVISED SITE-SCALE POTENTIOMETRIC SURFACE MAP FOR YUCCA MOUNTAIN, NEVADA

Prepared for

U.S. Nuclear Regulatory Commission
Contract NRC–02–97–009

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May 2002

ABSTRACT

This report discusses the data and approach used to revise the site-scale potentiometric surface map for Yucca Mountain, Nevada. The previous version of this map was based on more limited data (e.g., some, but not all, of the Phase 2 wells and no Phase 3 wells). Preliminary water-level data from Phase 3 wells and recent water-level data from Phase 2 wells of the Nye County Early Warning Drilling Program were used to revise the potentiometric surface. The revised map presented in this report agrees favorably with the U.S. Department of Energy (DOE) site-scale potentiometric surface map [Civilian Radioactive Waste Management System Management and Operating Contractor (CRWMS M&O), 2000, Figure 1-2]. Differences between the DOE potentiometric surface map and the revised map include: (i) the contour interval used, (ii) the interpreted potentiometric surface in the revised map is limited to the Yucca Mountain area north of Amargosa Farms, and (iii) recent Nye County Early Warning Drilling Program water-level data were used in the interpretation for the revised potentiometric surface map.

Reference:

CRWMS M&O. "Water-Level Data Analysis for the Saturated Zone Site-Scale Flow and Transport Model." ANL–NBS–HS–000034. Rev. 00. Las Vegas, Nevada: CRWMS M&O. 2000.

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ACKNOWLEDGMENTS

This report was prepared to document work performed by the Center for Nuclear Waste Regulatory Analyses (CNWRA) for the U.S. Nuclear Regulatory Commission (NRC) under Contract No. NRC–02–97–009. The activities reported here were performed on behalf of the NRC Office of Nuclear Material Safety and Safeguards, Division of Waste Management. The report is an independent product of the CNWRA and does not necessarily reflect the views or regulatory position of the NRC.

The authors wish to thank Chandrika Manepally for a thorough technical review, and Budhi Sagar for programmatic review. Both administrative and format support were provided by Paulette Houston.

QUALITY OF DATA, ANALYSES, AND CODE DEVELOPMENT

No original data were generated from the analyses presented in this report. Water-level data used in the generation of potentiometric contours are referenced. The original sources should be consulted for determining the level of quality for those data. ArcView Version 3.1 software was used to develop the potentiometric surface map presented in this report. ArcView Version 3.1 is controlled in accordance with CNWRA Technical Operating Procedure (TOP) TOP–018.

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1 INTRODUCTION

The U.S. Department of Energy (DOE) is evaluating Yucca Mountain, Nevada, as a potential site for geologic disposal of high-level waste. If approved, the repository would be located approximately 244–305 m (800–1,000 ft) above the present potentiometric surface. The interpretation of the potentiometric surface at Yucca Mountain is based on well water-level data and is important because it is used to establish potentiometric head values at boundaries for three-dimensional site-scale groundwater flow models (Winterle, et al, 2002). The output from the flow models are used in total-system performance assessments (Mohanty, et al., 2000) that consider both engineered and geologic barrier systems. These assessments are required to evaluate whether the potential repository can meet regulatory requirements.

The addition of new water-level data from the Nye County Early Warning Drilling Program has helped constrain the previous conceptual model of the site-scale potentiometric surface at Yucca Mountain described by Winterle, et al. (2002), specifically in the southern portion of the site along U.S. Highway 95. The Early Warning Drilling Program was initiated in 1998, with the purpose of identifying potential transport paths for contaminants from the proposed repository through the groundwater system. Borehole locations were selected to provide information pertaining to the depth of the water table, stratigraphy, and groundwater chemistry. The program was divided into three phases. Phase 1, which was completed in 1999, consisted of a well transect extending along U.S. Highway 95 southwest of Yucca Mountain to the eastern edge of Fortymile Wash. Phase 2, which was completed in 2001, consisted of a well transect similar in location to Phase 1. Phase 3, which is in progress during the time of this report, consists of a well transect that extends north of U.S. Highway 95 into the Fortymile Wash area (Figure 1-1).

A revised interpretation of the site-scale potentiometric surface for Yucca Mountain utilizing new water-level data obtained from the Nye County Early Warning Drilling Program is discussed in this report.

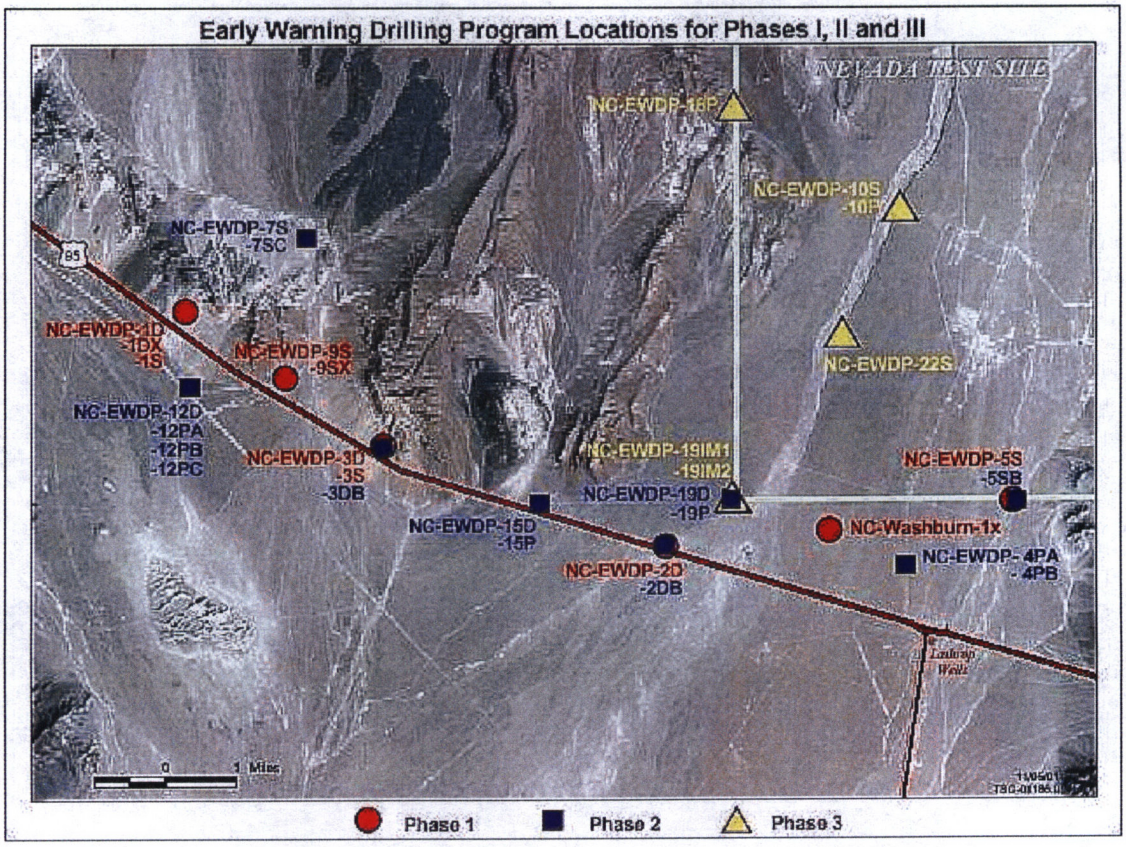

Figure 1-1. Location of Boreholes for Phases 1, 2, and 3 of the Nye County Early Warning Drilling Program*

*Figure can be obtained from internet site http://www.nyecounty.com/ewdpmain.htm. Internet site last accessed April 22, 2002.

2 WATER-LEVEL DATA SOURCES

Water-level data used in the interpretation of the potentiometric surface are listed in Table 2-1. Most of the water-level data in Table 2-1 are listed in the DOE site-scale saturated zone flow model report [Civilian Radioactive Waste Management System Management and Operating Contractor (CRWMS M&O), 2000a,Table 7]. Water-level data available on the Nye County Early Warning Drilling Program Internet site and preliminary Early Warning Drilling Program data for Phase 3 wells were used to revise the potentiometric surface (Table 2-1). Additionally, Well ONC#1, (Nye County, 1995) was used in the interpretation of the potentiometric contours.

Water-level data categorized as unreliable, or less reliable in CRWMS M&O (2000b, Table I-3) and which varied for surrounding wells categorized as reliabale in Table I-3, were not used in the interpretation of the revised potentiometric surface map and, therefore, are not listed in Table 2-1. Data from the wells referred to as Fred Cobb, Bob Wellock, Louise Pereidra, Joe Richards, James Shaw, L. Mason, Richard Washburn (abbreviated as Cobb, Bob, Pere, Rich, Shaw, Mason, RWash and Wash in Figure 2-1) and several wells in the Amargosa Farms area were omitted. Though these data were not used in the interpretation of the potentiometric surface map, some of the aforementioned well locations are included in Figure 2-1.

Wells identified as perched UE–25 WT6 and USW G2 (Bechtel SAIC Company, LLC, 2001) were excluded from the interpretation of the potentiometric contours in the revised potentiometric surface map. Wells UE–29A2, UE–25a#3, and N91 were also excluded as they are categorized as suspected perched in CRWMS M&O (2000b,Table I-8). Although not used in the revised interpretation, the locations of these wells are included in Figure 2-1. Wells UE–25 WT18 and USW G–1 were also categorized as suspected perched in CRWMS M&O (2000b,Table I-8). However, their water levels are consistent with surrounding wells; consequently, they were included in the interpretation.

Both UE–25P#1 and Nye County EWDP–2DB wells, which penetrate the regional paleozoic aquifer, were not used in the interpretation of the contours because they monitor a deep regional confined aquifer that is not representative of the local potentiometric surface. However, the well locations are included in Figure 2-1.

The location of well MR–3 (BGMW–12),[1] located near the low-level waste facility southeast of Beatty, Nevada, is included on the map.

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[1] Water-level data for Well MR–3 (BGMW–12) can be obtained from U.S. Geological Survey internet site http://water.usgs.gov/nv/nwis/gwsi/?site_no=364556116413501. The most recent water level reported November 2001, was 733.5 m [2,406 ft] above sea level. U.S. Geological Survey internet site last accessed on April 5, 2002.

Table 2-1. Well Identification, Water Level, and Data Source			
Well Identification	**Figure 2-1 Label**	**Water Level (m)**	**Source**
UE–25 WT#16	ii	738.3	CRWMS M&O, 2000a
USW UZ–14	a	779.0	CRWMS M&O, 2000a
UE-25 WT#18	d	730.8	CRWMS M&O, 2000a
USW G-1	b	754.2	CRWMS M&O, 2000a
UE–25 WT#4	i	730.8	CRWMS M&O, 2000a
UE–25 WT#15	WT15	729.2	CRWMS M&O, 2000a
USW G–4	g	730.1	CRWMS M&O, 2000a
UE–25 a#1	zz	731.0	CRWMS M&O, 2000a
UE–25 WT#14	w	729.7	CRWMS M&O, 2000a
USW WT–2	m	730.7	CRWMS M&O, 2000a
UE–25 c#1 (C-Wells)	u	730.3	CRWMS M&O, 2000a
UE–25 c#2 (C-Wells)	u	730.2	CRWMS M&O, 2000a
UE–25 c#3 (C-Wells)	u	730.3	CRWMS M&O, 2000a
UE–25 WT#13	WT13	729.1	CRWMS M&O, 2000a
USW WT–7	p	775.8	CRWMS M&O, 2000a
USW WT–1	t	730.4	CRWMS M&O, 2000a
USW G–3	s	730.5	CRWMS M&O, 2000a
J–13	J13	728.4	CRWMS M&O, 2000a
USW WT–10	x	776.0	CRWMS M&O, 2000a
UE–25 WT#17	y	729.7	CRWMS M&O, 2000a
USW VH–2	VH2	810.5	CRWMS M&O, 2000a
UE–25 WT#3	WT3	729.6	CRWMS M&O, 2000a
USW VH–1	VH1	779.4	CRWMS M&O, 2000a
UE–25 WT#12	WT12	729.5	CRWMS M&O, 2000a
USW WT–11	WT11	730.7	CRWMS M&O, 2000a
J–12	J–12	727.9	CRWMS M&O, 2000a
JF–3	JF–3	727.8	CRWMS M&O, 2000a
Cind–R–Lite	CRLite	729.8	CRWMS M&O, 2000a
NDOT	ff	705.3	CRWMS M&O, 2000a
Airport	ee	705.5	CRWMS M&O, 2000a
Ben Bossingham	Boss	718.4	CRWMS M&O, 2000a
TW–5	TW–5	725.1	CRWMS M&O, 2000a
USW H–1	c	730.9	CRWMS M&O, 2000a
USW H–5	f	775.5	CRWMS M&O, 2000a

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Table 2-1. Well Identification, Water Level, and Data Source (continued)			
Well Identification	**Figure 2-1 Label**	**Water Level (m)**	**Source**
UE–25 b#1	h	730.7	CRWMS M&O, 2000a
USW H–6	j	776.0	CRWMS M&O, 2000a
USW H–4	n	730.4	CRWMS M&O, 2000a
USW H–3	q	731.5	CRWMS M&O, 2000a
USW SD–6	k	731.2	CRWMS M&O, 2000a
USW SD–7	r	727.6	CRWMS M&O, 2000a
USW SD–9	e	731.1	CRWMS M&O, 2000a
USW SD–12	l	730.0	CRWMS M&O, 2000a
WT–24	z	839.8	CRWMS M&O, 2000a
NC–EWDP–1Dx	1Dx	787.2	Nye County EWDP*
NC–EWDP–1S	1S	787.4	Nye County EWDP*
NC–EWDP–2D	2D	706.2	Nye County EWDP*
NC–EWDP–3D	3D	719.1	Nye County EWDP*
NC–EWDP–3S	3S	720.0	Nye County EWDP*
NC–EWDP–5SB	5SB	723.6	Nye County EWDP*
NC–EWDP–4PB	4PB	723.6	Nye County EWDP*
NC–EWDP–9Sx	9Sx	766.4	Nye County EWDP*
NC–Washburn–1x	Wash1x	714.4	Nye County EWDP*
J–11 WW	J11	732.2	CRWMS M&O, 2000a
BGMW–11	Bgmw11	715.9	CRWMS M&O, 2000a
ONC#1	o	729.7	Nye County, 1995
NC–EWDP–12PA	12PA	722.9	Nye County EWDP*
NC–EWDP–7S	7S	829.9	Nye County EWDP*
NC–EWDP–15P	15P	722.4	Nye County EWDP*
NC–EWDP–19D	19D	712.9	Nye County EWDP*
NC–EWDP–10S	10S	726.4	Preliminary †
NC–EWDP–22S	22S	725.0	Preliminary †
NC–EWDP–18P	18P	729.2	Preliminary ‡

Note: 1 m = 3.28 ft; EWDP = Early Warning Drilling Program

* Nye County EWDP internet site http://www.nyecounty.com/ewdpmain.htm. The most recent water level reported for each well was used. Internet last accessed on April 9, 2002.

† Arlt, H. Personal communication (October 24) to M. Hill, CNWRA, San Antonio, Texas. Washington, DC: NRC. 2001.

‡ Arlt, H. Personal communication (November 30) to M. Hill, CNWRA, San Antonio, Texas. Washington, DC: NRC. 2001.

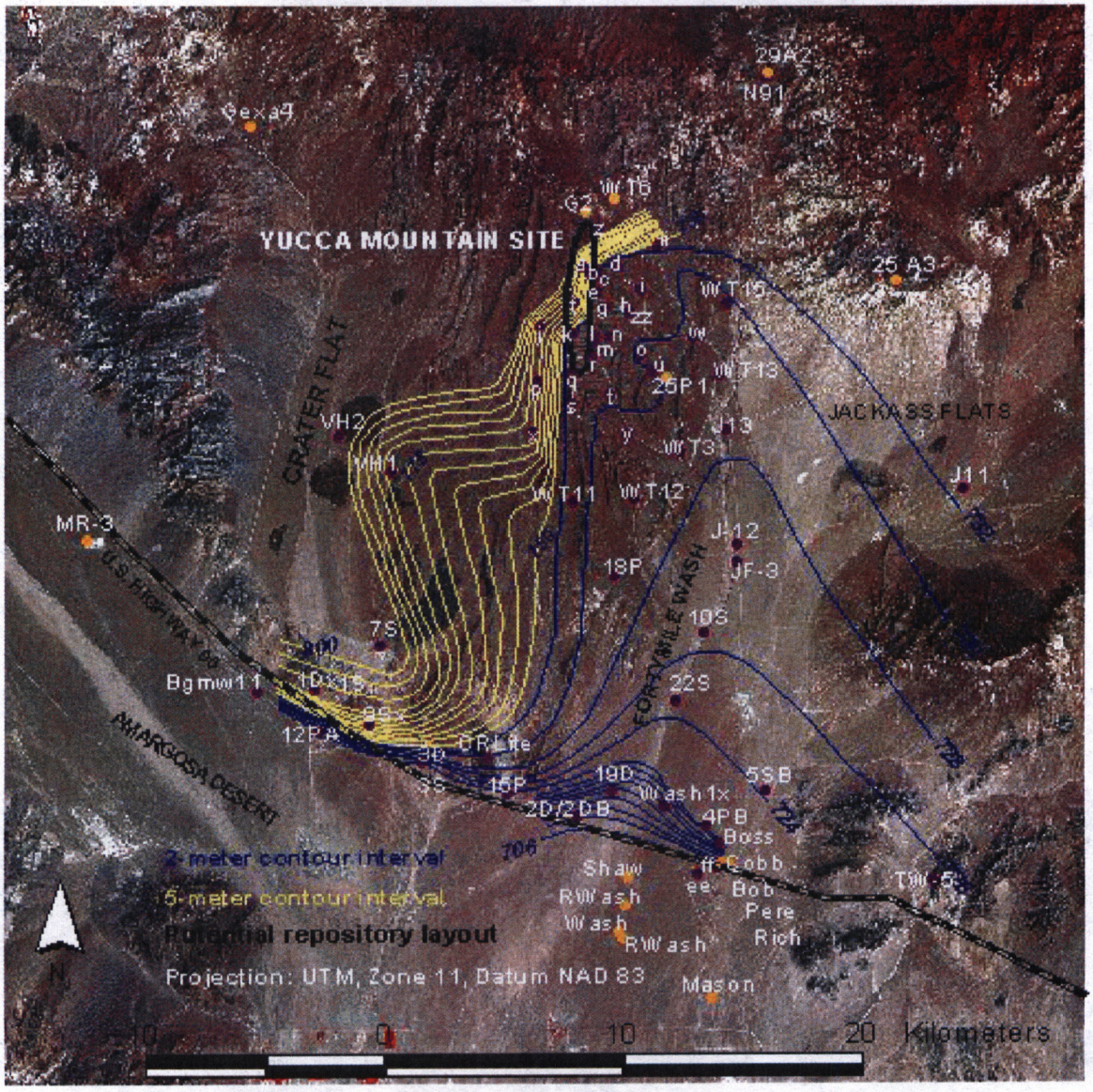

Figure 2-1. Revised Site-Scale Potentiometric Surface Map for Yucca Mountain

3 APPROACH

The revised site-scale potentiometric surface map for Yucca Mountain is shown in Figure 2-1. Potentiometric contours were developed using data from the wells listed in Table 2-1. For wells that monitor two or more depth intervals, the data from the uppermost interval was used. The contour lines shown in Figure 2-1 were drawn manually using the ArcView Version 3.1, Geographic Information System interface. Well locations and water-level data were plotted in ArcView overlaying a satellite image of the Yucca Mountain area. The line tool in ArcView was then used to draw visually interpolated potentiometric contours.

Two contour intervals were used in Figure 2-1. A 2-m [6.56-ft] contour interval, drawn in blue, is used for the area east and southeast of Yucca Mountain where the potentiometric surface is relatively flat. A 5-m [16.4-ft] contour interval, drawn in yellow, is used for the area west and north of Yucca Mountain where steep potentiometric gradients are observed. Also shown in Figure 2-1 is the proposed layout for the main repository block (DOE, 2001) drawn in black. Wells used in the interpretation of the potentiometric surface are indicated by purple dots. Wells omitted from the interpretation are indicated by orange dots, with the exception of Well NC–EWDP–2DB. Well identification labels in Figure 2-1 are abbreviated using the labels listed in Table 2-1.

4 SUMMARY

The revised potentiometric surface map presented in this report agrees favorably with the DOE map reported in CRWMS M&O (2000b, Figure 1-2). Differences between the two potentiometric surface maps are (i) the contour interval used, (ii) the interpreted potentiometric surface in the revised map is limited to the Yucca Mountain area north of Amargosa Farms, and (iii) recent Nye County Early Warning Drilling Program water-level data (including preliminary data for Phase 3 wells and the most recent water-level measurements for Phase 2 wells) were used in the interpretation for the revised potentiometric surface map.

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