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MCAS EL TORO
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DATE: 20 Feb 1995

CTO#: 145

LOCATION: MCAS El Toro

TASK/WORK ELEMENT:

John Dolegowski
John Dolegowski/Project Manager

Miriam E. Fuhrache for...
Ken Tomeo/Resource Center Manager

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Date of meeting: 07 April 1994

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CONFIRMATION OF:	CONFERENCE	X	DATE HELD	07 April 1994
	TELECOM		DATE ISSUED	14 February 1995
	OTHER		RECORDED BY	Hooshang Nezafati/CH2M HILL
			PLACE	Santa Ana, California

SUBJECT

Contract Task Order (CTO) No. 145
OU-1 FS Groundwater Modeling Meeting
Marine Corps Air Station (MCAS) El Toro

PARTICIPANTS: (* DENOTES PART-TIME ATTENDANCE)

John Dolegowski/CH2M HILL/SCO	Andy Piszkin/Code 1831.AP
Vish Parpiani/MCAS El Toro	Bret Raines/Code 1831.BR
Natasha Raykhman/CH2M HILL/SCO	Rich Freitas/EPA
Sherrill Beard/DTSC	Ginny Garelick/Code 1852.GV
John Broderick/RWQCB-8	Joe Zarnoch/DTSC-4
John Woodling/DTSC HQ	Tim Sovich/OCWD
Davi Richards/CH2M HILL/CVO	Peter Mock/CH2M HILL/TUS
Hooshang Nezafati/CH2M HILL/SCO	Sumant Gupta/CH2M HILL/SCO
Chrisa Mitchell/MCAS El Toro	Roy Herndon/OCWD

ACTION REQ'D. BY	ITEM

Introduction (Hooshang Nezafati)

- Hooshang Nezafati/CH2M HILL welcomed everybody and distributed an outline of the presentation (see attached). He stated that the main objective of this presentation is to share preliminary findings in the spirit of information exchange.

- H. Nezafati presented specific objectives for the groundwater modeling at Marine Corps Air Station (MCAS) El Toro and introduced Cathy Quinn and Natasha Raykhman as the main presenters, and Peter Mock and Dr. Sumant Gupta as the supporting team, all from CH2M HILL, and briefly discussed their presentation topics.

Groundwater Modeling Approach (Cathy Quinn)

C. Quinn presented the following groundwater modeling objectives:

- To adapt the established Orange County Water District (OCWD) 2-dimensional (2-D) Modflow model for the Irvine Subbasin to 3-D in order to evaluate Feasibility Study (FS) alternatives for Operable Unit (OU)-1 (MCAS El Toro objectives for numerical modeling of OU-1 alternatives differ from OCWD's objectives for numerical modeling of Irvine Desalter).

- To calibrate the 3-D Modflow model to roughly estimate parameters and conditions allowing a hydraulic balance between Subbasin hydrogeologic units consistent with current conceptual model and historical water level data. Check vertical velocities with particle tracking. Prepare the basis for the CFEST model that will be used to perform solute transport.

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	C. Quinn stated that the objectives of OCWD's 2-D and MCAS El Toro's 3-D models differ as follows: the 2-D model objective is to evaluate the influence of Desalter production wells on regional piezometric pressures and effectiveness in capturing total dissolved solids (TDS) and nitrate contamination in the main production aquifer of the Subbasin; the 3-D model objective is to evaluate an effective method for remediation of volatile organic compound (VOC)-contaminated groundwater that is found in Shallow Alluvium near MCAS El Toro and in the deeper Principle Aquifer off-Station, and to evaluate the impact of Desalter on Shallow Alluvium water levels in VOC-contaminated regions. C. Quinn briefly outlined the reasons for adaptation to a 3-D model: o To provide a tool for evaluation of FS alternatives to meet objectives of the OU-1. o OCWD's established 2-D model for the Irvine Subbasin was appropriate for evaluation of Irvine Desalter, which largely impacts the main production zone of the Subbasin (the Principal Aquifer). Impact to shallow water table conditions beneath MCAS El Toro was not specifically analyzed. The OCWD model was set-up as pseudo-3D with recharge from overlying shallow saturated zone accommodated as prescribed leakance. o OCWD's 2-D model was adapted to 3-D to accommodate vertical flow components that have a large effect on migration of contamination away from the MCAS, from shallow saturated zone beneath MCAS El Toro to increasingly deeper portions of the Principal Aquifer away from MCAS El Toro. o A vertical flow component is evidenced by 1) depth of occurrence of contamination in groundwater away from MCAS El Toro, and 2) "step-changes" in piezometric head observed in ports of multi-depth monitoring wells. **Conceptual Model** (C. Quinn) C. Quinn summarized hydrogeologic interpretation as follows: o Hydrostratigraphic characterization includes Shallow Alluvium (shallow water bearing zone), Intermediate Horizon (finer grained, lower hydraulic conductivity horizon that limits vertical flow), and Principal Aquifer (main water production zone) o The step-change in water levels between shallow and deeper ports of multi-depth monitoring wells, as well as variations in influence of seasonal pumping on shallow and deeper ports (observed in hydrographs) suggests an intermediate horizon that limits vertical flow between shallow and deeper water bearing zones (Shallow Alluvium and Principal Aquifer, respectively) o Cross-sections were prepared using hydraulic information, VOC analytical data, lithologic data, well construction, and geophysical data to assess the interval of occurrence and approximate lateral extent of an intermediate horizon.

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John Broderick/RWQCB wanted to know if we have been taking water level measurements on a monthly basis. He felt that the information should be shared quarterly with the agencies.

Model Parameters

- Layering of the 3-D model is based on conceptual model (interpreted from hydrogeologic data collected by OCWD and during the MCAS El Toro Phase 1 RI)
- Hydraulic parameters
  - Hydraulic conductivity (MCAS El Toro and OCWD aquifer test results compared with regional reported values)
  - Layer thickness and extrapolated extent
  - Anisotropy
- Tim Sovich/OCWD asked how the estimates for vertical k were made. C. Quinn replied that the ratio of K_H/K_V assumed was based on variations in lithology, and also checked by comparing seasonal differences in hydrographs for shallow and deeper ports of multi-depth monitoring wells (i.e., Neuman-Witherspoon analysis comparing amplitude and phase lag between peaks in hydrographs).

Boundary Conditions

C. Quinn summarized the boundary conditions as follows:

- At mountain front, no flow boundary conditions are used.
- Constant head boundary conditions were assumed at the western boundary of the modeled area adjacent to the Main Basin. The 1992 water level data were used for this purpose that varied from +30 ft above mean sea level (msl) at the northern extent of the boundary to -35 ft msl at the south end.
  - Review of water level contour maps: Assess changes in horizontal gradient throughout the Subbasin and near the west boundary with respect to historical pumping patterns
  - Findings: Inflow or outflow across the west boundary is not slowly controlled by amount of production from wells in Irvine Subbasin (direction of flow across the boundary appears to be affected by water balance in both Main Basin and Irvine Subbasin)
- Review of hydrographs for key wells throughout the Irvine Subbasin suggests near steady-state conditions have existed in the Subbasin for the last 10 years; **therefore, a steady-state calibration is appropriate.**

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	o Review of hydrographs for key wells near the boundary with Basin indicates slight decline in water levels, suggesting that large stresses, as induced by the Irvine Desalter, may affect boundary conditions; **therefore, transient simulation of the Irvine Desalter is appropriate.**
	Questions:
	o T. Sovich: Cannot predict pumpage in Main Basin in the future.
	o DTSC: Did we have data on the K of the fine-grained data?
	o Response: C. Quinn: Yes, Initial estimates of horizontal hydraulic conductivity were derived form aquifer tests of wells with slotted sections in the intermediate horizon, vertical hydraulic conductivity values were evaluated using a Neuman-Witherspoon analysis (as discussed above).
	Calibration
	o J. Broderick asked what year was used for calibration.
	o C. Quinn answered the year was 1992. She added that it is a steady-state calibration, not a transient calibration and the steady-state calibration was within 10 feet in Layers 1 and 3.
	o John Woodling/DTSC asked if gradients between Layers 1 and 3 have been matched very well.
	o T. Sovich stated that it would be beneficial to show the model generated vertical pressure profile (vertical gradients) at well cluster sites.
	o S. Gupta replied that we can generate that if needed.
	o J. Woodling verified that 15 feet/day was the value OCWD used for the Principal Aquifer when calibrating their 2-D model.
	Desalter Simulation
	o Analytical solutions were used to estimate boundary conditions with the Desalter. Insufficient historical data existed to estimate the impact of Irvine Desalter well production on boundary conditions. Therefore, the simulation was performed using constant head and constant flux conditions, and the expected effect of the Irvine Desalter is estimated to occur between these two bounding conditions.
	1. Constant flux - overestimates flow into basin. Change in head with time did not level off.
	2. Constant head - underestimates flow into basin. Impossible to calculate flux over time.

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	Thus, model was run with both boundary assumptions to estimate range. J. Woodling liked the approach. o J. Woodling asked if heavy agricultural pumping in the past has created stronger gradients in the past. o Peter Mock/CH2M HILL answered that that was looked at. The amounts pumped were not large enough to account for difference. o Results of prescribed flux simulation indicate that after 20 years, dewatering of Layer 1 in northern corner of Station would occur. o Rich Freitas/EPA asked if detected concentrations were within 1 percent of solubility. o H. Nezafati responded that they are less than 1 percent, meaning that dense nonaqueous phase liquid (DNAPL) presence is less likely. **Particle Tracking** o C. Quinn explained particle tracking and added that the results didn't match vertical gradients. Particles travel too slowly in the vertical downward direction in comparison with observed migration of the TCE plume. She added that this suggests some discontinuity in the Intermediate Horizon. o T. Sovich stated that the presence of a discontinuity agrees with the geologic data. MCAS El Toro's Layer 3 doesn't have continuous clay layers. o C. Quinn said that discontinuity of Intermediate Horizon to be accommodated in CFEST model. **Reason to Go to CFEST** o To perform solute transport, and to assess effect of vertical flow and transport in greater detail than with Modflow finite-difference model. **CFEST Model** o N. Raykhman explained the changes to the MODFLOW Model: - Thickness of layers were changed slightly due to conversion from finite-difference to finite-element. - Mountain front recharge was redistributed to have more recharge assigned to Santa Ana Mountains than San Joaquin Hills o T. Sovich asked if the project team adjusted the lateral to horizontal dispersivity. N. Raykhman replied that the project team did.

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	o Roy Herndon/OCWD felt that the fit was poor between observed vs. simulated plume.
	o T. Sovich said the source may have been variable. He asked if backwards particle tracking can be done.
	o N. Raykhman responded that it can be done, but you can't account for dilution effects.
	o J. Broderick thinks that vertical migration is due to secondary porosity.
	o Wells in model are not fully screened in Layers 1 through 5.
	o R. Herndon said that TIC-78 has been replaced by IRWD-78 because it will pump more. OCWD will monitor water quality after it is turned on.
	o R. Freitas prefers to see reverse particle tracking. Show capture with time. He prefers to use capture zone analysis from extraction wells.
	o J. Woodling also wants to see capture zone analysis. He said it may not be worth spending a lot more time on contaminant transport.
	o R. Freitas said that EPA is mostly concerned about containment. Model may be used to optimize cost.
	o J. Woodling said that a main issue with DTSC is whether the regulators can accept a system that allows contaminants to go to the Principal Aquifer.
	o R. Herndon feels that a K of 15 ft/day is too high for the shallow aquifer. Six hundred gpm is a significant cost impact to the Desalter.
	o J. Woodling said that the solution may be to capture what we can in the shallow zone.
	o R. Herndon suggested that the project team should evaluate whether shallow contamination can be captured with 100 to 200 gpm.
	o P. Mock stated that the final rates of pumping in the shallow zone are best determined by field tests.
	o R. Freitas said that he thinks enough work has been done; he wants to hear what the Navy will do about the problem now.
	o R. Herndon responded that this is only an interim Record of Decision.
	o Joe Zarnoch/DTSC-4 asked about the benzene plume. N. Raykhman said three wells are provided for capture.

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	Wrap Up o R. Herndon and T. Sovich will work with the CH2M modeling group. o R. Herndon feels that anything above 200 gpm would likely impact the Desalter design. o The desalter design is 25 percent designed. o P. Mock thinks that 200 gpm may be enough. o Davi Richards/CH2M HILL said that there is not enough time to complete pilot extraction wells prior to public comments.