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Internal Technical Memorandum Report

Subject: Technical Memorandum Report – Groundwater Capture Assessment for SSWD Wells N17, 56A and 73

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1. INTRODUCTION

1.1 Background and Purpose

There are known groundwater contamination plumes located in the groundwater basin underlying the Sacramento Suburban Water District (District). Task 3.5.2 of the Scope of Work for the Sacramento Suburban Water District Master Plan Update states that Brown and Caldwell will estimate plume travel times for adjective flow to existing and potential future District wells and ASR/conjunctive use facilities, based on current plume locations and rough estimates of transmissivities and hydraulic gradients using Darcy's Law.

Due to the current level of uncertainty with respect to actual plume extents, the potential groundwater capture radius of groundwater in the vicinity of three representative water supply wells operated by the District was assessed. The representative wells that were selected include: Wells N17, 56A and 73. These wells were selected primarily due to their high capacity and relative proximity to the McClellan plume (Wells N17 and 56A) and Aerojet plume (Well 73).

1.2 ANALYTICAL METHODS

The WINFLOW™ analytical element groundwater flow model was used to simulate two-dimensional, steady state groundwater flow for the assessment. The steady-state module of the model simulates horizontal groundwater flow in a uniform, regional flow field using Darcian-based analytical functions developed by Strack (1989). The input parameters for this model application include: (1) aquifer hydraulic conductivity, (2) aquifer thickness, and (3) pumping rate from the aquifer.

Particle tracking/flow path groundwater capture analyses were also performed with the analytical element groundwater flow model. The radial extent of groundwater capture for a 10-year timeframe under steady state well pumping conditions was calculated. This time frame was selected for consistency with current, State of California Drinking Water Source Assessment criteria. A generalized porosity of 0.2 was assumed for all particle tracking solutions.

2 HYDROLOGIC SETTING

The hydrogeologic setting of the aquifer in the vicinity of the proposed well site is primarily comprised of a thick zone of basinfill sediments and stratigraphy. Although it was not explicitly simulated in this analysis, the principal sources of recharge to the aquifer system in the study area is derived from channel recharge along the American and Sacramento Rivers as well as from distal mountain front recharge. These natural sources of recharge also induce the primary regional flow direction and gradient upon the large-scale aquifer system.

2.1 AQUIFER COEFFICIENTS

Transmissivity (T-value) and effective hydraulic conductivity (K-value) of the local aquifer at each well was estimated based on measured specific capacities of the representative wells, an assumed well efficiency of 65 percent, and an empirical relationship between the theoretical specific capacity of a 100-percent efficient well and aquifer transmissivity.

Empirical relationship from Driscoll (1986) is as follows:

$$T / 2000 = SC$$

where

T = transmissivity of the aquifer perforated by the well in gallons per day per foot of drawdown (gpd/ft);

SC = theoretical specific capacity of a 100% efficient well

Table 1 below presents the results of the calculations to estimate local T-values and effective K-values at the three wells.

Table 1. Aquifer Transmissivity and Effective Hydraulic Conductivity Estimates

Well	Capacity (gpm)	Specific Capacity (gpm/ft)	Drawdown (ft)	Upper Screened Interval (ft bls)	Lower Screened Interval (ft bls)	Sat Thickness (ft)	100% Efficient Theoretical Specific Capacity (gpm/ft)[1]	Est Transmissivity (gpm/ft)[2]	Est Effective Hydraulic Conductivity (ft/d)
N17	1,100	141.3	7.8	220	550	330	217.4	435,000	176.2
56A	2,400	116.4	20.6	250	505	255	179.1	358,000	187.7
73	3,500	102.5	34.1	230	470	240	157.7	315,000	175.4

Notes: assume well efficiency of 65%

gpm – gallons per minute

ft bls = feet below land surface

ft = feet

gpm/ft = gallons per minute per foot of drawdown

gpd/ft = gallons per day per foot of drawdown

Effective hydraulic conductivity (K-value) of the aquifer adjacent to each representative well was evaluated by the following relationship between the T-value and saturated thickness of the well under pumping conditions:

$$T = Kb$$

where

T = estimated transmissivity of the aquifer perforated by the well;

b = saturated thickness of the aquifer perforated by the well under pumping conditions; and

K = effective hydraulic conductivity of the aquifer perforated by the well.

3 IMPACT OF WELLS

The estimated steady-state, 10-year groundwater capture radial extents are summarized in Table 2. Note that the radial extents have been rounded up to the nearest 500 foot interval.

Table 2. Calculated Groundwater Capture Radial Extents

Well	Capacity (gpm)	Steady State, 10-Year Groundwater Capture Radial Extent (ft)
N17	1,100	2,000
56A	2,400	3,500
73	3,500	4,500

4 SUMMARY AND CONCLUSIONS

Based on this analysis, the potential, ten-year groundwater capture extent for the wells nearest the Aerojet plume (Well 73) is 4,500 ft. Generally, this suggests that if the Aerojet plume were to come within 4,500 feet of Well 73 or neighboring wells with similar production capacities, it is estimated that in ten years a portion of the groundwater production from such wells could potentially be derived from contaminated water from the Aerojet plume.

The potential, ten-year groundwater capture extent for the wells near the McClellan plume (Well N17 and Well 56A) are estimated to be 2,000 ft for Well N17 and 3,500 ft for Well 56A. This suggests that if the McClellan plume were to come within 2,000 ft of Well N17 (and other similar capacity wells) or 3,500 ft for Well 56A (and other similar capacity wells), it is estimated that in ten years a portion of the groundwater production from such wells could potentially be derived from contaminated water from the McClellan plume.

5 REFEFENCES

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