

Table 3.5-1 Measured Groundwater Chemistry of Shallow Wells

LOCATION	WELL NAME AND NUMBER	DATE	DEPTH (ft)	pH	Hardness (mg/L)	TOC/TSS ⁴	Dissolved Sulfide (mg/L)	Sulfate (mg/L)	Total Copper (µg/L)	Dissolved Copper (µg/L)	Copper K _d (L/kg)	Total Zinc (µg/L)	Dissolved Zinc (µg/L)	Zinc K _d (L/kg)
NORTH														
	SSB1	7/25/01	0-0.5	6.9					5		10,000	170		1,059
	SSB2	7/25/01	0-0.5	7.0					5		6,800	10		15,000
	SSB3	7/25/01	1-1.5	6.4					12		14,417	130		2,277
	GRD1	11/14/01		7.1	4900	0.03	<0.04	970	16 J ¹	17 J ¹		<50	88	
	GRD2	11/14/01		6.9	2600	0.01	<0.04	350	8 J	11 J ¹		<50	<50	
	GRD3	11/14/01		6.7	3300	0.01	<0.04	8	<5 UJ	10 J ¹		<50	<50	
	Average			6.8			<0.04	443	9	13	10,406	77	63	6,112
	Median			6.9			<0.04	350	7	11	10,000	50	50	2,277
SOUTH														
	SSB4	7/19/01	1-1.5	6.8					17		6,765	42		4,310
	SSB5	7/19/01	4-4.5	6.0					2400		500	5900		115
	SSB6	7/25/01	1-1.5	7.8					15		1,867	38		2,079
	SSB7	7/19/01	4-4.5	7.4					27		25,185	350		1,329
	SSB8	7/19/01	0-0.5	7.1					17		32,941	22		13,636
	SSB10	7/25/01	4-4.5	5.9					5		22,800	10		31,100
	SSB11	7/25/01	3-3.5	6.9					12		47,667	1900		226
	SSB12	7/19/01	0-0.5	6.7					5		79,000	26		22,192
	GRD4	11/14/01		6.9	7000	0.14	69	130	8 J ¹	9 J ¹		<50	<50	
	GRD5	11/14/01		4.8	2700	0.02	<0.04	1800	8800 J ¹	9300 J ¹		22000	25000	
	GRD6	11/14/01		5.5	2500	0.50	<0.04	1300	6000 J ¹	5400 J ¹		21000	18000	
	GRD7	11/14/01		4.2	720	1.00	<0.04	600	8200 J ¹	7800 J ¹		16000	14000	
	GRD8	11/14/01		6.2	1200	0.13	<0.04	1200	9100 J ¹	8000 J ¹		35000	42000	
	Average			6.3			<0.04	1006	2662	6102	27,091	7872	19810	9,373
	Median			6.7			<0.04	1200	17	7800	23,993	350	18000	3,194
SF BAY														
	RMP ²			7.7						2	33507		1	351586
	WQO ³										3.1		81	

¹J indicates an estimated value; ²Based on average values of nearby RMP Stations (Pacheco Creek, Grizzly Bay, Honker Bay (SFEI, 1994-1999));

³Ambient Bay Water Quality Objectives are 3.1 µg/L for Copper and 81 µg/L for Zinc (California Toxics Rule, EPA (2000)) (Shading indicates higher concentrations)

⁴TOC/TSS is a relative indicator of dissolved organic matter if TOC/DOC ratio is relatively constant; Higher values in southern spread may indicate higher DOC

Table 3.5-2: Measured Groundwater Chemistry of Deep Wells

LOCATION	WELL NAME AND NUMBER	DATE	DEPTH	pH	Average pH ¹	Median pH ¹	Dissolved Sulfide (mg/L)	Dissolved Sulfate (mg/L)	Average Dissolved Copper (µg/L) ¹	Median Dissolved Copper (µg/L) ¹	Average Dissolved Zinc (µg/L) ¹	Median Dissolved Zinc (µg/L) ¹
NORTH												
	MW62	11/12/01	18-20.5	6.8	6.9	6.9	R	<0.50	5	3	9	5
	MW51	11/12/01	15-20	7.1	7.3	7.4	R	12	5	3	11	5
	MW18	11/12/01	7.5-12.5	7.1	7.2	7.2	0.05	5.0	5	3	7	5
	MW4A	11/12/01	8.5-18.5	7.0	7.1	7.2	17	30	5	3	12	5
SOUTH												
	MW57	11/12/01	10-20	7.4	6.9	7.0	R	1200	3	3	12	5
	MW58	11/12/01	10-20	7.0	6.8	6.8	R	4.3	7	3	23	10
	MW19	11/14/01	9.5-15.5	5.8	5.5	5.6	<0.04	9,700	3	3	593590	627500
	MW3A	11/14/01	4.5-14.5	6.3	6.1	6.2	<0.04	6,800	248	3	118846	57500
	MW20	11/14/01	7.5-12.5	6.7	6.7	6.8	11	190	5	3	32	12
	MW8A	11/14/01	8.5-18.5	7.0	6.8	6.9	23	34	5	3	11	5
	MW8Ad	11/14/01	8.5-18.5	7.0			18	32				
	MW25	11/14/01	4.5-7	4.5	5.4	6.1	<0.04	5,000	45	17	3504	66
SF BAY												
	RMP ²				7.7				1.9			1
	WQO ³								3.1			81

¹ Average and median values for the period 1993-2001; ² Based on average values of nearby RMP Stations (Pacheco Creek, Grizzly Bay, Honker Bay (SFEI, 1994-1999));

³ Ambient Bay Water Quality Objectives are 3.1 µg/L for Copper and 81 µg/L for Zinc (California Toxics Rule, EPA (2000)) (Shading indicates higher concentrations)

Table 3.5-3: Summary of Sulfate Reduction and Metal Precipitation Rates at Ambient Conditions

Element	Reaction	Rate (mg/L/yr)	Condition	Reference
Sulfur	$\text{SO}_4^{2-} + 2 \text{H}^+ = \text{H}_2\text{S} + 2 \text{O}_2$	1.8E-01 1.0E-07 9.0E-17	Inorganic; pH = 2; $\Sigma\text{S}_{\text{tot}} = 0.01 \text{ mol}$ Inorganic; pH = 4-7; $\Sigma\text{S}_{\text{tot}} = 0.01 \text{ mol}$ Inorganic; pH = 9; $\Sigma\text{S}_{\text{tot}} = 0.01 \text{ mol}$	Ohmoto and Lasaga (1982)
	$\text{CH}_2\text{O} + 0.5 \text{SO}_4^{2-} + \text{H}^+ = 0.5 \text{H}_2\text{S} + \text{CO}_2 + \text{H}_2\text{O}$	5-450 2200 6000 23000	Sandy Aquifer, TOC = 0.01 % wt Marine Sediments Mining Lake Simulated Wetland; Nutrient Spike	Jakobsen and Postma (1999) Boudreau and Canfield (1984) Blodau et al. (1998) Reynolds et al. (1997)
	$0.25 \text{CH}_2\text{O} + \text{FeOOH(s)} + 2 \text{H}^+ = 0.25 \text{CO}_2 + 1.75 \text{H}_2\text{O} + \text{Fe}^{2+}$	90 1300-4000	Sandy Aquifer, TOC = 0.01 % wt Mining Lake; Estimated	Jakobsen and Postma (1999) Blodau et al. (1998)
Iron	$\text{Fe}^{2+} + \text{H}_2\text{S} = \text{FeS} + 2 \text{H}^+$	30 2.8E+06	Simulated Wetland; FeS Assumed; Cum. Rate Inorganic; Assumed $\Sigma\text{S}_{\text{tot}} = 0.001 \text{ mol}$	Reynolds et al. (1997) Rickard (1995)
	$\text{Cu}^{2+} + \text{H}_2\text{S} = \text{CuS} + 2 \text{H}^+$	1.7E+08	Inorganic; pH = 2.0	Oktabybas et al. (1994)
Copper	$\text{Zn}^{2+} + \text{H}_2\text{S} = \text{ZnS} + 2 \text{H}^+$	1.3 2.7E+07	Simulated Wetland; ZnS Assumed; Cum. Rate Inorganic; $\Sigma\text{S}_{\text{tot}} = 0.001 \text{ mol}$; Zn = 0.01 mol	Reynolds et al. (1997) Mishra and Das (1992)
Zinc				

Table 3.5-4: Summary Of MIKE 21 ME Model Scenarios

Run	DESCRIPTION			
	SOUTH OF LEVEE	NORTH OF LEVEE	REALIGNMENT	OTHER
1	Fill to ERM	Unchanged	Average Measured Conc.	NA
2	Fill to Background	Unchanged	Average Measured Conc.	NA
3	Fill to ERM	Unchanged	Average Measured Conc.	MAX Resusp.
4	Fill to ERM	Unchanged	Average Measured Conc.	MIN Ads.
5	Fill to ERM	Unchanged	Maximum Measured Conc.	NA
6	Fill to ERM	Unchanged	Maximum Measured Conc.	Resusp./Ads. N
7	Fill to ERM	Unchanged	Maximum Measured Conc.	o MSVD discharge

Table 3.5-5: Summary Of Initial Chemical Concentrations Used In the MIKE 21 ME Model

Case	COPPER				ZINC				Suspended Sediment Concentration, Water (mg/L)
	Dissolved Concentration, Water (mg/L)	Adsorbed Concentration, Water (mg/L)	Dissolved Concentration, Porewater (mg/L)	Adsorbed Concentration, Sediment (mg/kg)	Dissolved Concentration, Water (mg/L)	Adsorbed Concentration, Water (mg/L)	Dissolved Concentration, Porewater (mg/L)	Adsorbed Concentration, Sediment (mg/kg)	
1	1.8	0.6	5	Figure 3.5-3 a	0.5	1.7	11	Figure 3.5-4 a	10
2	1.8	0.6	5	Figure 3.5-3 b	0.5	1.7	11	Figure 3.5-4 b	10
3	1.8	0.6	5	Figure 3.5-3 a	0.5	1.7	11	Figure 3.5-4 a	10
4	1.8	0.6	5	Figure 3.5-3 a	0.5	1.7	11	Figure 3.5-4 a	10
5	1.8	0.6	5	MAX Realign.	0.5	1.7	11	MAX Realign.	10
6	1.8	0.6	5	MAX Realign.	0.5	1.7	11	MAX Realign.	10
7	1.8	0.6	5	MAX Realign.	0.5	1.7	11	MAX Realign.	10

Table 3.5-6: Summary Of Constants Used In the MIKE 21 ME Model

Case	COPPER			ZINC			Diffusion Coefficient (m ² /s)	Boundary Layer Thickness (m)	Settling Velocity (m/s)	Critical Velocity (m/s)	Resuspension Rate (g/m ² /d)
	Adsorption Rate (L/g/d)	Desorption Rate (d ⁻¹)	Adsorption Rate (L/g/d)	Desorption Rate (d ⁻¹)	Adsorption Rate (L/g/d)	Desorption Rate (d ⁻¹)					
1	0.016	0.47	0.005	2	0.005	2	6.0 E-10	0.01	1.0 E-7	0.40	50
2	0.016	0.47	0.005	2	0.005	2	6.0 E-10	0.01	1.0 E-7	0.40	50
3	0.016	0.47	0.005	2	0.005	2	6.0 E-10	0.01	1.0 E-7	0.20	100
4	0.005	0.47	0.017	2	0.005	2	6.0 E-10	0.01	1.0 E-7	0.40	50
5	0.016	0.47	0.005	2	0.005	2	6.0 E-10	0.01	1.0 E-7	0.40	50
6	0.005	0.47	0.017	2	0.005	2	6.0 E-10	0.01	1.0 E-7	0.20	100
7	0.005	0.47	0.017	2	0.017	2	6.0 E-10	0.01	1.0 E-7	0.20	100

*Shading indicates value changed from Case 1 **Difference between Cases 6 and 7 is that the latter does not include the wastewater treatment facility outfall