Appendix 3

Weighted Mean Values

A primary literature review was conducted and all published values of hydrogeologic parameters characterizing the hydrologic units in each county studied were tabulated in this appendix and summarized in the following tables. The weighted means ($\overline{Z}$) of the data were calculated to determine representative values to be used in the risk assessment. The weighted mean method essentially reduces the effect of extreme data outliers (very high or very low values). The following equation was used to develop the weighted means for all hydrogeologic data (Mendenhall and Beaver, 1994).

$$\overline{Z} = \left[\frac{0.5Z_1 + 0.75Z_2 + \sum_{i=3}^{m-2} Z_i + 0.75Z_{m-1} + 0.5Z_m}{m - 1.5} \right] \qquad \text{(Eqn. 1)}$$

Where: Z = Hydrogeologic datum
m = Total number of values
i = Chronological interger

The above equation is not valid for data sets containing less than five values, therefore, the following equation was used.

$$\overline{Z} = \left[\frac{0.5Z_1 + \sum_{i=2}^{m-1} Z_i + 0.5Z_m}{m - 1.0} \right] \qquad \text{(Eqn. 2)}$$

For data sets with two values, an average was calculated.

In the Intermediate, Upper Floridan and Lower Floridan aquifers, hydrogeological data for the discretized geologic units within the aquifer are presented in the following tables. Representative hydrogeologic data for the entire aquifer were then determined by weighting the data in proportion to the thickness of the individual geologic units within each hydrogeologic unit.

Weighted means for the data sets are color coded in blue, while representative values used in the analysis are color coded in red.

Where there were insufficient data available, the following assumptions were made:

- Anisotropy ratios and porosity values were assumed to be consistent for equivalent aquifer units in each county, in the absence of site-specific data.

- Parameters for the horizontal and vertical hydraulic conductivities and porosities for each geologic layer in Brevard County were assumed to be consistent with data provided for the same equivalent depositional unit in Dade County.

- A horizontal hydraulic gradient of 0.001 were assumed for the injection zone and the overlying units in Dade and Brevard Counties.

- In Pinellas County, a horizontal hydraulic gradient of 0.05 in the injection zone was assumed. This accounted for the effects of pressure head due to injection. In the overlying units, a horizontal hydraulic gradient of 0.001 was used.

- A porosity of 0.5 was assumed for the Boulder Zone for horizontal ground water flow. Conduit flows occur in the Boulder Zone due to cavernous pores or large fractures in the rock (Meyer, 1984, Maliva and Walker, 1998); therefore a larger porosity is required to address this issue.

Appendix Table 3-1 Dade County

County: Dade																
Hydrogeologic Units	Surficial	Intermediate					Upper Floridan							Middle Confining Unit	Lower Floridan	
		Semiconfining Unit	Tamiami-upper Hawthorn Aquifer	Semiconfining Unit	Lower Hawthorn-upper Tampa Aquifer	Lower Tampa Semiconfining Unit	Tampa (Zone A)	Suwannee (Semiconfining Zone)	Suwannee (Zone B)	Ocala (Semiconfining Zone)	Avon Park (Zone C)	Avon Park (Semiconfining Zone)	Avon Park (Zone D)			Bolder Zone
Horizontal Conductivities	148						0.45							8.37E-07		2,307
	2900						9							0.003		2,461
	1524						55							0.03		18,923
							121.8							3		6538
							42							4.3		
														6		
														28		
														4.7		
Vertical Conductivities			8.8E-05											2.00E-05		
			0.1											1.30E-04		
														1.30E-04		
														2.00E-02		
														0.24		
														0.04		
Transmissivity	5800	10000					2,700									3.20E+06
	160000	100000					10,000									3.20E+06
	82900	55000					10,000									1.30E+07
							10,000									2.46E+07
							10,000									2.46E+07
							24,000									1.36E+07
							31,000									
							32,000									
							49,100									
							60,000									
							60,000									
							64,800									
							100,000									
							132,000									
							40,060									
Thickness	50	150					250	120		150		100		250	100	300
	105	450					500	300		200		270		440	200	300
	150	575					700	210		175		185		450	300	600
	175	590					700							900	200	600
	180	600					1100							488		650
	200	600					650									500
	270	700								1220					700	
	270	805													1300	
	275	1050													1800	
	830	614													1910	
	232														1468	
Porosity							0.3			0.2		0.3		0.336		0.3
										0.45		0.4		0.464		
										0.33		0.5		0.45		
												0.4		0.43		
										0.32						
Temperature	73.04	66.92					66.92							62.96	57.92	53
	98.06	73.04					62.96							57.92	60.08	60.5
	85.55	69.98					64.94							60.44	59.00	60.6
																61.3
																74
																61.56
Salinity								1840				3800		11800		
														35600		
USDW (below land surface)	1415															
	1640															
	1750															
	2170															
	1728															

Appendix Table 3-2 Pinellas County

County: Pinellas																
Hydrogeologic Units	Surficial	Intermediate					Upper Floridan							Middle Confining Unit	Lower Floridan	
		Semiconfining Unit	Tamiami-upper Hawthorn Aquifer	Semiconfining Unit	Lower Hawthorn-upper Tampa Aquifer	Lower Tampa Semiconfining Unit	Tampa (Zone A)	Suwannee (Semiconfining Zone)	Suwannee (Zone B)	Ocala (Semiconfining Zone)	Avon Park (Zone C)	Avon Park (Semiconfining Zone)	Avon Park (Zone D)			
Horizontal Conductivities	2.00E-03	0.005	17	0.1	18	10		0.0013	70	0.007	25		100			
	10		56		59			0.1	65	0.01		100				
	13		125		38.5			0.4	1	0.02						
	13		64					0.20	67.5	0.023						
	13			23						0.03						
	32			1.00E-04						0.06						
	33			1.1E-04						0.06						
	33			0.021						0.08						
	159			3.91						0.09						
	29									0.1						
										0.1						
										0.1						
										0.11						
										0.14						
										0.19						
										0.23						
										0.25						
										0.52						
										0.57						
										1						
										0.16						
										19.78						
										0.003						
										0.3						
										0.45						
										121.8						
										22						
Vertical Conductivities	0.36	2.40E-03		1.00E-04				1.30E-03		0.005				6.60E-07		
	0.36	2.40E-03		1.10E-04				1.30E-03		0.01				4.00E-05		
	0.36	2.40E-03		1.30E-04				0.1		0.01				3.00E-03		
	13			6.90E-03				0.4		0.01				3.30E-03		
	13			1.00E-02				1		0.01				5.20E-02		
	13			0.021				2		0.02				1.1		
	6.68			0.1				2		0.03				2		
				0.1				0.73		0.06				0.34		
				10						0.09						
				10						0.09						
				1.50						0.1						
				1.16						0.28						
										0.57						
										1						
										2.27						
										2.5						
										0.29						
Transmissivity	150	1260	100		200	15400	500		5,000		900,000			1.00E+01	2,000	3.20E+06
	1100	1525	200		200	17900	5600		8,900		1,200,000			9.00E+05	3,000	1.30E+07
	1100	1608	300		500	16650	5600		13,000		1,050,000			1.20E+06	370,000	2.46E+07
	1340	2970	400		740		10000		13,000					750003	94,500	1.35.E+07
	1800	3320	500		1300		10000		13,000							
	1850	3800	550		2400		15400		72,000							
	1248	5500	650		3500		15400		17,983							
		7800	650		5000		21000									
		3307	800		5000		22000									
			1100		5600		25000									
			1100		6200		29000									
			5100		8200		29000									
			8000		9600		30000									
			8000		10000		35000									
			1708		4071		40000									
				7259			43200									
				400			20,928									
				7000												
Transmissivity				5415						539,999						
										29,000						
										30,000						
										51,000						
										75,000						
										100,000						
										850,000						
										198,727						

Appendix Table 3-2 Pinellas County

County: Pinellas																
Hydrogeologic Units	Surficial	Intermediate					Upper Floridan							Middle Confining Unit	Lower Floridan	
		Semiconfining Unit	Tamiami-upper Hawthorn Aquifer	Semiconfining Unit	Lower Hawthorn-upper Tampa Aquifer	Lower Tampa Semiconfining Unit	Tampa (Zone A)	Suwannee (Semiconfining Zone)	Suwannee (Zone B)	Ocala (Semiconfining Zone)	Avon Park (Zone C)	Avon Park (Semiconfining Zone)	Avon Park (Zone D)			
Thickness	3	5	40	29	20	15	100	10	50	250	300	100	22	750	1260	
	20	10	40	115	170	90	112	90	50	350	386		121			
	25	10	80	140	170	90	115	125	50	419	343		72			
	50	150	80	140	190	240	150	170	75	436	515					
	50	32.5	60	113	200	103	245	240	75	452	892					
	60				157		250	127	75	490	957					
	60	465					250		250	500	1028					
	85	115					300		81	540	1155					
	100	99					1100	208		616	1174					
	132	115					256	232		453	970					
	56	137						273								
		150						397								
		200						269								
		203					1948									
		500														
		219														
Porosity	0.292	0.21					0.26	0.22	0.19	0.22	0.15	0.26	0.22	0.034		
	0.292	0.3					0.26	0.36	0.24	0.03	0.14	0.33	0.39	0.45		
	0.322	0.41					0.31	0.29	0.3	0.09	0.21	0.30	0.31	0.317		
	0.322	0.31					0.31		0.49	0.22	0.16					
	0.31						0.41		0.29	0.22	0.21					
							0.31	0.29		0.22	0.02					
								0.3		0.22	0.07					
								0.42		0.24	0.11					
								0.39		0.24	0.20					
								0.35		0.24	0.24					
										0.25	0.14					
										0.25						
										0.27						
										0.27						
										0.28						
										0.28						
										0.31						
										0.34						
										0.36						
										0.37						
										0.37						
										0.37						
										0.37						
										0.38						
										0.4						
										0.40						
										0.43						
										0.45						
										0.48						
										0.49						
										0.43						
							0.26									
Temperature	74.48	75.92					78.08									
	90.32	81.5					83.12									
		76.1					82.4									
		78.8					87.8									
Salinity	25		228	52	250		450		450	19000	19000		21000	21000	27000	
	25		326		316		508		1500		20000		39800	25000	31000	
	32		330		420		969		1500		37800		43500	23000	29000	
	120		390		890		1120		1600		37900		38600			
	210		406		1200		1530		2300		38100		42500			
	259		423		1200		5530		2500		38200		38300			
	300		458		1400		6540		2900		39200					
	404		484		1600		7700		3000		41800					
	500		500		1700		32900		3210		34892					
	3040		546		1700		5136		3520		35480					
	383		590		1700				3780		1800					
Salinity			650		1900				4490		18000					
			660		1910				10900		20000					
			660		2058				15000		20000					
			756		2058				19,000		21000					
			791		2170				21000		21000					
			980		2,170				26700		25200					
			1200		2170				30400		30000					
			1240		2200				35500		32100					
			1300		2200				38400		32800					
			1630		2300				10755		32800					
			1900		2600						33300					
			2040		2750						34090					
			693		1583						23481					

Appendix Table 3-2 Pinellas County

County: Pinellas																
Hydrogeologic Units	Surficial	Intermediate					Upper Floridan							Middle Confining Unit	Lower Floridan	
		Semiconfining Unit	Tamiami-upper Hawthorn Aquifer	Semiconfining Unit	Lower Hawthorn-upper Tampa Aquifer	Lower Tampa Semiconfining Unit	Tampa (Zone A)	Suwannee (Semiconfining Zone)	Suwannee (Zone B)	Ocala (Semiconfining Zone)	Avon Park (Zone C)	Avon Park (Semiconfining Zone)	Avon Park (Zone D)			
Salinity			3000		2750						35,000					
			3240		2900						35000					
			4700		2930						35200					
			5500		2930						37500					
			21000		3000						29741					
			1681		4000											
					10300											
					21000											
					2609											
Density	0.997						0.998		1.025		1.025		1.026			
	0.998						1		1.024		1.025		1.026			
	0.998						1		1.024		1.025		1.026			
	0.997						1.002		1.02		1.025		1.029			
	0.998						1.003		1.018		1.026		1.027			
	0.998						1.018		1.022		1.025					
							1.003									
USDW below land surface	100															
	140															
	540															
	590															
	1013															
	1053															
	1300															
	680															

Appendix Table 3-3 Brevard County

County: Brevard																
Hydrogeologic Units	Surficial	Intermediate					Upper Floridan							Middle Confining Unit	Lower Floridan	
		Semiconfining Unit	Tamiami-upper Hawthorn Aquifer	Semiconfining Unit	Lower Hawthorn-upper Tampa Aquifer	Lower Tampa Semiconfining Unit	Tampa (Zone A)	Suwannee (Semiconfining Zone)	Suwannee (Zone B)	Ocala (Semiconfining Zone)	Avon Park (Zone C)	Avon Park (Semiconfining Zone)	Avon Park (Zone D)			Bolder Zone
Horizontal Conductivities	20													0.8	1.00E-03	500
	32														0.0028	800
	33														0.028	650
	33														8.65E-03	
	33															
	33															
	33															
	35															
	36															
	37															
	38															
	40															
	42															
	44															
	45															
	48															
	49															
	49															
	50															
	50															
	52															
	53															
	53															
	53															
	56															
	57															
	58															
	58															
	59															
	62															
	71															
	76															
	78															
	91															
	97															
	100															
	100															
	121															
	126															
	56															
Vertical Conductivities		7.80E-07												5.10E-05	2.80E-01	
		5.00E-03													0.005	
		1.50E-02													0.06	
		6.25E-03													0.07	
															0.12	
															0.1	
Transmissivity	400						3,289							5,600	6,500	1.00E+07
	394						3,637							8,900	30,000	
	488						4,932							43,000	60,000	
	562						5,416							16,600	130,000	
	564						6,551								52,750	
	575						6,685									
	630						6,912									
	669						7,346									
	715						7,436									
	781						7,594									
	853						8,172									
	868						8,201									
	869						9,084									
	925						9,422									
	980						9,615									
	1000						9,827									

Appendix Table 3-3 Brevard County

County: Brevard																
Hydrogeologic Units	Surficial	Intermediate					Upper Floridan							Middle Confining Unit	Lower Floridan	
		Semiconfining Unit	Tamiami-upper Hawthorn Aquifer	Semiconfining Unit	Lower Hawthorn-upper Tampa Aquifer	Lower Tampa Semiconfining Unit	Tampa (Zone A)	Suwannee (Semiconfining Zone)	Suwannee (Zone B)	Ocala (Semiconfining Zone)	Avon Park (Zone C)	Avon Park (Semiconfining Zone)	Avon Park (Zone D)			Bolder Zone
Transmissivity	1042									9,953						
	1123									10,000						
	1150									10,000						
	1255									10,000						
	1315									10,050						
	1337									10,243						
	1372									10,896						
	1455									10,919						
	1482									11,064						
	1497									11,115						
	1532									11,564						
	1645									11,691						
	1724									12,271						
	1736									12,560						
	1765															
	1799									12,568						
	1859									12,609						
	1859									12,693						
	1872									13,284						
	1908									13,381						
	2000									13,815						
	2005									13,945						
	2005									13,998						
	2005									14,025						
	2006									14,266						
	2006									14,307						
	2006									14,316						
	2026									14,588						
	2313									14,707						
	2366									14,887						
	2406									14,890						
	2407									15,001						
	2644									15,988						
	2674									16,567						
	2674									16,857						
	2808									18,692						
	2947									19,926						
	2991									20,140						
	3022									20,510						
	3075									20,816						
	3209									22,023						
	3342									22,073						
	3342									22,462						
	3342									23,616						
	3342									24,485						
	3342									27,876						
	3476									28,077						
	3476									29,072						
	3476									29,204						
	3610									30,626						
	3743									31,754						
	3944									31,866						
	4011									34,537						
	4011									34,774						
	4011									35,000						
	4011									37,279						
	4319									37,365						
	4412									38,045						
	4679									41,313						
	4800									43,285						
	5214									45,672						
	5348									46,079						
	5348									49,023						
	5589									49,832						
	5749									50,000						

Appendix Table 3-3 Brevard County

County: Brevard																
Hydrogeologic Units	Surficial	Intermediate					Upper Floridan							Middle Confining Unit	Lower Floridan	
		Semiconfining Unit	Tamiami-upper Hawthorn Aquifer	Semiconfining Unit	Lower Hawthorn-upper Tampa Aquifer	Lower Tampa Semiconfining Unit	Tampa (Zone A)	Suwannee (Semiconfining Zone)	Suwannee (Zone B)	Ocala (Semiconfining Zone)	Avon Park (Zone C)	Avon Park (Semiconfining Zone)	Avon Park (Zone D)			Bolder Zone
Transmissivity	5829									50,000						
	6016									61,729						
	6016									62,037						
	6017									65,000						
	6217									67,905						
	6642									71,065						
	6819									72,090						
	7086									74,000						
	7313									74,337						
	7353									84,124						
	8021									98,225						
	8021									100,000						
	9292									100,000						
	9546									100,000						
	10027									120,000						
	10424									200,000						
	10589									210,000						
	10695									250,000						
	11364									250,000						
	12032									400,000						
	12777									510,000						
	13330									42,025						
	13343															
	22727															
	26738															
	4100															
Thickness	90			40						300				110		85
	95			130						350				250		190
	120			300						325				450		700
	150			360										500		291
	112			210										700		
														900		
														335		
															1400	
															1500	
															2000	
															2100	
															1750	
												2410				
												2300				
												2400				
												2617				
												2656				
												2900				
												2900				
												2194				
Porosity																0.2
Temperature																
Salinity																
USDW below land surface									1190							
									1190							
									1634							
									1670							
									1700							
									1499							

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