Appendix 5: Current Study Groundwater Discharge Estimates for Predevelopment Conditions and Ranges of Previously Reported Estimates of Groundwater Discharge for Each Hydrographic Area within the Great Basin Carbonate and Alluvial Aquifer System Study Area

By Melissa D. Masbruch

Appendix 5 of
Conceptual Model of the Great Basin Carbonate and Alluvial Aquifer System

Edited by Victor M. Heilweil and Lynette E. Brooks

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Conversion Factors

Inch/Pound to SI

Multiply	By	To obtain
	Length	
inch (in.)	2.54	centimeter (cm)
inch (in.)	25.4	millimeter (mm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
	Area	
acre	4,047	square meter (m^2)
acre	0.4047	hectare (ha)
square mile (mi^2)	2.590	square kilometer (km^2)
	Volume	
gallon (gal)	3.785	liter (L)
gallon (gal)	0.003785	cubic meter (m^3)
gallon (gal)	3.785	cubic decimeter (dm^3)
cubic foot (ft^3)	28.32	cubic decimeter (dm^3)
cubic foot (ft^3)	0.02832	cubic meter (m^3)
acre-foot (acre-ft)	1,233	cubic meter (m^3)
acre-foot (acre-ft)	0.001233	cubic hectometer (hm^3)
	Flow rate	
acre-foot per year (acre-ft/yr)	1,233	cubic meter per year (m^3/yr)
acre-foot per year (acre-ft/yr)	0.001233	cubic hectometer per year (hm^3/yr)
foot per year (ft/yr)	0.3048	meter per year (m/yr)
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)
cubic foot per day (ft^3/d)	0.02832	cubic meter per day (m^3/d)
gallon per minute (gal/min)	0.06309	liter per second (L/s)
	Hydraulic conductivity	
foot per day (ft/d)	0.3048	meter per day (m/d)
inch per day (in./d)	25.38	millimeter per day (mm/d)
	Transmissivity*	
foot squared per day (ft^2/d)	0.09290	meter squared per day (m^2/d)

Note: The conversion factors given above are for the entire report. Not all listed conversion factors will be in any given chapter of this report.

Temperature in degrees Celsius (°C) may be converted to degrees Fahrenheit (°F) as follows:
°F=(1.8×°C)+32

Temperature in degrees Fahrenheit (°F) may be converted to degrees Celsius (°C) as follows:
°C=(°F-32)/1.8

Temperature in kelvin (K) may be converted to degrees Fahrenheit (°F) as follows:
°F=1.8K-459.67

Temperature in kelvin (K) may be converted to degrees Celsius (°C) as follows:
°C=K-273.15

Vertical coordinate information is referenced to the North American Vertical Datum of 1988 (NAVD 88).

Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83).

Altitude, as used in this report, refers to distance above the vertical datum.

*Transmissivity: The standard unit for transmissivity is cubic foot per day per square foot times foot of aquifer thickness [(ft^3/d)/ft^2]ft. In this report, the mathematically reduced form, foot squared per day (ft^2/d), is used for convenience.

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Table A5–1. Current study groundwater discharge estimates for predevelopment conditions and ranges of previously reported estimates of groundwater discharge for each hydrographic area within the Great Basin carbonate and alluvial aquifer system study area.

[All values in acre-feet per year rounded to two significant figures. Estimated error in all current study values is ±30 percent. Previously reported total groundwater discharge minimum and maximum: totals adjusted to exclude groundwater discharge by subsurface outflow (unadjusted estimates are presented in Auxiliary 3P). Abbreviations: HA, hydrographic area; #, number; ETg, groundwater evapotranspiration; —, no estimate]

HA #	HA name	Current study groundwater discharge estimates						Previously reported estimates	
		ETg	Mountain streams	Basin-fill streams/ lakes/ reservoirs	Springs	Adjustment to natural discharge for well withdrawals	Total groundwater discharge	Total groundwater discharge (minimum)	Total groundwater discharge (maximum)
Flow System 7: Humboldt System									
42	Marys River Area	26,000	400	0	1,300	0	28,000	—	—
43	Starr Valley Area	19,000	1,300	0	0	0	20,000	—	—
44	North Fork Area	19,000	2,100	0	3,200	0	24,000	—	—
45	Lamoille Valley	12,000	3,600	0	1,500	0	17,000	—	—
46	South Fork Area	3,000	0	0	1,500	0	[1]4,500	[1,2]3,400	—
47	Huntington Valley	10,000	0	0	3,500	0	14,000	[2]14,000	—
48	Tenmile Creek Area	4,000	10	0	0	0	4,000	[2]4,000	—
49	Elko Segment	2,300	0	0	9,700	0	12,000	—	—
50	Susie Creek Area	1,700	72	See footnote 3	0	0	1,800	[2]1,700	—
51	Maggie Creek Area	9,000	51	See footnote 3	0	0	9,100	[2]9,000	—
52	Marys Creek Area	700	2,500	[3]9,500	4,400	0	[4]17,000	[2,4]3,700	—
53	Pine Valley	17,000	0	5,000	3,200	0	25,000	24,000	54,000
54	Crescent Valley	12,000	0	0	0	600	13,000	[2]14,000	—
55	Carico Lake Valley	7,600	0	0	0	0	7,600	[2]8,200	—
56	Upper Reese River Valley	37,000	4,200	0	0	0	41,000	37,000	57,000
59	Lower Reese River Valley	25,000	0	0	0	0	25,000	—	—
60	Whirlwind Valley	990	0	0	0	0	990	—	—
61	Boulder Flat	30,000	0	0	0	0	30,000	—	—
62	Rock Creek Valley	0	[5]1,100	0	0	0	1,100	—	—
63	Willow Creek Valley	0	See footnote 5	0	0	0	0	—	—
Flow System 23: Monte Cristo Valley									
136	Monte Cristo Valley	400	0	0	0	0	400	[2]400	—

Table A5–1. Current study groundwater-discharge estimates for predevelopment conditions and ranges of previously reported estimates of groundwater discharge for each hydrographic area within the Great Basin carbonate and alluvial aquifer system study area.—Continued

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HA #	HA name	Current study groundwater discharge estimates						Previously reported estimates	
		ETg	Mountain streams	Basin-fill streams/ lakes/ reservoirs	Springs	Adjustment to natural discharge for well withdrawals	Total groundwater discharge	Total groundwater discharge (minimum)	Total groundwater discharge (maximum)
Flow System 24: South-Central Marshes									
117	Fish Lake Valley	21,000	0	0	3,600	0	25,000	[2]24,000	—
118	Columbus Salt Marsh Valley	4,000	0	0	0	0	4,000	[2]4,000	—
137A	Big Smoky Valley-Tonopah Flat	6,000	0	0	0	0	6,000	[2]6,000	—
141	Ralston Valley	2,500	0	0	0	0	2,500	[2]2,600	—
142	Alkali Spring Valley	400	0	0	0	0	400	[2]400	—
143	Clayton Valley	23,000	0	0	1,200	0	24,000	[2]24,000	—
149	Stone Cabin Valley	1,500	46	0	0	0	1,500	[2]2,000	—
Flow System 25: Grass Valley									
138	Grass Valley	7,500	0	0	1,500	0	9,000	—	—
Flow System 26: Northern Big Smoky Valley									
137B	Northern Big Smoky Valley	62,000	4,700	0	2,300	0	69,000	64,000	77,000
Flow System 27: Diamond Valley System									
139	Kobeh Valley	12,000	0	0	2,400	0	14,000	[2]15,000	—
140A	Monitor Valley-Northern Part	500	330	0	1,500	0	2,300	[2]2,000	—
140B	Monitor Valley-Southern Part	9,200	1,200	0	0	0	10,000	[2]9,200	—
151	Antelope Valley	3,200	0	0	810	0	4,000	[2]4,200	—
152	Stevens Basin	0	0	0	0	0	0	[2]0	—
153	Diamond Valley	19,000	0	0	7,400	0	26,000	23,000	30,000
Flow System 28: Death Valley System									
	Amargosa/Death Valley Subarea								
144	Lida Valley	0	0	0	480	0	[1]480	[1,2]0	—
145	Stonewall Flat	0	0	0	0	0	0	[2]0	—
146	Sarcobatus Flat	13,000	0	0	0	0	13,000	3,000	13,000
147	Gold Flat	0	0	0	0	0	0	—	—
148	Cactus Flat	0	0	0	0	0	0	—	—
157	Kawich Valley	0	0	0	0	0	0	—	—
158A	Emigrant Valley-Groom Lake Valley	0	0	0	0	0	0	—	—
158B	Emigrant Valley-Papoose Lake Valley	0	0	0	0	0	0	—	—
159	Yucca Flat	0	0	0	0	0	0	—	—
160	Frenchman Flat	0	0	0	0	0	0	—	—
161	Indian Springs Valley	0	0	0	1,800	0	[1]1,800	[1,2]660	—
168	Three Lakes Valley-Northern Part	0	0	0	0	0	0	—	—
169A	Tikapoo Valley-Northern Part	0	0	0	0	0	0	—	—
169B	Tikapoo Valley-Southern Part	0	0	0	0	0	0	—	—
170	Penoyer Valley	3,800	0	0	0	0	3,800	3,800	6,400
173A	Railroad Valley-Southern Part	200	0	0	0	0	200	[2]200	—
211	Three Lakes Valley-Southern Part	0	0	0	0	0	0	—	—
225	Mercury Valley	0	0	0	0	0	0	—	—
226	Rock Valley	0	0	0	0	0	0	—	—

Table A5–1. Current study groundwater-discharge estimates for predevelopment conditions and ranges of previously reported estimates of groundwater discharge for each hydrographic area within the Great Basin carbonate and alluvial aquifer system study area.—Continued

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HA #	HA name	Current study groundwater discharge estimates						Previously reported estimates	
		ETg	Mountain streams	Basin-fill streams/ lakes/ reservoirs	Springs	Adjustment to natural discharge for well withdrawals	Total groundwater discharge	Total groundwater discharge (minimum)	Total groundwater discharge (maximum)
Flow System 28: Death Valley System—Continued									
				Amargosa/Death Valley Subarea					
227A	Fortymile Canyon-Jackass Flats	0	0	0	0	0	0	—	—
227B	Fortymile Canyon-Buckboard Mesa	0	0	0	0	0	0	—	—
228	Oasis Valley	4,700	0	0	1,300	0	6,000	2,200	6,000
229	Crater Flat	0	0	0	0	0	0	—	—
230	Amargosa Desert	1,400	0	0	18,000	0	19,000	19,000	27,000
243	Death Valley	[6]33,000	0	61	3,700	0	37,000	[2]38,000	—
				Pahrump Valley Subarea					
162	Pahrump Valley	1,000	280	0	9,700	0	11,000	10,000	11,000
240	Chicago Valley	[7]430	0	0	0	0	430	[2]430	—
241	California Valley	[8]0	0	0	0	0	0	—	—
242	Lower Amargosa Valley	[9]8,500	0	0	0	0	8,500	[2]8,500	—
244	Valjean Valley	200	0	0	0	0	200	—	—
245	Shadow Valley	0	0	0	0	0	0	—	—
Flow System 29: Newark Valley System									
154	Newark Valley	22,000	0	0	3,600	0	26,000	16,000	60,000
155A	Little Smoky Valley-Northern Part	0	0	0	6,100	0	6,100	4,000	12,000
155B	Little Smoky Valley-Central Part	0	0	0	0	0	0	—	—
Flow System 30: Railroad Valley System									
150	Little Fish Lake Valley	10,000	0	0	0	0	10,000	9,700	9,800
155C	Little Smoky Valley-Southern Part	0	0	0	0	0	0	[2]0	—
156	Hot Creek Valley	5,700	49	300	1,500	0	7,500	5,000	9,000
173B	Railroad Valley-Northern Part	49,000	550	0	31,000	0	81,000	80,000	85,000
Flow System 32: Independence Valley System									
177	Clover Valley	16,000	0	0	3,300	0	19,000	19,000	84,000
188	Independence Valley	9,500	0	0	0	0	9,500	9,500	47,000
Flow System 33: Ruby Valley System									
176	Ruby Valley	58,000	2,500	0	10,000	0	70,000	68,000	170,000
178A	Butte Valley-Northern Part	6,200	0	0	2,200	0	8,400	[2]7,900	—
Flow System 34: Colorado System									
				Lake Mead Subarea					
164A	Ivanpah Valley-Northern Part	0	0	0	0	0	0	[2]0	—
164B	Ivanpah Valley-Southern Part	0	0	0	0	0	0	[2]0	—
165	Jean Lake Valley	0	0	0	0	0	0	[2]0	—
166	Hidden Valley South	0	0	0	0	0	0	—	—
167	Eldorado Valley	0	0	0	0	0	0	—	—
212	Las Vegas Valley	19,000	0	0	5,000	0	[10]24,000	[2,10]67,000	—
215	Black Mountains Area	0	0	100	1,600	0	1,700	[2]1,500	—

Table A5–1. Current study groundwater-discharge estimates for predevelopment conditions and ranges of previously reported estimates of groundwater discharge for each hydrographic area within the Great Basin carbonate and alluvial aquifer system study area.—Continued

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HA #	HA name	Current study groundwater discharge estimates						Previously reported estimates	
		ETg	Mountain streams	Basin-fill streams/ lakes/ reservoirs	Springs	Adjustment to natural discharge for well withdrawals	Total groundwater discharge	Total groundwater discharge (minimum)	Total groundwater discharge (maximum)
Flow System 34: Colorado System—Continued									
				Muddy River Subarea					
171	Coal Valley	100	0	0	0	0	100	—	—
172	Garden Valley	0	0	0	0	0	0	—	—
181	Dry Lake Valley	0	0	0	0	0	0	—	—
182	Delamar Valley	0	0	0	0	0	0	—	—
183	Lake Valley	2,900	0	0	5,500	0	8,400	6,000	8,500
198	Dry Valley	10	0	0	0	0	10	—	—
199	Rose Valley	10	0	0	0	0	10	—	—
200	Eagle Valley	290	0	0	0	0	290	—	—
201	Spring Valley	1,000	0	0	0	0	1,000	—	—
202	Patterson Valley	0	0	0	0	0	0	—	—
203	Panaca Valley	530	0	0	7,900	0	8,400	—	—
204	Clover Valley	210	0	0	0	0	210	—	—
205	Lower Meadow Valley Wash	1,400	0	0	0	0	1,400	—	—
206	Kane Springs Valley	0	0	0	0	0	0	—	—
208	Pahroc Valley	0	0	0	0	0	0	[2]0	—
209	Pahranagat Valley	0	0	0	26,000	0	26,000	[2]27,000	—
210	Coyote Spring Valley	0	0	0	0	0	0	[2]0	—
216	Garnet Valley	0	0	0	0	0	0	—	—
217	Hidden Valley North	0	0	0	0	0	0	—	—
218	California Wash	0	0	0	0	0	[11]0	[2,11]2,700	—
219	Muddy River Springs Area	0	0	0	35,000	0	35,000	—	—
220	Lower Moapa Valley	0	0	730	0	0	[11]730	[2,11]15,000	—
				White River Valley Subarea					
174	Jakes Valley	0	1,900	0	0	0	[1]1,900	[1]500	[1]1,000
175	Long Valley	1,000	0	0	0	0	1,000	1,000	11,000
180	Cave Valley	1,400	0	0	650	0	2,000	0	2,000
207	White River Valley	34,000	1,200	1,500	43,000	0	80,000	35,000	77,000
				Virgin River Valley Subarea					
221	Tule Desert	0	0	0	0	0	0	—	—
222	Virgin River Valley	0	570	36,000	2,600	0	39,000	—	—
Flow System 35: Goshute Valley System									
178B	Butte Valley-Southern Part	12,000	0	0	0	0	12,000	12,000	12,000
179	Steptoe Valley	64,000	3,600	0	45,000	0	110,000	70,000	130,000
187	Goshute Valley	6,600	0	0	0	0	[12]6,600	[2,12]42,000	—
Flow System 36: Mesquite Valley									
163	Mesquite Valley	2,200	0	0	0	0	2,200	[2]2,200	—

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HA #	HA name	Current study groundwater discharge estimates						Previously reported estimates	
		ETg	Mountain streams	Basin-fill streams/ lakes/ reservoirs	Springs	Adjustment to natural discharge for well withdrawals	Total groundwater discharge	Total groundwater discharge (minimum)	Total groundwater discharge (maximum)
Flow System 37: Great Salt Lake Desert System									
184	Spring Valley	65,000	480	0	17,000	0	82,000	71,000	90,000
185	Tippett Valley	2,000	0	0	0	0	2,000	0	2,900
186A	Antelope Valley-Southern Part	210	0	0	0	0	[13]210	[2,13]0	—
186B	Antelope Valley-Northern Part	100	0	0	0	0	100	[2]100	—
189A	Thousand Springs Valley-Herrell-Brush Creek	1,500	260	0	0	240	2,000	[2]1,800	—
189B	Thousand Springs Valley-Toano-Rock Spring	1,600	0	0	0	0	1,600	[2]1,700	—
189C	Thousand Springs Valley-Rocky Butte Area	1,200	0	0	0	0	1,200	[2]1,200	—
189D	Thousand Springs Valley-Montello-Crittenden	12,000	0	0	2,600	0	15,000	[2]14,000	—
191	Pilot Creek Valley	4,000	0	0	1,400	0	5,400	[2]4,600	—
251	Grouse Creek Valley	11,000	960	0	0	1,400	13,000	[2]13,000	—
252	Pilot Valley	6,900	0	0	480	0	7,400	[2]7,600	—
253	Deep Creek Valley	14,000	0	0	4,400	0	18,000	14,000	17,000
254	Snake Valley	100,000	2,800	0	30,000	0	130,000	82,000	130,000
255	Pine Valley	0	0	0	0	0	[11]0	[11]7,000	[11]7,100
256	Wah Wah Valley	620	0	0	900	0	1,500	1,400	1,500
257	Tule Valley	37,000	0	0	1,000	0	38,000	32,000	40,000
258	Fish Springs Flat	8,000	0	0	26,000	0	34,000	35,000	35,000
259	Dugway-Government Creek Valley	1,000	0	0	5,100	0	[1]6,100	[1]3,800	[1]3,800
260A	Park Valley-West Park Valley	4,100	0	0	1,200	0	5,300	—	—
261A	Great Salt Lake Desert-West Part	56,000	0	0	18,000	0	74,000	[2]83,000	—
Flow System 38: Great Salt Lake System									
260B	Park Valley-East Park Valley	11,000	1,100	0	0	0	12,000	—	—
261B	Great Salt Lake Desert-East Part	7,400	0	0	0	0	7,400	—	—
262	Tooele Valley	17,000	7,800	0	24,000	13,000	62,000	66,000	68,000
263	Rush Valley	27,000	5,900	0	0	3,400	36,000	[2]32,000	—
264	Cedar Valley	0	390	0	3,700	0	4,100	—	—
265	Utah Valley Area	49,000	110,000	81,000	110,000	64,000	410,000	310,000	500,000
266	Northern Juab Valley	4,400	3,400	5,800	13,000	11,000	38,000	[2]41,000	—
267	Salt Lake Valley	60,000	34,000	170,000	20,000	75,000	360,000	[2]360,000	—
268	East Shore Area	8,000	6,200	0	70,000	35,000	120,000	[2]130,000	—
269	West Shore Area	2,400	0	0	4,700	0	7,100	[2]6,800	—
270	Skull Valley	27,000	0	0	4,100	3,500	35,000	[2]35,000	—
271	Sink Valley	0	0	0	0	0	[14]0	[2,14]200	—
272	Cache Valley	63,000	190,000	130,000	130,000	27,000	[1]540,000	[1]280,000	[1]330,000
273	Malad-Lower Bear River Area	130,000	9,600	130,000	86,000	11,000	370,000	[2]370,000	—
274	Pocatello Valley	0	0	0	0	0	0	—	—
275	Blue Creek Valley	700	0	0	7,700	0	8,400	[2]8,500	—

Table A5–1. Current study groundwater-discharge estimates for predevelopment conditions and ranges of previously reported estimates of groundwater discharge for each hydrographic area within the Great Basin carbonate and alluvial aquifer system study area.—Continued

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HA #	HA name	Current study groundwater discharge estimates						Previously reported estimates	
		ETg	Mountain streams	Basin-fill streams/ lakes/ reservoirs	Springs	Adjustment to natural discharge for well withdrawals	Total groundwater discharge	Total groundwater discharge (minimum)	Total groundwater discharge (maximum)
Flow System 38: Great Salt Lake System—Continued									
276	Hansel and North Rozel Flat	7,600	0	0	0	0	7,600	[2]10,000	—
277	Promontory Mountains Area	7,300	0	0	3,800	0	[15]11,000	[2,15]18,000	—
278	Curlew Valley	13,000	410	0	41,000	22,000	76,000	[2]93,000	—
279	Great Salt Lake	0	0	57,000	1,500	0	58,000	—	—
Flow System 39: Sevier Lake System									
280	Beryl-Enterprise Area	26,000	0	0	0	0	[10]26,000	[2,10]86,000	—
281	Parowan Valley	12,000	8,800	0	0	22,000	43,000	—	—
282	Cedar City Valley	22,000	6,700	0	3,300	0	32,000	39,000	40,000
283	Beaver Valley	18,000	15,000	2,200	26,000	6,900	68,000	[2]56,000	—
284	Milford Area	33,000	0	0	0	0	[10]33,000	[2,10]81,000	—
285	Leamington Canyon	15,000	1,200	See footnote 16	3,100	0	19,000	—	—
286	Pavant Valley	24,000	5,500	0	0	42,000	72,000	[2]84,000	—
287	Sevier Desert	59,000	3,000	[16]35,000	15,000	0	110,000	—	—

[1]Current study estimate exceeds previously reported value by more than 30 percent as current study estimate includes discharge to mountain springs and (or) mountain streams not quantified in previous report.

[2]Only one previously reported total discharge estimate for this HA.

[3]Estimate is total for HAs 50, 51, and 52.

[4]Current study estimate exceeds previously reported value as current study estimate includes discharge to the Humboldt River not included in previously reported estimate.

[5]Estimate is total for HAs 62 and 63.

[6]Estimate does not include ETg from Tecopa area, which is listed under HA 242.

[7]Estimate is for northern portion of HA only.

[8]Small amount of ETg for this HA is included in estimate as part of the Tecopa and California Valley areas reported in HA 242.

[9]Estimate is for Tecopa/California Valley, which includes ETg from HAs 240, 241, 242, and 243; majority in HA 242 and Shoshone areas.

[10]Prveiously reported values exceed current study estimate by more than 30 percent as previously reported estimate includes groundwater discharge to well withdrawals that would not have been occurring under predevelopment conditions; total discharge estimates for predevelopment conditions were not included in previous report.

[11]Previously reported value exceeds current study estimate by more than 30 percent as estimates of ETg from previous report appear to be surface-water supported, and were not used in current study estimate.

[12]Previously reported value exceeds current study estimate by more than 30 percent as previous estimate is from Nichols (2000), which is suspected to be too high; Nichols (2000) estimate was not used in current study estimates; see text for explanation).

[13]Current study estimate exceeds previously reported value by more than 30 percent as previous report includes discharge only from subsurface outflow, which is not quantified at the HA level in the current study.

[14]Previously reported value exceeds current study estimate by more than 30 percent as previously reported ETg was very small, and there was no previously mapped ETg area for the HA; ETg from the previous study, therefore, was not used in current study estimate.

[15]Previously reported value exceeds current study estimate because previous study estimate of spring discharge is suspected to be too high.

[16]Estimate includes some groundwater that discharges to the Sevier River within HA 285.