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A Feasibility Study of Water Production from Deep Carbonate Aquifers in Nevada

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hypothetical systems in two dimensions. It has been found that, given certain boundary conditions, usually imposed by permeability, topography and available recharge, it is possible for what have been called local, intermediate and regionals systems to exist (Toth, 1963).

The models provide important points of departure in attempts to delineate naturally occurring groundwater flow systems. The importance of models can be seen in Figure 2, because a commonly assumed criterion for a system boundary is a region of high groundwater potential. These regions of high potential are usually recognized in nature by the configuration of saturation, and fluid potentials at depth are rarely known. The models in Figure 2 clearly suggest that such regions of high fluid potentials are not necessarily perfect boundaries to the system as a whole, and that flow can occur at depth from one "cell" of the depicted system to another.

Most important to the flow-system delineation are hydrogeologic conditions of relatively high permeability at depth such as exists in carbonate rocks. In such situations models suggest that large quantities of water can move from one "cell" to another. Thus, it may be insufficient to map only the surficial or "shallow" fluid potential field of a groundwater system if full and reliable identification of the system is to be accomplished in terrane which may be underlain by rocks of high relative permeability. Most hydrologic data of groundwater potential are limited to close to the top of the zone of saturation, and hence even a detailed knowledge of the configuration of saturation may be woefully inadaquate to ascertain where some waters leave the system, or where they enter the system in areas underlain by permeable zones at depth. There is good evidence for extensive permeable zones at considerable depths with the carbonate rocks in eastern and southern Nevada.

Flow System Delineation In Carbonate Terrane

The evidence available suggests that thick sequences of carbonate rocks underlie most of the alluvial basins and much of the volcanic rock sequences of eastern Nevada. Deep petroleum wildcat drilling indicates that intervals of cavernous carbonate rock exist to depths perhaps greater than 10,000 feet, as many test holes experienced extreme circulation difficulties, and a few have experienced dropping bits upon encountering caverns (see Appendix IV).

Name & Location	Date	Elevation (ft.)	Lithologic Unit	Discharge (gpm)	SpC (µmohs/cm)	TDS (mg/ℓ)	Temp. (F°)	pH	Ca (mg/ℓ)	Mg (mg/ℓ)	Na (mg/ℓ)	K (mg/ℓ)	Cl (mg/ℓ)	SO_4 (mg/ℓ)	HCO_3 (mg/ℓ)	System Class	Source of Information
Big Spring 33/10N/70E		5580		3590 E	401	216	64	7.8	47	20	-	5.9	3.7	8.0	238		USGS
--- 27/9N/67E	7/15/64				236		70	7.9	24	6.8	-	18	11	11	122		USGS
Belmont 26/9N/45E	5/23/73					239		8.13	54	11	10	1.0	3.0	18	197	L	DRI
Ducan Ranch Hot Creek Canyon: 25/8N/49E	4/24/72					428		7.62	72	22	-	48	19	52	361	R	NSHS
Butterfield Springs 28/7N/62E	1/1/44					283			40	23	-	2.0	18	27	178		DRI
--- 24/8N/49E	8/29/65				462	284	92	8.0	18	26	-	52	22	64	204	R	USGS
--- 29/8N/50E	8/30/65				718	447	94	8.2	13	26	-	124	33	81	340	R	USGS
Immigrant Spring SW/NE/19/9N/62E	7/31/75	5450	Ord.-Sil.-Dev. Carb.	1350	425	370	67	6.8	88	35	41	6.0	84	107		SL-L	DRI
Lockes Stockyard Spring NE/NE/15/8N/55E	11/12/66	4860	Devonian NV Fm.	425 E			89-93		-	4.74*	-	2.55*	-	1.57*	-	R	DRI
Reynolds Spring SE/NE/15/8N/55E	11/12/66	4860	Nevada Formation	323			97-99		-	4.65*	-	2.45*	-	1.58*	-	R	DRI
Blue Eagle & Jack's Spring: SE/SE/11/8N/57E	11/12/66	4760	Devonian Carbonate	2270 V		590	82		80	24	-	30	10	34	385	R	NSS
Tom Spring NW/NW/12/8N/57E	11/12/66	4760	Devonian Carbonate	250 E			71		-	5.20*	-	1.77*	-	0.99*	-	R	DRI
Butterfield Spring NE/SE/27/8N/57E	11/13/66	4750	Devonian Carbonate	200 E			61		-	4.81*	-	1.70*	-	0.99*	-	R	DRI
Butterfield Springs NW/NE/28/7N/62E	11/14/66	5250	Ord.-Sil. Carbonate	1125					-	3.98*	-	0.34*	-	0.36*	-	L	DRI
Flag Springs SW/NW/33/7N/62E	7/6/75	5250	Fish Haven Dolomite	1125	405	350	64	7.5	50	20	8.0	2.0	27	11		L	DRI
Forest Home Spring NE/SE/18/6N/59E	11/14/66	6210	Paleozoic Carbonate	425 E			57		-	4.81*	-	0.42*	-	0.61*	-	L	DRI
Moon River Spring NW/25/6N/60E	11/14/66	5200	Lehman Fm. of Pogonip Group	900			92		-	4.26*	-	1.23*	-	1.10*	-	R	DRI
Hot Creek Springs SE/NE/18/6N/61E	5/27/49	5200	Silurian Lake-town Dolomite	6885		346	92		58	22	-	32	12	45	294	R	NSS
Cave Spring 16/9N/64E	5/24/66	6500	Pole Canyon Limestone	400 V			cool		-	0.77*	-	0.12*	-	0.22*	-	SL	DRI
Geyser Spring SW4/9N/65E	8/7/63	6800	Pole Canyon Limestone	58-1153		115	68	8.0	30	3.4	0.2	1.0	3.0	5.0	103	SL	USGS
Franks Warm Springs 20/4N/50E	5/23/73					819		8.27	67	24	156	32	30	105	642	R	NSHS
Willow Spring 36/2S/43E		5950		<1.0													USGS
Stonewall Spring 5/5S/44E		5800		10	282		69										USGS
Stainingers Springs 6/11S/43E	1/20/67	3200		200	734	(419)	77	8.1	9.6	2.4	-	149	47	92	238	R	USGS
Grapevine Springs 6/11S/43E		2800		>20													USGS
Summer Spring 17/2S/51E		6700		3.0													USGS
Cedar Spring 21/2S/51E	8/1/67	6540		2.5	533	(346)	77	7.7	62	5.9	47	2.5	23	48	240	R	USGS
Storm Spring 11/6S/54E	10/7/71	4805		5.0	1200		98						17				USGS

APPENDIX II (cont.)