GEOLOGICAL SURVEY OF WYOMING

THERMAL, CHEMICAL, AND HYDROLOGIC DATA FOR THE THERMOPOLIS HYDROTHERMAL SYSTEM: BACKGROUND DATA FOR GEOLOGICAL SURVEY OF WYOMING PRELIMINARY REPORT NO. 20

by

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Introduction

This open file report consists of data compilations pertinent to the geothermal system near Thermopolis, Wyoming. The data contained in this report is discussed and interpreted in "The Thermopolis Hydrothermal System With an Analysis of Hot Springs State Park," Wyoming Geological Survey Preliminary Report No. 20. Updated information may be added to this open file report when available.

Oil field bottom-hole temperature data for the Thermopolis study area

The following table is a compilation of oil and gas well bottom-hole temperatures for the Thermopolis study area. Bottom-hole temperatures were taken from oil and gas well logs available at the Geological Survey of Wyoming in Laramie Wyoming, and the Wyoming Oil and Gas Conservation Commission in Casper, Wyoming.

These temperatures are usually made with a maximum recording mercury thermometer that is attached to a downhole logging tool. The tool is lowered down the drill hole a short time after fluid circulation in the hole is stopped. When the tool is returned to the surface, the temperature is written on the log. Since the fluid circulation in the drill hole disturbs the true rock temperature, a bottom-hole temperature measures the disturbed temperature. However, bottom-hole temperatures will still generally be representative of the thermal regime of an area.

Location	Depth (feet)	Temp. (°F)	Gradient (°F/1000 ft)
T7N R4E Sec 14	3684	91	12.2
T8N R2E Sec 14	3592	88	11.7
T8N R3E Sec 6	4206	108	14.7
33	1407	84	27.0
T9N R1E Sec 36	2445	104	11.5
T9N R2E Sec 33	1332	68	16.5
36	3712	95	13.2
T9N R3E Sec 31	4781	108	
T41N R91W Sec 4	2356	83	15.7
5	2106	98	24.7
11	1999	68	11.0
14	1662	86	24.1
27	1105	69	20.8
T42N R88W Sec 21	3885	105	15.4
T42N R89W Sec 16	3206	104	18.4
18	4065	96	12.5
T42N R90W Sec 2	4046	95	12.1
3	4315	101	12.8
4	1941	95	25.2
6	3991	105	14.8
8	4202	90	10.5
12	4327	124	18.0
13	3889	92	11.8
14	4311	104	13.5
16	3647	102	15.4
17	3926	96	12.7
21	3065	107	19.9
33	2937	82	12.3
T42N R91W Sec 18	3507	118	20.5
25	3407	108	18.2
29	3153	84	12.1
31	2341	81	15.0
32	2964	115	15.3
T42N R92W Sec 2	3246	85	12.0
23	3215	81	10.9

Location	Depth (feet)	Temp. (°F)	Gradient (°F/1000 ft)
T42N R96W Sec 2	2848	83	13.0
12	1150	102	48.7
13	1377	75	21.1
14	4058	93	11.6
T43N R89W Sec 3	6700	114	10.3
7	6189	113	11.0
25	2106	80	11.3
33	3478	88	12.4
T43N R90W Sec 2	5618	107	10.9
6	6218	130	13.5
8	6152	125	12.8
9	5572	114	12.2
9	5027	109	12.5
22	4746	114	14.3
25	4594	98	11.3
27	4557	105	12.9
27	3800	95	12.9
31	4138	90	10.6
31	3409	104	17.0
35	3746	95	13.1
36	4586	102	12.1
T43N R91W Sec 6	4476	109	14.1
6	4524	107	13.5
6	4530	104	12.8
6	4601	119	15.9
6	4733	112	13.9
6	3174	90	13.9
6	4620	103	13.6
6	5197	112	12.7
6	4688	118	15.4
T43N R91W Lot 49	3497	91	12.9
T43N R91W Sec 8	4632	115	14.9
8	4627	108	13.4
8	4505	118	16.0
12	6041	120	12.2

Location	Depth (feet)	Temp. (°F)	Gradient (°F/1000 ft)	Location	Depth (feet)	Temp. (°F)	Gradient 0°F/1000 ft)
T43N R91W Sec 19	3935	94	12.2	T43N R92W Sec 10	3781	102	14.8
25	3523	98	14.8		3774	120	19.7
26	3459	118	20.8		3828	98	13.6
	3758	102	14.9		3817	89	11.3
27	4437	104	13.1	11	3711	90	11.9
	3293	89	13.1	13	3546	102	13.0
	3288	94	14.6	14	3574	102	15.7
28	3616	126	22.1	16	3562	118	20.3
	3490	87	11.1	T43N R93W Sec 2	4149	110	15.4
	3293	88	12.8	3	4511	119	16.2
29	3393	92	13.6	4	4538	129	18.3
34	3450	94	13.9	5	4827	128	17.0
35	3294	82	10.9	10	4061	133	21.4
	3522	93	13.3	18	2453	84	15.5
36	4550	96	11.0	19	1373	116	51.0
	4040	103	14.1	21	1585	85	24.6
	3315	82	10.9		2673	88	15.7
	3338	99	15.9	25	2445	80	13.9
	3371	94	14.2	28	1056	85	36.9
	3462	102	16.2		1348	82	26.7
T43N R92W Sec 1	4794	129	13.6		1074	80	31.7
	4743	108	13.1		1347	80	25.2
	1806	82	19.9		1337	78	23.9
	5190	112	12.7		1355	81	25.8
	4717	110	13.6		1369	81	25.6
	4814	123	16.0		1356	82	26.5
	4645	103	12.3		1357	81	25.8
3	3730	105	13.8		1446	84	26.3
4	3975	101	13.8	29	1192	80	26.3
5	4598	110	13.9		1425	90	33.7
	4613	109	13.7	T43N R94W Sec 5	3717	94	12.9
6	4858	110	13.2		3353	110	19.1
	4918	118	14.6	8	2358	97	21.6
8	4563	105	12.9	15	2413	90	18.2
	4494	110	14.2	16	2424	87	16.9
10	3342	102	16.3		2347	90	18.7

Location	Depth (feet)	Temp. (°F)	Gradient (°F/1000 ft)
T43N R94W Sec 16	1737	86	23.0
31	200	106	300.0
32	370	74	75.7
36	1166	101	47.2
	903	85	43.1
T43N R95W Sec 18	418	145	236.8
21	385	116	181.8
22	305	126	262.3
31	3307	98	15.7
T43N R96W Sec 2	723	161	159.1
12	1798	150	57.8
T43N R99W Sec 4	5248	97	9.7
5	5689	100	9.5
T44N R90W Sec 13	2621	117	27.1
15	9264	131	16.8
17	6753	130	12.4
24	2921	96	17.1
31	5940	138	15.5
T44N R91W Sec 20	7460	118	9.7
	7679	128	10.7
28	7289	128	11.2
31	4957	106	12.1
35	6065	107	10.1
	6350	120	11.7
36	6134	118	11.7
	6403	115	10.8
T44N R92W Sec 7	8057	132	10.7
11	6685	114	10.2
24	7377	140	12.7
24	5268	117	13.5
27	5648	118	12.7
	5448	118	13.2
	5614	115	12.3
29	5784	121	13.0
32	4661	117	15.2
34	5866	124	13.3

Location	Depth (feet)	Temp. (°F)	Gradient (°F/1000 ft)
T44N R92W Sec 34	5483	116	12.8
	5357	120	13.8
35	4762	104	12.2
	3430	137	21.3
	5251	115	13.1
	5079	110	12.6
	5255	110	12.2
	5139	114	13.2
	5091	120	14.5
	5059	114	13.4
	5025	107	12.1
	5021	110	12.7
	5071	113	13.2
	5103	108	12.1
	4980	117	14.3
36	4990	110	12.8
	4966	115	13.9
	4821	111	13.5
	4780	112	13.8
	4985	120	14.8
	4851	123	15.9
T44N R93W Sec 17	6173	146	16.2
	6753	130	12.4
21	5552	158	20.2
27	5180	123	14.9
	4843	119	15.1
33	4601	130	18.3
35	4662	141	20.4
36	4562	128	18.0
	1162	70	20.7
	4594	118	15.7
T44N R94W Sec 19	6102	125	12.9
28	6045	134	14.6
30	5939	126	13.5
31	3868	112	17.1
	4183	94	11.5

Location	Depth (feet)	Temp. (°F)	Gradient (°F/1000 ft)
T44N R95W Sec 7	6802	127	11.9
8	4123	104	14.1
	6578	121	11.4
11	7449	142	12.9
14	5343	128	15.3
	5320	129	15.6
15	5460	132	15.8
	5335	138	17.2
	5325	133	16.5
22	5291	149	19.7
	5353	124	14.6
	5243	130	16.0
23	5235	135	17.0
	5086	146	19.7
	5140	128	16.0
	5164	137	18.8
	5221	146	19.2
	5199	130	16.3
	5191	130	16.4
	5230	131	16.3
	5207	133	16.7
	5194	131	16.4
	5238	129	15.8
	5252	128	15.6
	5092	131	16.7
	5249	134	16.8
	5151	124	15.1
	5170	135	17.2
	7987	162	14.5
24	5381	135	16.7
	5437	136	16.6
	5269	132	16.3
	5317	130	15.8
	5260	130	16.0
	5213	133	16.7
T44N R96W Sec 2	3991	120	13.7
	5027	110	12.8

Location	Depth (feet)	Temp. (°F)	Gradient (°F/1000 ft)
T44N R96W Sec 2	6167	138	14.9
	5903	116	11.9
	6001	132	14.1
	2249	76	13.3
	6190	121	12.1
3	6097	128	13.5
7	3899	129	21.3
	4936	118	14.6
	3704	144	32.8
	3805	141	25.0
11	5595	120	13.2
19	3135	105	18.8
	3150	136	28.6
	2864	118	25.1
28	2427	102	23.1
35	1764	122	43.1
T44N R97W Sec 1	4711	104	12.3
7	2935	112	22.5
10	4107	119	17.8
	3421	120	21.6
12	3783	145	26.2
	3754	126	21.3
	3801	130	22.2
	4705	141	20.2
18	3270	120	22.6
	3458	122	22.0
	2789	107	22.7
	3441	122	22.1
	3601	121	20.8
	3519	120	21.0
	3351	123	22.9
19	3091	118	23.3
	3065	112	21.5
	3460	124	22.5
	3436	120	21.5
	3506	128	23.4
20	3923	115	17.6

Location	Depth (feet)	Temp. (°F)	Gradient (°F/1000 ft)	Location	Depth (feet)	Temp. (°F)	Gradient (°F/1000 ft)
T44N R97W Sec 20	2785	111	23.3	T44N R98W Sec 13	3366	126	23.8
24	3124	112	20.7		3367	132	25.5
32	5324	107	11.5		3467	128	23.7
T44N R98W Sec 6	4749	120	15.6		3498	108	17.7
	4546	122	16.7		3299	130	25.5
	5479	120	16.9	14	3333	125	23.7
8	4748	130	17.7		2391	114	28.4
9	4506	130	18.6		3363	124	24.4
	3949	148	25.8		3141	128	27.8
11	3479	142	27.6		3216	132	26.7
	2611	102	21.4		3332	120	22.2
	2610	115	26.4		3389	130	25.40
	2762	114	24.6		3018	102	24.5
	2683	132	32.1		2950	140	31.9
	2812	121	26.7		3330	129	24.9
	2704	114	25.1		3341	144	29.3
	2529	108	24.5		3043	115	22.7
12	2649	106	22.7		3073	114	22.1
	2528	108	24.4		2580	122	29.4
	2723	112	24.2		3606	116	19.4
13	3299	130	25.5		3573	120	20.7
	3270	135	23.5	15	3640	162	31.9
	3364	140	27.9	18	3265	148	31.8
	3416	136	26.4	19	3162	130	26.6
	2787	143	34.8	23	3613	119	20.2
	3292	122	23.4		4101	118	15.8
	2959	130	28.4		2949	115	23.4
	2765	122	27.5		3212	117	22.6
	3168	128	25.9	24	3075	116	22.8
	3311	137	27.5		2790	125	28.4
	3334	125	23.7		2509	112	26.3
	3631	104	16.0		2936	114	23.2
	3398	129	24.5		3315	138	27.8
	3351	132	25.7		3118	126	25.7
	3288	130	27.4		3242	118	22.2
	3333	132	25.8		2679	111	24.3
	3142	130	26.7		2846	117	26.0

Location	Depth (feet)	Temp. (°F)	Gradient (°F/1000 ft)
T44N R98W Sec 24	3426	116	20.2
	3070	126	26.1
	3207	122	23.7
	2651	126	30.2
26	5639	126	14.2
T44N R99W Sec 20	6889	130	12.2
23	7162	110	8.9
T45N R88W Sec 9	2622	89	16.8
11	3419	133	25.7
T45N R89W Sec 27	7479	133	11.8
T45N R90W Sec 5	6540	101	8.4
6	6689	128	72.3
9	9154	133	9.5
T45N R91W Sec 10	10689	143	9.1
28	10499	118	9.2
29	10197	145	7.6
30	10542	159	10.7
30	10630	157	10.4
T45N R92W Sec 14	11058	169	20.2
19	10370	165	11.5
	4754	92	17.7
	10962	182	12.4
	10186	119	7.2
20	10025	148	10.2
21	10022	159	11.3
22	10100	152	10.5
T45N R93W Sec 7	8722	135	10.2
13	10732	171	11.6
14	10298	144	9.5
15	5466	108	11.4
24	10430	190	13.8
29	11921	155	16.6
T45N R95W Sec 27	11578	140	14.8
T45N R96W Sec 28	8764	140	10.7

Location	Depth (feet)	Temp. (°F)	Gradient (°F/1000 ft)
T45N R97W Sec 12	9009	155	12.6
	7111	138	12.9
	9575	172	24.1
	9329	168	13.1
	10089	180	24.2
	9208	156	21.8
14	7510	134	21.3
	10024	173	12.7
23	6739	132	12.8
27	5600	160	20.4
	5885	162	19.7
34	4468	133	19.5
35	5932	149	17.4
	5183	114	13.1
T45N R98W Sec 31	5581	161	39.9
34	5000	139	18.6
T45N R99W Sec 5	5577	101	9.9
17	6142	97	8.3
25	3506	90	12.6
35	7306	136	12.3

Water chemistry data for the Thermopolis study area

The importance of water chemistry data in an evaluation of the Thermopolis hydrothermal system is twofold: 1) Water chemistry for specific formations in the area elucidates the source or sources of thermal waters and demonstrates the range of chemical characteristics of area groundwater, and 2) Documentation of the chemistry of thermal waters themselves is a necessary component of developmental planning and should allow anticipation of waste disposal and mineral scaling problems. General characteristics and average chemistry for the principal Paleozoic aquifers have been presented in the text; this compilation includes individual analyses from wells and springs within the study area. Although a larger and more complete data base can be developed by considering the entire Bighorn Basin, this also leads to greater chemical variation and suggests the more restricted group of analyses is appropriate to a specific study of Thermopolis.

Water chemistry data are generally collected by the oil and gas industry for the characterization and identification of formation waters in association with hydrocarbon accumulations. Thus, these analyses do not derive from a random, representative sampling of a given formation, but come primarily from the crestal portions of anticlines and domes, commonly sites of relatively stagnant and more mineralized waters. Oil-field water analyses can be recognized in the listing by the inclusion of the field name with the location.

The other source of water chemistry data is the sampling of water wells and springs. Since the wells were presumably cited to maximize yield and accessibility and minimize mineral concentration, their waters are from a variety of structural settings encouraging free flow, and are generally more dilute than oil-field waters. These analyses are grouped with the oil-field waters by formation, but are not located by field.

Finally, water analyses for the hot wells and springs in the immediate Thermopolis area have not been assigned to specific formations. Since these waters are assumed to result from interformational migration and mixing along the crest of the Thermopolis anticline, they are presented together as an additional category representing the chemistry of waters likely to be developed from the hydrothermal system.

Locations are given using standard township-range-section notation. Chemical concentrations are collected from sources using both parts per million (ppm) and milligrams per liter (mg/l). For dilute waters these units are effectively the same and are not distinguished in the listing. The "total solids" reported here represent either the anhydrous residue of a heated sample or the sum of the analyzed constituents. The reader is referred to the sources listed for the details of an individual analysis.

Park City Formation Water Chemistry
(ion concentrations in ppm or mg/l)

Location	Field	Temp.	Ca	Mg	Na+K	Na	K	HCO_3	CO_3	SO_4	Cl	F	NO_3	SiO_2	T.S.	pH	Source
T9N R2E Sec36	Owl Creek		192	86	38			366	0	558	24				1078		(1)
T42N R95W Sec24			182	76	45			490		355	66				965		(2)
T42N R95W Sec25		22	146	50	48	41	7.4	377	0	276	39	1.2	.3	13	759	8.0	(3)
T43N R91W Sec 6	Murphy Dome		532	117	2356			1143		5391	276				9234		(4)
T43N R91W Sec35	Black Mtn.		220	44	819			515	72	1497	291				3195		(4)
T43N R91W Sec35	Black Mtn.		673	99	428			1097	34	1935	35				3743		(2)
T43N R91W Sec35	Black Mtn.		582	154	427			781		2176	78				3802		(2)
T43N R92W Sec11	Lake Creek		1122	320	6329			8126		6991	2799				21557		(4)
T43N R92W Sec21	Kirby Creek		934	168	11912			2456		9617	11996				35835		(4)
T43N R93W Sec 3	Corley		569	109	1201			1465		2922	168				5690		(4)
T43N R94W Sec34	Warm Spring		261	111	432			1195		565	340				2297		(4)
T43N R94W Sec36	E. Warm Spg.		548	135	263			890		1376	235				2995		(2)
T44N R91W Sec36	Water Creek		389	108	10937			878	0	15000	6300				33166		(1)
T44N R93W Sec35	Zimmerman		285	152	2236			1041	101	4414	416				8115		(4)
T44N R95W Sec23	Gebo		380	71	3897			1185		5720	1980				12632		(4)
T44N R97W Sec	Hamilton Dome		530	94	1828			1045	0	2638	1477				7081		(1)
T44N R97W Sec12	Waugh Dome		505	85	866			1285		1752	437				4277		(4)
T44N R97W Sec12	Waugh Dome		57	79	640			245		1356	173				2426		(2)
T44N R97W Sec 7	Waugh Dome		173	65	905			915		1376	340				3309		(2)
T44N R98W Sec14	Hamilton Dome		419	89	2521			1187		3023	1945				8566		(4)
T44N R98W Sec14	Hamilton Dome		273	90	3867			550		4592	3000				12092		(2)
T44N R98W Sec14	Hamilton Dome		56	32	3620			245		4239	2500				10567		(2)
T44N R98W Sec14	Hamilton Dome		326	81	3294			660		3851	2667				10543		(2)

Tensleep Sandstone
(ion concentrations in ppm or mg/l)

Location	Field	Temp. (°C)	Ca	Mg	Na+K	Na	K	HCO_3	CO_3	SO4	Cl	F	NO_3	SiO_2	T.S.	pH	Source
T42N R88W Sec21		12.0	43	24	4.9	3.5	1.4	212	0	32	1.2	0.4	0.9	11	221	7.7	(5)
T42N R88W Sec31			42	18	8.3	4.3	4.0	200	0	24	3.6	0.3	0.6	11	204	7.8	(6)
T42N R94W Sec26			92	41	11.6	10	1.6	298	0	170	3.1	2.2	0.4	12	446	8.2	(5)
T42N R95W Sec13		19.5	280	86	135	113	22	711	0	542	125	2.2	0.0	13	1620	7.8	(5)
T43N R87W Sec11		10.0	43	22	3.2	1.4	1.8	228	0	9.0	1.0	0.2	1.0	11	202	7.5	(5)
T43N R87W Sec21			59	27	3.6	2.6	1.0	258	0	44	1.0	0.3	.0	9.4	272	7.4	(5)
T43N R87W Sec21			50	27	4.9	2.1	2.8	250	0	33	1.8	0.3	0	8.4	248	8.0	(6)
T43N R91W Sec 6	Murphy Dome		486	82	883			170		3080	88				4703		(4)
T43N R91W Sec25	Black Mtn.		68	19	51			380		28	12				365		(2,4)
T43N R91W Sec36	Black Mtn.		41	30	20			287		21	8				261		(2)
T43N R91W Sec36			78	20	70			385		92	12				461		(2)
T43N R92W Sec13	Lake Creek		84	31	129			600	0	67	40				646		(1)
T43N R92W Sec11			79	33	20.3	13	7.3	289	0	84	39	0.6	0.2	21	420	8.1	(5)
T43N R92W Sec14	Lake Creek		86	42	30			340		47	45				454		(4)
T43N R92W Sec21	Kirby Creek		41	15	195			185		388	23				753		(4)
T44N R87W Sec 8		14.5	43	16	2.5	1.3	1.2	166	0	34	1.0	0.6	.0	8.0	187	7.5	(5)
T44N R87W Sec 8			42	16	4.1	2.9	1.2	170	0	35	1.8	0.3	0.2	9.2	193	8.2	(6)
T44N R87W Sec 9		13.0	37	14	3.2	2.3	0.9	160	0	20	0	0.1	0.1	9.3	164	8.3	(6)
T44N R87W Sec17		13.5	45	21	13.2	12	1.2	192	0	60	2.0	0.2	0.3	9.6	247	7.5	(5)
T44N R95W	Gebo		479	53	2973			158		6410	768				9923		(4)
T44N R97W	Hamilton Dome		484	131	652			1040	60	1340	580				3759		(1)
T44N R97W Sec12	Waugh Dome		342	15	435			505		961	3171				2318		(4)
T44N R97W Sec18	Hamilton Dome		507	96	549			1440	0	1047	414				3321		(1)
T44N R98W Sec 6	Wagonhound		499	72	1773			283		4867	70				7420		(4)
T44N R98W Sec13	Hamilton Dome		524	90	760			974		1892	401				4146		(4)
T45N R97W Sec12	Golden Eagle		728	128	1729			4705		1103	779				6781		(4)

Madison Limestone
(ion concentrations in ppm or mg/1)

Location	Field	Temp. (^oC)	Ca	Mg	Na+K	Na	K	HCO_3	CO_3	SO_4	Cl	F	NO_3	SiO_2	T.S.	pH	Source
T43N R91W Sec 6	Murphy Dome		107	1	388			194	16	842	38				1487		(4)
T43N R91W Sec36	Black Mtn.		75	37	5			370		15	22				336		(4)
T43N R92W Sec21	Kirby Creek		204	46	213			335		798	40				1166		(4)
T43N R93W Sec28	Red Spring		646	171	80			850		1405	234				2954		(4)
T43N R93W Sec28	Red Spring		388	122	180			1080		607	244				2072		(4)
T44N R98W Sec24	Hamilton Dome		361	102	319			878	0	593	480				2287		(2)
T44N R98W Sec14	Hamilton Dome		448	124	426			1175		938	500				3051		(1)

Location	Field	Temp. (°C)	Ca	Mg	Na+K	Na	K	HCO_3	CO_3	SO_4	Cl	F	NO_3	SiO_2	T.S.	pH	Source
Bighorn Dolomite (ion concentrations in ppm or mg/l)																	
T44N R98W Sec14	Hamilton Dome		276	78	528			989		763	392				2523		(4)
Gros Ventre Formation (ion concentrations in ppm or mg/l)																	
T43N R93W Sec28		30.0	429	7.2		530	12	36	0	1010	839	2.5	.0	19	2870	7.4	(5)
Flathead Sandstone (ion concentrations in ppm or mg/l)																	
T43N R96W Sec12	Red Rose Dome		327	43		778		210	0	993	1050				3294		(1)
T44N R97W	Hamilton Dome		109	33		1142		1035	0	1272	510				3576		(1)

Thermopolis Hydrothermal System Chemistry
(ion concentrations in ppm or mg/l)

Location	Name	Temp. (°C)	Ca	Mg	Na	K	HCO_3	CO_3	SO_4	Cl	F	NO_3	SiO_2	S	B	Fe	T.S.	pH	H_2S	Date	Source
T43N R95W Sec25	Sacajawea		396	76	227	46	741	0	819	300		.1			.37			6.6		4/21/69	(3)
		52	340	79	270	40	760	0	840	300	5.4	0	35	<.001	.45	0	2390	7.0		9/2/76	(3)
T43N R94W Sec30	McCarthy	54	350	76	270	40	760	0	830	300	4.4	0	36	<.001	.41		2380	7.1		9/3/76	(3)
T43N R95W Sec35	Spomer*	49	340	66	270	35	620	0	760	360	4.5	.1	34	.0	1.0	1.3	2300	6.6		2/20/81	(7)
T43N R94W Sec30	White Sulphur		383	80	253	45	784		773	308	3.8	.1	37			.05	2321		2.3	6/12/33	(3)
		53	340	77	270	42	750	0	820	300	8.1	0	37	<.001	.45		2350	7.0		9/2/76	(3)
T43N R95W Sec25	Bathtub	53	340	73	270	44	730	0	780	330	4.2	0	39	.001	.49		2330	7.1		9/3/76	(3)
T43N R94W Sec31	Black Sulphur	55	385	75	266	49	740		777	334	3.8	.1	71			.05	2378		1.4	6/12/33	(3)
T43N R94W Sec31	Big Spring		315	113	83	91			556	84			40							(1906)	(3)
			315	113	258	91			556	355			40							(1926)	(3)
			385	76	262	49	766		769	328	3.7	.1	38			.08	2373		4.5	6/12/33	(3)
			380	67	280	53	740	0	777	314	3.0	0	40			.06	2280	6.4		4/11/58	(3)
			360	86	250	51	708	0	774	294	5.5	0	35		.61	.04	2200	7.0		2/24/71	(3)
		56	310	71	250	37	710	0	730	300	6.8	0	37	.006	.54	0	2190	6.9		9/2/76	(3)

Trace Element Analyses
(mg/C)

		As	Cu	Mn	Zn	Ba	Cd	Cr	Pb	Se	Ag	Hg	Ni	Date	Source
Sacajawea	52	<.05	<.01	<.05	<.02	<.5	<.01	<.1	<.1	<.001	<.5	<.001	<.1	9/2/76	(3)
Spomer*	49	<.005	.2	.06	.30	<.1	<.03	<.05	<.2	<.005	<.005	<.001	<.1	2/20/81	(7)
Big Spring	56	<.05	<.01	<.05	<.02	<.5	<.01	<.1	<.1	<.001	<.5	<.001	<.1	9/2/76	(3)

*Sampled via brass pump and garden hose

Sources:

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5) Lowry, Marlin E. and Gregory C. Lines, 1972, Chemical analyses of ground water in the Bighorn Basin, northwestern Wyoming, Wyoming Dept. of Economic Planning and Development, 16 p.

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Hydraulic head data for the Thermopolis study area

The hydraulic head data for the Thermopolis study area comes from three basic sources of varying quality and reliability:

1) The best data are from flowing wells and springs. The potentiometric surface of the aquifer is clearly coincident with the ground surface at these locations. Since water is discharging such points must represent some local decrease in aquifer pressure, though the magnitude and extent of this "drawdown" must be determined from aquifer properties. The only problem with these data are possible ambiguities in the exact source of the water due to unknown perforation intervals for wells and fracture conduits for springs.

2) The Wyoming State Engineer's Office in Cheyenne maintains well records which commonly report static water levels. In properly cased and reported wells these records provide the best possible data for no flow is involved. In practice, however, uncertainties in identification of the producing formation, and water level reports based on anything from a careful measurement to an offhand guess, require some judgement in the use of these data. Values which upon examination of the logs appeared obviously suspect are not included in the listings.

3) The most abundant source of deep pressure data is the testing of oil and gas wells. Drill-stem tests (DST's) are routinely performed in the course of exploration and are reported on individual well Petroleum Information Cards. An actual test produces a continuous plot of pressure vs. time, reported summaries generally only provide the final flow and

shut-in pressures recorded and the height of the column of fluids recovered. Earlougher (1977) and Murphy (1964) provide descriptions of well test interpretation including discussion of the problems and complications involved. Based on their ideas all available DST data for the study area were examined and those judged to have sufficient permeabilities, shut-in times, and formation fluid recovery to be approximate measurements of formation fluid pressure were identified. Without knowing the details of pressure build-up relationships, such judgements are necessarily subjective; yet when hydraulic head elevations were computed and compared, the values which had been previously identified as superior showed consistently better areal correlation than did all data considered together. All values are reported in Table 5, those of questionable reliability are identified with an asterisk.

Data are converted to elevation above mean sea level based on well site surveys or U.S. Geological Survey topographic maps. Pressure data are converted to hydraulic heads according to the relationship:

$$1 \text{ psi} = 2.32 \text{ ft. of water}$$

Locations are given to the nearest quarter-quarter-quarter section where possible. The letter designations of sub-section divisions are explained along with unit conversions in Appendix E.

References Cited

Earlougher, Robert C., 1977, Advances in well test analysis, Soc. Pet. Eng. Monograph Ser. v. 5, 264 p.

Murphy, W.C., 1964, The interpretation and calculation of formation characteristics from formation test data, Halliburton Technical Publication, April, 1964, 18 p.

Hydraulic Head Data

Location			Hydraulic Head Elevation (ft.)	Formation	Data Source	Comments
T6N	R6E	Sec 5ddd	4556	Gallatin	(1)	natural spring
		Sec15da	~4550	(Cambrian)	(2)	well water level
		Sec16bbc	7430	(Cambrian)	(1)	natural spring
		Sec28acc	4940	(Cambrian)	(1)	2 natural springs
		Sec28bd	~4700	(Cambrian)	(2)	well water level
		Sec28da	~5400	(Cambrian)	(2)	flowing well
T7N	R4E	Sec 6dd	4397	Park City	(3)	
			4365	Madison	(3)	
			2461*	Gros Ventre	(3)	
T8N	R2E	Sec 6aab	4489*	Park City	(3)	
		Sec 6a	5500	Tensleep (?)	(4)	3050 ft. deep flowing well
T8N	R2E	Sec 3bbc	5527	Park City	(5)	flowing well
		Sec 8cc	6000	Park City	(2)	well water level
		Sec 8cd	6000	Park City	(2)	well water level
		Sec14bbb	4561*	Park City	(3)	
T9N	R2E	Sec36baa	4465	Park City	(3)	
T41N	R90W	Sec24db	6400	Park City	(2)	flowing well
T41N	R91W	Sec 4dc	5293*	Park City	(3)	
			5593	Tensleep	(3)	
		Sec 5cb	5029*	Park City	(3)	
		Sec11bb	5598	Park City	(3)	
		Sec14bb	5582	Park City	(3)	
T41N	R93W	Sec25aa	6800	Bighorn	(2)	well water level
T42N	R91W	Sec 7dd	5185	Park City	(2)	flowing well
		Sec 7dd	5082*	Park City	(3)	
		Sec25cb	5461*	Park City	(3)	
		Sec30dd	5058*	Park City	(3)	
			5153*	Park City	(3)	
		Sec31cc	3280*	Park City	(3)	
		Sec32cb	5531	Park City	(3)	
		Sec33bc	5152*	Park City	(3)	
T42N	R92W	Sec 2cb	1862*	Park City	(3)	
			1805*	Park City	(3)	
		Sec23db	2404*	Park City	(3)	
T42N	R94W	Sec26cac	4620	Tensleep	(6)	well water level
T42N	R95W	Sec13acd	4380	Tensleep	(6)	flowing well
		Sec24b	~4400	Park City	(7)	
		Sec25bc	4380	Park City	(8)	natural spring
T42N	R96W	Sec 2abc	4367*	Park City	(3)	
			4640*	Park City	(3)	
		Sec12dd	4300	Park City	(2)	well water level
		Sec14ba	4311*	Tensleep	(3)	
			4062*	Amsden	(3)	
			4275*	Madison	(3)	
			4325*	Gros Ventre	(3)	

Location			Hydraulic Head Elevation (ft.)	Formation	Data Source	Comments
T43N	R90W	Sec 6baa	4700	Park City	(2)	flowing well
		Sec25da	5200	Park City	(2)	flowing well
T43N	R91W	Sec20cd	~ 5000	Amsden	(2)	flowing well
		Sec26bcc		Tensleep	(4)	flowing well
		Sec26ab		Tensleep	(4)	flowing well
T43N	R92W	Sec 4bd	4607	Park City	(2)	flowing well
T43N	R93W	Sec 2bb	4117	Park City	(3)	
		Sec 3cd	4225	Park City	(3)	
			4368	Tensleep	(3)	
		Sec 4ca	4348	Park City	(9)	
			4361	Tensleep	(3)	
		Sec 5ac	4362	Park City	(3)	
		Sec 5ac	4342*	Park City	(9)	
			4168*	Park City	(9)	
		Sec10da	4399	Park City	(3)	
		Sec18dd	4148*	Park City	(3)	
		Sec19dd	4330*	Tensleep	(3)	
		Sec21dc	4366	Park City	(3)	
		Sec25ca	4291*	Park City	(3)	
			4301	Park City	(9)	
		Sec28cc	4470	Gros Ventre	(2)	thermal log T8
T43N	R94W	Sec 5dcc	4144*	Park City	(3)	
		Sec 5cb	4340	Park City	(9)	flowing well
		Sec16ac	4361	Park City	(3)	
		Sec30cb	4340	Park City	(10)	McCarthy well #1
		Sec32bc	~4580(?)	Park City	(2)	well water level
		Sec35cb	4350	Amsden	(2)	well water level
T43N	R95W	Sec21bd	4392	Park City	(10)	thermal log T3
		Sec24dc	4312	Tensleep(?)	(10)	Maytag well
		Sec25ab	4318	Tensleep(?)	(10)	Sacajawea well
		Sec31bc	4370	Madison(?)	(10)	Big Spring
		Sec35ab	4475	Park City	(2)	well water level
T43N	R96W	Sec 2ac	4406	Tensleep	(10)	thermal log T1
		Sec12	4356	Park City	(3,11)	
		Sec12	4361	Gallatin	(5)	
T43N	R99W	Sec 4dd	4710	Park City	(3)	
T44N	R93W	Sec35dab	4540	Park City(?)	(2)	flowing well
T44N	R95W	Sec23db	4480	Park City	(12)	
		Sec24bd	4652	Tensleep	(12)	
T44N	R96W	Sec 2bc	3906*	Park City	(3)	
			4256	Tensleep	(3)	
			4295	Madison	(3)	
		Sec 2dc	4329	Tensleep	(3)	
		Sec 7cb	4162*	Park City	(3)	
			4404*	Tensleep	(3)	
		Sec 7cb	4343	Park City	(3)	
		Sec19bdc	4327*	Park City	(3)	
		Sec19ca	4368*	Park City	(3)	
			4243*	Tensleep	(3)	
		Sec20cd	4342	Park City	(3)	
		Sec35bd	4376	Park City	(3)	
T45N	R90W	Sec 9cab	4114	Tensleep	(3)	
T45N	R92W	Sec13bb	4178*	Park City	(3)	

Location			Hydraulic Head Elevation (ft.)	Formation	Data Source	Comments
T45N	R92W	Sec21cb	4426	Tensleep	(3)	
		Sec24aa	4544	Tensleep	(3)	
		Sec26ba	3705*	Park City	(3)	
			3721*	Tensleep	(3)	
T45N	R93W	Sec13bb	3806	Park City	(3)	
T45N	R96W	Sec17ca	4160	Tensleep(?)	(3)	
		Sec34dd	4272	Park City	(3)	
T45N	R97W	Sec12bdb	7745*	Madison	(3)	
		Sec34aa	4049	Park City	(3)	
		Sec35ac	4325	Park City	(3)	
			4310	Park City	(3)	
		Sec35cd	4102*	Park City	(3)	
T45N	R98W	Sec26bbc	4154*	Park City	(3)	
			3534*	Tensleep	(3)	
		Sec31bc	4410	Park City	(3)	

*drill-stem test value of questionable reliability based on evaluation of test periods and fluid recoveries.

Sources: 1) Elevation from U.S. Geological Survey topographic maps; geology from compilations for this report (see Fig. 5).

2) Water well files of Wyoming State Engineer, Cheyenne, Wyoming; geology from well logs and map compilations for this report.

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