

## **Appendix E**

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### **Cumulative Hydrologic Impact Analysis Report for Smith Ranch and North Butte**

**AQUI-VER, INC.**



# **Cumulative Hydrologic Impact Assessment**

**Cameco Resources**

**Smith Ranch-Highland and Reynolds Ranch Facilities  
Converse County, Wyoming**

January 26, 2012

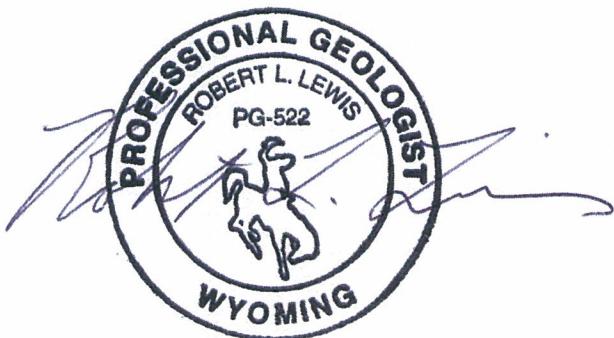
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## 1. EXECUTIVE SUMMARY

Cameco Resources has conducted an assessment of the hydrologic impacts resulting from In-Situ Recovery (ISR) and Niobrara Shale oil well development operations in Converse County, Wyoming. Hydrologic impacts (drawdown) resulting from the development of Cameco Resources Smith Ranch-Highland and Reynolds Ranch satellite ISR facilities (SRH-RR) were included in this assessment. The hydrologic impact of existing and permitted Niobrara Shale oil well drilling and fracing operations were also considered. Finally, the combined or cumulative hydrologic impact resulting from ISR and Niobrara Shale oil well development was calculated.

Hydrologic impacts due to ISR and Niobrara Shale oil well development were simulated using a three-dimensional groundwater flow model over a 33-year ISR development and restoration period, and a two-year limited Niobrara Shale oil well development period. The drawdown computed by the groundwater flow model was evaluated at 287 stock and domestic well locations located within a 10-mile radius of the SRH-RR facilities.

In general, maximum hydrologic impacts occur in wells closest to ISR facilities and completed within ISR production sand intervals (e.g. deeper wells). Drawdown in the shallow water-table aquifer due to ISR operations is predicted to be less than 10 feet at stock and domestic well locations over the life of the mine. ISR drawdown impacts greater than 10 feet are predicted in one stock watering and domestic supply well completed in the deeper production sand aquifers and located nearest to the SRH-RR facilities. Maximum impacts due to ISR development generally occur toward the end of the mine life. The predicted drawdown due to ISR development should not have an adverse impact on water resources in the area.

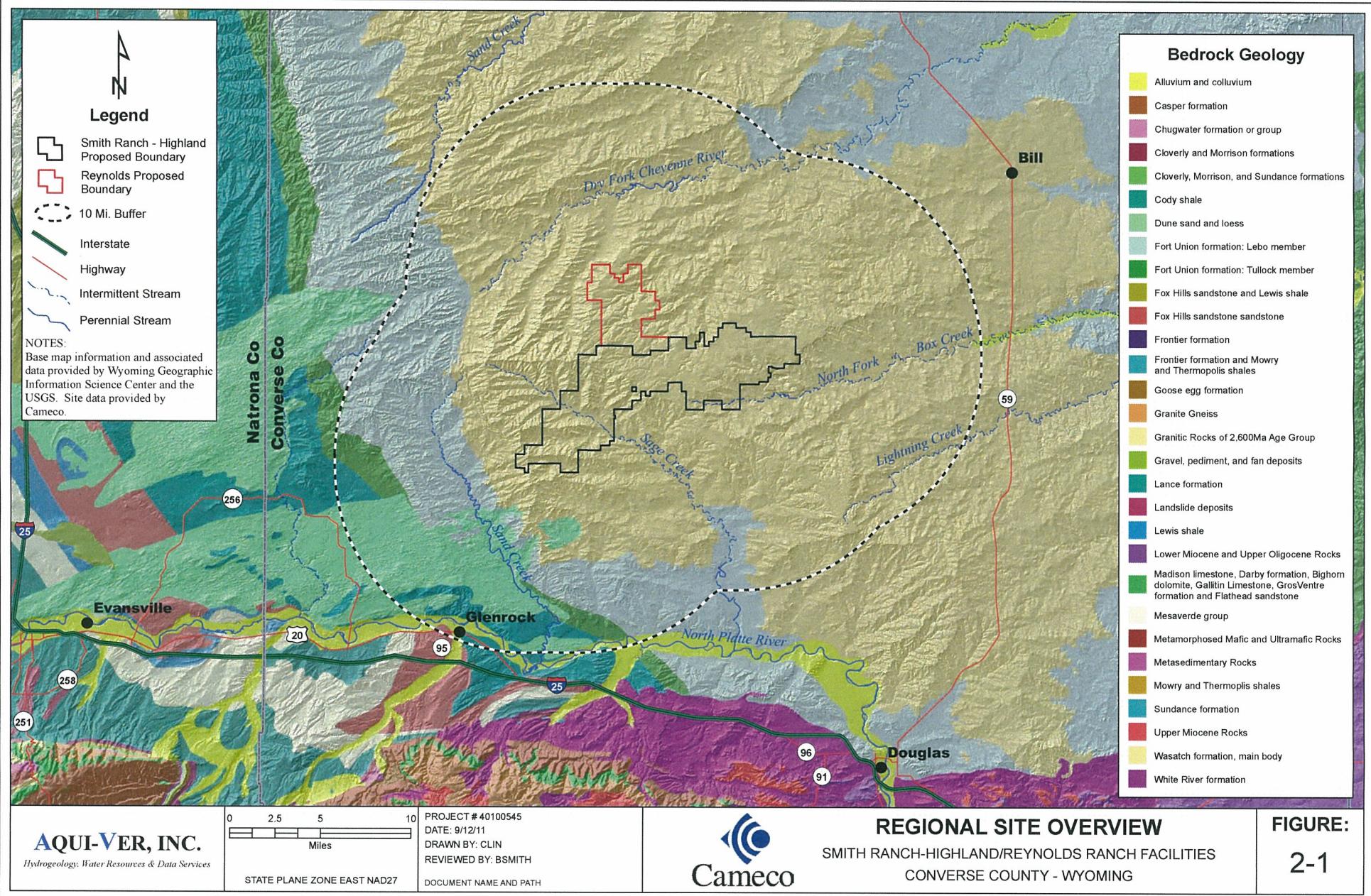
The withdrawal of groundwater to support Niobrara Shale oil drilling and fracing operations was simulated over a limited two-year development period for currently producing and permitted Niobrara oil wells within a 10-mile radius of the SRH-RR ISR facilities. Drawdown impacts due to limited Niobrara Shale oil well development are less than 1-foot at stock and domestic well locations over the limited two-year development period. It is likely, however, that Niobrara Shale oil well development will be more extensive and of greater longevity than simulated in this study. Hydrologic impacts associated with shale oil development may therefore be more significant than predicted herein.

As a practical matter, predicted hydrologic impacts associated with ISR and limited Niobrara Shale oil well development should not adversely impact water resources. Predicted drawdown due to ISR and shale oil development is less than 10 percent of the available water column in all but one stock watering and domestic supply well. In the worse case, a small decrease in well yield may be observed due to a decreased pumping level in wells having the highest potential drawdown impacts. In the event this should cause a significant concern, the problem may be overcome by lowering the pump, or in the worse case, by installing an additional supply well (and pump) to make up for lost production.

## **2. INTRODUCTION**

Cameco Resources (Cameco) has conducted an assessment of the hydrologic impacts resulting from In-Situ Recovery (ISR) and Niobrara Shale oil well development operations in Converse County, Wyoming (**Figure 2-1**). The following specific tasks were accomplished as part of this work:

- Assessment of the hydrologic impact to stock and domestic wells resulting from the operation of Cameco's Smith Ranch-Highland and Reynolds Ranch satellite ISR facilities (SRH-RR),
- Assessment of the hydrologic impact to stock and domestic wells resulting from the withdrawal of shallow groundwater to support existing and permitted Niobrara Shale oil well drilling and fracing operations, and
- Assessment of the combined or cumulative hydrologic impacts of the aforementioned individual ISR and Niobrara Shale oil well development operations.



### 3. GROUNDWATER FLOW MODEL DEVELOPMENT

Potential hydrologic impacts resulting from ISR and Niobrara Shale oil well development in the region were simulated using MODFLOW-2000, a three-dimensional groundwater flow model developed by the United States Geological Survey (Harbaugh and others, 2000).

The groundwater flow model was constructed as a “superposition” or “impact” model. An impact model is designed to evaluate only the changes that occur in the aquifer system due to applied stress – in this case, drawdown due to ISR development and Niobrara Shale oil well development operations. Impact model output includes the observed changes in water level elevation (drawdown) and changes in aquifer flows due to aquifer stress. Hydraulic head or groundwater elevation is not explicitly simulated using an impact model. One advantage of the impact modeling approach is that drawdown impacts from individual ISR and Niobrara Shale oil well development operations can be simulated and the results can be superimposed or added together to estimate the cumulative impact of the combined operations.

#### 3.1 Model Grid, Layering, and Boundary Conditions

The groundwater flow model domain consists of 26 layers, 291 rows, and 413 columns. The model domain is approximately 40 miles east to west and 35 miles north to south, and includes the southernmost portion of the Powder River Basin (**Figure 3-1**). The model domain extends to natural outcrop locations on the southern, western and eastern margins of the basin, which are represented by No-Flow boundaries (see **Figure 2-1** for location of geologic formation boundaries). General Head boundaries were assigned along the northern model boundary to allow groundwater flow into the model domain as flow conditions change over time. Specific boundary conditions for each model layer are included in **Attachment A**.

**Table 3-1** and cross-sections provided in **Figures 3-2 through 3-5** summarizes the model layering and associated hydrostratigraphy. The uppermost layer of the groundwater flow model represents shallow saturated sands of the Lower Wasatch Formation (W/E/G-Sands). This layer represents the shallow water-table aquifer over much of the model domain. ISR production sands of interest to this study include a thick sequence of stacked sands separated by lower permeability claystone and siltstone of the Tongue River member of the Upper Fort Union Formation (Layers 2-25). The ISR production sands are labeled alphabetically from deepest (K-Sand) to shallowest (U-Sand). Underlying the ISR production sand interval is a thick sequence (>1,200 feet) of lower permeability siltstone, claystone, and lesser sandstone of the Lebo Shale and Tullock members of the Fort Union Formation (Layer 26). The bottom of the flow model is represented by the top of the Cretaceous Lance Formation.

#### 3.2 Model Aquifer Characteristics

Aquifer properties were assigned to each model layer including horizontal and vertical hydraulic conductivity, specific storage, specific yield, and top and bottom elevation (depth below water table for impact model). A summary of model aquifer properties is provided in **Table 3-1**.

### **3.2.1 Hydraulic Conductivity and Storage**

Representative average values of hydraulic conductivity and storage for each mine unit were developed from results of site-specific aquifer testing and provided by Cameco for this study (**Table 3-1**). These data were supplemented by regional aquifer studies where site-specific data were lacking (Brenneis, 1997; AHA, 2002). Aquifer properties for model layers above and below the production sand interval (e.g. Layer 1 and Layer 26) were assigned using values from regional aquifer studies (e.g. Brennis, 1997; AHA, 2002).

### **3.2.2 Model Layer Elevation (Depth)**

Representative average values for production sand top and bottom elevation for each mine unit were provided by Cameco for this study. These data were used to construct elevation contour maps for each model layer as depicted on model cross-sections (**Figures 3-2 through 3-5**). The elevation of each model layer is provided in **Attachment A**.

The water-table elevation was utilized as the reference elevation (zero datum) for the impact modeling. The estimated elevation of the water-table was derived from static water level data provided in the State Engineers Office electronic well database and is illustrated in **Figure 3-6**. All layer elevations were transformed to represent depth below the water-table for impact modeling purposes.

## **3.3 Stock and Domestic Wells**

The hydrologic impact (drawdown) from ISR and Niobrara Shale oil well development was evaluated at 287 stock and domestic well locations located within a 10-mile radius of the SRH-RR facility (**Figure 3-7 and Table 3-2**). Water well user information was compiled from mine permitting documents and the electronic well database maintained by the State Engineers Office. Some stock and domestic wells located in the extreme southeastern portion of the study area are completed in deeper Cretaceous aquifers (e.g. Lance Formation) and hydraulically isolated from the overlying Fort Union and production sand aquifers. These wells are therefore not included in this study. In addition, approximately 30 percent of wells included in the SEO well database did not include well construction information (e.g. depth and completion interval) or have well logs available for review. In these cases, well construction was estimated based on the construction of the nearest neighboring wells.

## **3.4 Oil and Gas (Niobrara Shale) Wells**

Oil and Gas well data for this study was obtained from the Wyoming Oil and Gas Commission (WYOGC) electronic database (WYOGC, 2011). Conventional deep oil and gas wells do not use large volumes of fresh water (e.g. shallow groundwater) in the process of drilling and well completion, and therefore drawdown impacts associated with conventional oil and gas development are not significant. More recently, however, unconventional oil and gas development has expanded with the advance of hydraulic fracturing ("fracing") and horizontal well technology used to extract oil and gas from lower permeability organic shale (e.g. shale oil or shale gas). Unlike conventional oil and gas wells, the drilling and fracing of horizontal shale oil wells uses a significant amount of good quality water (estimated at 4-5 million gallons per well), often obtained from shallow groundwater in more remote locations (WyoFile, 2010). Of relevance to this study is

the expansion of non-conventional oil and gas exploration and production associated primarily with the Niobrara Shale oil play in the southern Powder River Basin and Converse County. Oil and gas well data for wells within a 10-mile radius of the SRH-RR facility are provided in **Attachment B**.

As of August 2011, the WYOGC database lists one Niobrara Shale oil well as producing oil and/or gas (Spillman Draw Unit, Purple Sage Field), and seven additional wells that have been permitted and which are expected to be completed within the next six months to one year, within a 10-mile radius of the SRH-RR facility. The SEO water well database lists eight groundwater supply wells that have been permitted to provide a water supply for existing and future drilling and fracing operations. It should also be noted that existing stock and domestic wells in the region are also being used to supply water for non-conventional oil and gas development, but the location of these wells is not available in public domain databases (WyoFile, 2010). The location of existing and permitted Niobrara Shale oil wells and associated water supply wells is shown in **Figure 3-8**.

**Table 3-1. Model Hydrostratigraphy and Aquifer Properties**

Layer	SRH-RR Unit	Highland Unit	Kh (ft/day)	Kz (ft/day)	Specific Storage ( $\text{ft}^{-1}$ )	Specific Yield	Source
1	W/E/G-Sands		0.17	0.02	5.00E-05	0.2	AHA (2002), Brennis (1997)
2	V-Shale		0.01	5.18E-05	2.00E-05	5.00E-02	AHA (2002), Brennis (1997)
3	U-Sand		0.86	0.26	5.00E-05	0.2	AHA (2002), Brennis (1997)
4	T-Shale		0.01	5.18E-05	2.00E-05	5.00E-02	AHA (2002), Brennis (1997)
5	S-Sand		0.86	0.26	5.00E-05	0.2	AHA (2002), Brennis (1997)
6	R-Shale		0.01	5.18E-05	2.00E-05	5.00E-02	AHA (2002), Brennis (1997)
7	Q-Sand	90 Sand	1.45	0.15	5.00E-05	0.2	AHA (2002), Brennis (1997), Cameco Pumping Test Technical Reports
8	P-Shale		0.004	4.00E-05	2.00E-05	5.00E-02	AHA (2002), Brennis (1997), Cameco Pumping Test Technical Reports
9	O4-Sand	80 Sand	3.20	0.30	7.50E-05	0.2	AHA (2002), Brennis (1997), Cameco Pumping Test Technical Reports
10	Shale		0.01	5.18E-05	5.00E-06	5.00E-04	AHA (2002), Brennis (1997), Cameco Pumping Test Technical Reports
11	O3-Sand	70 Sand	3.20	0.11	2.80E-04	0.1	AHA (2002), Brennis (1997), Cameco Pumping Test Technical Reports
12	Shale		0.01	5.18E-05	5.00E-06	5.00E-04	AHA (2002), Brennis (1997), Cameco Pumping Test Technical Reports
13	O3-Sand	60 Sand	3.20	0.86	2.80E-04	0.1	AHA (2002), Brennis (1997), Cameco Pumping Test Technical Reports
14	Shale		0.01	5.18E-05	5.00E-06	5.00E-04	AHA (2002), Brennis (1997), Cameco Pumping Test Technical Reports
15	O2-Sand	50 Sand	3.20	1.50	7.50E-05	0.2	AHA (2002), Brennis (1997), Cameco Pumping Test Technical Reports
16	Shale		0.01	5.18E-05	5.00E-06	5.00E-04	AHA (2002), Brennis (1997), Cameco Pumping Test Technical Reports
17	O2-Sand	40 Sand	3.20	1.50	7.50E-05	0.2	AHA (2002), Brennis (1997), Cameco Pumping Test Technical Reports
18	Shale		1.45	5.18E-05	5.00E-06	5.00E-04	AHA (2002), Brennis (1997), Cameco Pumping Test Technical Reports
19	O1-Sand	30 Sand	3.20	1.50	7.50E-05	0.2	AHA (2002), Brennis (1997), Cameco Pumping Test Technical Reports
20	Shale		0.01	5.18E-05	5.00E-06	5.00E-04	AHA (2002), Brennis (1997), Cameco Pumping Test Technical Reports
21	O1-Sand	20 Sand	1.50	1.50	1.00E-06	0.1	AHA (2002), Brennis (1997), Cameco Pumping Test Technical Reports
22	N-Shale		0.01	5.18E-05	5.00E-06	5.00E-04	AHA (2002), Brennis (1997), Cameco Pumping Test Technical Reports
23	M-Sand	10 Sand	1.50	1.50	1.00E-06	0.1	AHA (2002), Brennis (1997), Cameco Pumping Test Technical Reports
24	L-Shale		0.01	5.18E-05	5.00E-06	5.00E-04	AHA (2002), Brennis (1997)
25	K-Sand		1.65	1.50	7.30E-05	0.1	AHA (2002), Brennis (1997)
26	Lower Fort Union		0.86	0.26	1.00E-04	0.20	AHA (2002), Brennis (1997)

Table 3-2. Stock and Domestic Well User Information

Applicant	Easting (ft)	Northing (ft)	Owner	Uses	Surface Elevation (ft-MSL)	Static Water Level (ft)	Groundwater Elevation (ft-MSL)	Top Screen (ft-MSL)	Bot Screen (ft-MSL)	Water Column (ft)
Canon Land & Livestock Ltd.	461957	890800	SOUTHEAST BALLARD, #37-3	STK	4816	160	4656.0	4656.0	4606.0	50
Canon Land & Livestock Ltd.	459398	894824	BALLARD HOUSE #37-1	STK	4845	160	4685.4	4685.4	4635.4	50
Canon Land & Livestock Ltd.	453100	889494	BALLARD #5, #37-5	STK	4913	150	4762.9	4752.9	4722.9	40
Canon Land & Livestock Ltd.	449083	889408	BALLARD #6, #37-6	STK	4940	170	4769.8	4769.8	4719.8	50
Jake Johnson, Inc.	461999	885406	JAKE JOHNSON #7	STK	4790	20	4770.4	4650.4	4620.4	150
Jake Johnson, Inc.	464772	877391	JAKE JOHNSON #4	STK	4857	70	4786.6	4736.6	4696.6	90
Canon Land & Livestock Ltd.	456082	905345	BALLARD #9, #37-9	STK	5010	170	4840.1	4840.1	4790.1	50
USDA - National Forest Service	437179	930207	MORTON #T B 113	STK	4965	120	4844.6	4734.6	4695.6	149
Jake Johnson, Inc.	463363	873373	JAKE JOHNSON #5	STK	4910	40	4869.9	4509.9	4479.9	390
MART MADSEN SHEEP COMPANY	438625	921000	MADSEN #9	STK	4901	30	4870.5	4635.5	4605.5	265
MART MADSEN SHEEP COMPANY	456057	910619	MADSEN #6	STK	4984	110	4873.8	4838.8	4808.8	65
MEISNER INC.	464696	866698	PAXTON #1 NW	STK	4991	110	4880.9	4290.9	4260.9	620
MART MADSEN SHEEP COMPANY	419677	927420	MADSEN #1	STK	4919	30	4888.9	4718.9	4688.9	200
MICHAEL R. & THOMAS J. BOLAND	435392	879938	BOLAND #1	STK	4966	64	4902.1	4883.1	4838.1	64
Jake Johnson, Inc.	452756	871950	JAKE JOHNSON #6	STK	4953	50	4903.5	4103.5	4073.5	830
MART MADSEN SHEEP COMPANY	430453	924928	SCOTT/MEEKER	STK	5041	129	4911.7	4665.7	4644.7	267
Boner Brothers Partnership	442690	903911	BALLARD #7 #37-7	STK	5094	170	4923.5	4893.5	4863.5	60
FRED AND BETTY LUND	436678	887912	LUND #2	STK	5019	85	4934.2	4919.2	4889.2	45
SMITH SHEEP CO.	404775	817233	SMITH #52	STK	5137	200	4937.5	4937.5	4887.5	50
Hardy Enterprises, LP	383741	946805	SKY #1	STK	5221	270	4950.9	4885.9	4823.9	127
Boner Brothers Partnership	447368	855860	READ WELL #2	STK	5064	100	4963.6	3843.6	3813.6	1150
Boner Brothers Partnership	437254	899956	BALLARD #8 #37-8	STK	5125	160	4964.8	4874.8	4844.8	120
Boner Brothers Partnership	455372	863882	ANDERSON #1	STK	5022	50	4972.1	3832.1	3802.1	1170
ROBERT W. MANNING	375819	953426	MANNING B C 18	STK	5064	90	4973.8	4681.8	4634.8	339
Boner Brothers Partnership	447368	855860	READ WELL #1	STK	5064	85	4978.6	3843.6	3813.6	1165
USDA - National Forest Service	385074	948110	HARDY #T B 139	STK	5202	220	4981.7	5006.7	4889.7	92
WARREN A. MANNING	401042	913919	MANNING #10	STK	4999	15	4983.5	4734.5	4707.5	276
Canon Land & Livestock Ltd.	443470	894648	BALLARD #4, #37-4	STK	5141	150	4991.2	4971.2	4941.2	50
WARREN A. MANNING	407666	919339	MANNING #7	STK	5075	80	4995.2	4899.2	4895.2	100
SMITH SHEEP COMPANY	394195	817251	LAKE PASTURE #1	STK	5023	26	4996.6	4997.6	4988.6	8
USDA - National Forest Service	370528	953427	MANNING #T B 138	STK	5102	100	5001.7	5001.7	4975.7	26
Boner Bros. Partnership	412996	877069	NORTH BOX #2	STK	5211	206	5004.5	4520.5	4490.5	514
WARREN A. & JUDITH Y. MANNING	402352	915254	#3 G MANNING DOMESTIC WELL	DOM_GW; STK	5026	21	5005.0	4764.0	4729.0	276
SMITH SHEEP CO.	398232	815902	SMITH #3	STK	5066	60	5005.8	4995.8	4965.8	40
Boner Brothers Partnership	438004	854550	LIGHTNING CREEK	STK	5221	190	5030.8	4200.8	4170.8	860
Boner Brothers Partnership	449996	865213	MACHINE PASTURE #122	STK	5084	50	5033.6	4083.6	3593.6	1440
Boner Brothers Partnership	431232	867814	BOX CREEK #3	STK	5070	36	5033.9	5004.9	4992.9	41
Harold Carson	387771	952047	CARSON (PHILLIPS) #1	STK	5158	120	5038.1	4598.1	4568.1	470
SMITH LAND COMPANY	390273	833076	SMITH #38	DOM_GW; STK	5084	40	5044.5	4964.5	4920.5	124
Boner Brothers Partnership	428630	866444	BULL PASTURE	DOM_GW	5080	35	5045.2	5015.2	5003.2	42
WARREN A. MANNING	423717	918349	MANNING #8	STK	5141	96	5045.4	4982.4	4970.4	75
USDA, NATIONAL FOREST SERVICE	391747	949392	HARDY #T.B. 267	STK	5257	211	5046.4	4444.4	4422.4	624
Roy C. & Ferol Baker	381080	921772	BAKER 10 A	DOM_GW	5105	50	5055.1	4865.1	4805.1	250
SMITH SHEEP CO.	387666	830461	HILL TOP #1	DOM_GW	5198	140	5057.7	5027.7	4997.7	60
DUCK CREEK RANCHES INC.	382398	907307	DCR # 27 (37-73)	STK	5219	140	5079.3	4369.3	4219.3	860
EVERT L. BOURQUIN	357492	826546	BOURQUIN #2	STK	5261	170	5090.6	5090.6	5060.6	30
ULYSES H. & SHARON A. BERNARD	345528	824016	BERNARD #1	DOM_GW; STK	5241	150	5091.1	5031.1	5016.1	75
U.S.A. Exxon, Co.	402605	879692	ENL HIGHLAND #22	STK	5352	260	5092.0	4973.0	4820.0	272
EDWARD D. MOORE	373183	819947	ED MOORE, SPRING PASTURE WELL #1	STK	5166	71	5094.5	4914.5	4877.5	217
ROY C. BAKER	381073	923092	BAKER #1	DOM_GW	5116	20	5096.4	4826.4	4796.4	300
Boner Bros. Partnership	420790	858420	SOUTH BOX #1	STK	5183	81	5102.0	4873.0	4843.0	259

**Table 3-2 (Cont'd). Stock and Domestic Well User Information**

Applicant	Easting (ft)	Northing (ft)	Owner	Uses	Surface Elevation (ft-MSL)	Static Water Level (ft)	Groundwater Elevation (ft-MSL)	Top Screen (ft-MSL)	Bot Screen (ft-MSL)	Water Column (ft)
SMITH LAND COMPANY	388985	835739	SMITH #13	STK	5132	30	5102.3	4972.3	4942.3	160
Hornbuckle Ranch	374451	940287	HORNBUCKLE #23	STK	5267	160	5106.9	5056.9	4996.9	110
L. JOE WHITING	363901	811950	PACIFIC POWER & LIGHT #4	STK	5166	45	5121.2	5006.2	4966.2	155
Boner Brothers Partnership	419563	883754	NORTH BOX #130	STK	5203	82	5121.5	4153.5	4033.5	1088
Canon Land & Livestock Ltd.	415784	862520	MONUMENT #68	STK	5207	85	5122.2	4967.2	4937.2	185
JACOB S. NEGLY	325811	824145	NEGLY #4	DOM_GW	5222	100	5122.4	5122.4	5087.4	35
HARDY RANCH COMPANY	364009	956032	HARDY #13	STK	5165	40	5124.9	4794.9	4764.9	360
SMITH SHEEP CO.	379775	841082	SOUTH TOMMY #1	STK	5184	55	5128.7	5043.7	4988.7	140
HILDEBRAND INC.	352122	818672	HILDEBRAND #1	DOM_GW; STK	5144	15	5128.8	4813.8	4783.8	345
AUBREY MANNING INC.	365245	949475	MANNING #11 B C	STK	5144	14	5129.6	4893.6	4863.6	266
WARREN A. & JUDITH Y. MANNING	406298	907350	MANNING #6	STK	5190	60	5130.0	5025.0	4980.0	150
Roy C. & Ferol Baker	360132	953428	BAKER #12	STK	5181	50	5131.3	4691.3	4631.3	500
James W. & Catherine M. Strock	406045	839835	DUGAN #1	STK	5213	80	5132.6	5092.6	5062.6	70
USDI - BLM	362698	944227	ORPHA TRAIL WELL #1	STK	5190	55	5134.9	5039.9	5009.9	125
SMITH LAND COMPANY	395554	839732	SMITH #14	STK	5186	48	5138.0	5006.0	4976.0	162
JOE PATTERSON RANCH CORP.	350834	950733	MAIL BOX	STK	5259	120	5139.0	4889.0	4839.0	300
ROBERT W. MANNING	357448	946856	MANNING B C 17	DOM_GW; STK	5210	70	5140.5	4806.5	4747.5	393
Boner Bros. Partnership	427378	891793	ANTONE #3	STK	5353	210	5143.1	4843.1	4813.1	330
Boner Brothers Partnership	439358	835861	EDWARDS #97	STK	5219	75	5144.5	4469.5	4439.5	705
WILLIAM J. SMITH	357464	822589	PN5 L314	MIS; STK	5245	99	5146.4	4710.4	4641.4	505
U.S.A. Exxon, Co.	403931	881020	ENL HIGHLAND #23	STK	5408	260	5147.5	4950.5	4757.5	390
HENRY LAND COMPANY	353380	925727	HENRY #9	DOM_GW	5183	35	5148.0	5023.0	5003.0	145
WARREN A. & JUDITH Y. MANNING	399882	903409	#1 G MANNING SOUTHWEST WINDMILL	STK	5277	126	5151.0	5097.0	5067.0	84
JACOB S. NEGLY	325811	824145	NEGLY #5	DOM_GW	5222	70	5152.4	5152.4	5102.4	50
MARK A. & ARDITH A. HICKERSON	356161	826555	HICKERSON #1	DOM_GW	5234	80	5154.1	5084.1	5049.1	105
SMITH LAND COMPANY	379739	835769	SMITH #10	STK	5195	38	5156.8	5014.8	4984.8	172
SMITH SHEEP COMPANY	389019	843725	EAST SHEARING PENS #1	STK	5251	90	5161.3	5056.3	5051.3	110
GARY & KAREN HUXTABLE	358812	823892	HUXTABLE #1	DOM_GW	5244	80	5163.6	5123.6	5083.6	80
James W. & Catherine M. Strock	407399	837161	DUGAN #2	STK	5244	80	5164.5	5134.5	5104.5	60
AUBREY MANNING INC.	357462	948168	MANNING 1 B C	DOM_GW; STK	5198	32	5165.7	4817.7	4787.7	378
MELVIN H. SR. & E. LOUISE SEIDEL	315491	844033	POPSKULL 2B-2	DOM_GW; STK	5391	225	5165.9	5165.9	5115.9	50
FRED & BEVERLY RUNNION	319324	829507	RUNNION #1	DOM_GW; STK	5349	180	5168.7	5028.7	5013.7	155
Roy A Strock	406072	837163	Strock #2	STK	5223	54	5168.9	5132.9	5083.9	85
ROY ASHIRLEY A STROCK	412662	834513	STROCK #1	STK	5324	155	5169.2	5133.2	5111.2	58
DAMON J & GRETCHEN C ENGEL	314179	842713	Hoyer #1	DOM_GW; STK	5395	225	5170.3	5170.3	5120.3	50
SMITH SHEEP CO.	363970	819888	SMITH #45 (DEEPENED)	STK	5323	150	5173.4	5163.4	5143.4	30
SMITH SHEEP CO.	375875	847697	SMITH #18	STK	5189	14	5175.2	5051.2	5034.2	141
Canon Land & Livestock Ltd.	415477	857029	EAST JENKINS #13	STK	5288	110	5177.7	5137.7	5112.7	65
AUBREY MANNING INC.	360096	946857	MANNING 7 B C	STK	5203	25	5178.0	5098.0	5088.0	90
TILLARD 55 RANCH	334141	826536	TILLARD RANCH 15	STK	5400	220	5179.8	4959.8	4919.8	260
ROY SHIDELER	314165	836109	ROY #1	DOM_GW; STK	5430	250	5180.2	5012.2	4980.2	200
JOE PATTERSON	342822	941538	Solar Well #1	DOM_GW; STK	5299	118	5180.5	5118.5	5098.5	82
J. S. NEGLY	357492	826546	NEGLEY #1	DOM_GW; STK	5261	80	5180.6	5150.6	5120.6	60
SMITH SHEEP CO.	334945	818792	SMITH #6	DOM_GW; STK	5241	60	5180.8	4970.8	4940.8	240
EUGENE L. EVANOFF	344197	824040	EVANOFF #3	DOM_GW	5282	100	5182.1	5092.1	5062.1	120
James W. & Catherine M. Strock	407431	834490	CLARK DUGAN #1	STK	5263	80	5182.7	5132.7	5102.7	80
BRADLEY D. ANDERSON	358820	826534	ANDERSON #1	DOM_GW	5243	60	5183.4	5123.4	5093.4	90
J. S. NEGLY	358812	823892	NEGLEY #2	DOM_GW; STK	5244	60	5183.6	5043.6	5013.6	170
HILDEBRAND INC.	348170	822657	HILDEBRAND #2	STK	5201	15	5185.9	4960.9	4930.9	255
EARL G. DOEGE	358817	825215	LUCK FIVE #2	DOM_GW	5286	100	5186.0	5146.0	5111.0	75
ELMER DOEGE	358817	825215	ELRU #1	DOM_GW	5286	100	5186.0	5151.0	5111.0	75

**Table 3-2 (Cont'd). Stock and Domestic Well User Information**

Applicant	Easting (ft)	Northing (ft)	Owner	Uses	Surface Elevation (ft-MSL)	Static Water Level (ft)	Groundwater Elevation (ft-MSL)	Top Screen (ft-MSL)	Bot Screen (ft-MSL)	Water Column (ft)
SMITH SHEEP CO.	392937	845040	SPENCER #2	STK	5327	140	5187.1	5112.1	5032.1	155
SMITH LAND COMPANY	386390	847696	#15 SMITH	STK	5354	165	5188.6	5053.6	5045.6	143
MERLE H. DUNHAM	358812	823892	HIGHWAY CORNER #1	DOM_GW	5244	55	5188.6	5043.6	5013.6	175
A.C. LAYTON	356153	825243	LAYTON #3	STK	5211	20	5190.9	5110.9	5100.9	90
PASTOR ROB DAVIS	318033	830825	DAVIS #1	DOM_GW	5394	200	5193.8	5048.8	5033.8	160
ROY G. HOYER	316807	840020	HOYER #1	DOM_GW; STK	5360	165	5194.5	5194.5	5154.5	40
AUBREY MANNING INC.	354766	941566	MANNING 8 B C	STK	5285	90	5195.3	5047.3	5017.3	178
EVERT L. BOURQUIN	357492	826546	BOURQUIN #1	DOM_GW	5261	65	5195.6	5150.6	5145.6	50
HENRY J. KEENAN	348225	825273	HENRY KEENAN #1	DOM_GW; STK	5256	60	5196.5	5136.5	5106.5	90
Hombuckle Ranch	359978	919128	HORNBUCKLE WELL #6	STK	5222	25	5197.0	5002.0	4982.0	215
MERLE H. DUNHAM	358812	823892	HIGHWAY CORNER #2	DOM_GW	5244	45	5198.6	5043.6	5013.6	185
L. RAYMOND ALLEMAND	344239	956038	CONOCO 30-4-38-74	STK	5379	180	5199.4	5039.4	4989.4	210
DUCK CREEK RANCHES	374440	903377	DUCK CREEK #28	STK	5311	110	5200.8	5180.8	5109.8	91
J. S. NEGLEY	358817	825215	NEGLEY #6	DOM_GW	5286	85	5201.0	5136.0	5106.0	95
AUBREY MANNING INC.	360043	935041	MANNING 4 B C	STK	5238	35	5203.3	4959.3	4953.3	250
JOE R. KEENAN	349548	825261	KEENAN #4	DOM_GW; STK	5246	42	5204.0	5154.0	5132.0	72
EARL G. DOEGE	358817	825215	LUCKY FIVE #1	DOM_GW	5286	80	5206.0	5166.0	5106.0	100
ROBERT D. HAUN	358817	825215	KT #1	DOM_GW	5286	80	5206.0	5166.0	5106.0	100
SMITH LAND COMPANY	381175	851695	SMITH #17	STK	5286	75	5211.5	5126.5	5110.5	101
James W. & Catherine M. Strock	411378	823894	LYNCH #1	STK	5292	80	5211.5	5111.5	5081.5	130
SMITH SHEEP CO.	362674	835837	SMITH #20	STK	5272	60	5211.8	5131.8	5106.8	105
JOE PATTERSON RANCH	344154	941536	BROOK # 1	DOM_GW; STK	5300	86	5213.5	4894.5	4879.5	334
Canon Land & Livestock Ltd.	419235	837189	WILLIAMS SPRINGS #102	STK	5414	200	5213.7	5173.7	5160.7	53
JOSEPH D. DONA	340339	825357	NORTH DONA #1	STK	5375	161	5214.1	5180.1	5150.1	64
ALLEN USEREY	316799	842674	URSEY #1	DOM_GW	5364	150	5214.3	5204.3	5194.3	20
A.C. LAYTON	365274	834495	LAYTON #2	STK	5267	50	5216.9	5191.9	5176.9	40
E.L. EVANOFF	345528	824016	E EVANOFF #1	STK	5241	23	5218.1	5051.1	5021.1	197
TILLARD 55 LTD	324558	824564	TILLARD NO 11	STK	5232	12	5220.4	5182.4	5162.4	58
FOWLER RANCH PARTNERSHIP	416937	886377	COWGER 1	STK	5419	198	5220.9	4458.9	4428.9	792
AUBREY MANNING INC.	354743	932359	MANNING #15 B C	STK	5245	23	5221.5	4982.5	4969.5	252
Boner Bros. Partnership	424612	842524	MARY WHITE #1	STK	5462	240	5222.3	5012.3	4982.3	240
James W. & Catherine M. Strock	416623	830558	FLEMING #1	STK	5304	80	5224.0	5074.0	5044.0	180
HENRY J. KEENAN	348225	825273	HENRY #2	DOM_GW; STK	5256	32	5224.5	5136.5	5106.5	118
HENRY J. KEENAN	348225	825273	HENRY KEENAN #3	DOM_GW; STK	5256	32	5224.5	5136.5	5106.5	118
WILLIAM M. HENRY	356009	912520	HENRY #3	STK	5248	23	5224.7	5027.7	5014.7	210
DUCK CREEK RANCHES INC.	370465	899427	DUCK CREEK #32	STK	5469	240	5228.6	5228.6	5178.6	50
Hombuckle Ranch	370498	913889	HORNBUCKLE WELL #7	STK	5331	100	5230.6	5100.6	5070.6	160
Hombuckle Ranch	358645	912539	HORNBUCKLE WELL #10	STK	5323	90	5233.4	5238.4	5183.4	50
LEE FOWLER	411819	887687	FOWLER #1	DOM_GW	5416	182	5234.2	4666.2	4636.2	598
JACOB S. NEGLEY	325853	826784	NEGLEY #3	DOM_GW	5315	80	5234.8	5234.8	5194.8	40
HENRY J. KEENAN	342969	829296	HENRY KEENAN #5	STK	5295	60	5235.0	5165.0	5135.0	100
AUBREY MANNING INC.	354786	945506	MANNING #12 B C	STK	5253	18	5235.2	4883.2	4853.2	382
AUBREY MANNING INC.	353422	938921	MANNING 9 B C	STK	5373	138	5235.3	5280.3	5216.3	19
JERRY/CAROLINE MOOREN	315476	834772	MOOREN # 1	DOM_GW; STK	5396	160	5235.9	4935.9	4905.9	330
JOE PATTERSON RANCH	342822	941538	PATTERSON #9	DOM_GW; STK	5299	60	5238.5	5078.5	5048.5	190
ROBERT W. MANNING	352080	936277	STRANGE FED #1-27	STK	5450	210	5240.3	5060.3	4640.3	600
TILLARD 55 RANCH	327875	829397	TILLARD RANCH 16	STK	5361	120	5240.9	5080.9	5060.9	180
JAMES W. STROCK	413983	841155	STROCK #1	STK	5321	80	5240.9	5190.9	5178.9	62
DUCK CREEK RANCHES INC.	380930	894401	REYNOLDS NO. 3	STK	5263	21	5241.6	5158.6	5122.6	119
SMITH LAND COMPANY	345593	831924	SMITH #37	STK	5343	100	5243.4	5223.4	5200.4	43
James W. & Catherine M. Strock	412662	834513	DEIL #1	STK	5324	80	5244.2	5144.2	5114.2	130

**Table 3-2 (Cont'd). Stock and Domestic Well User Information**

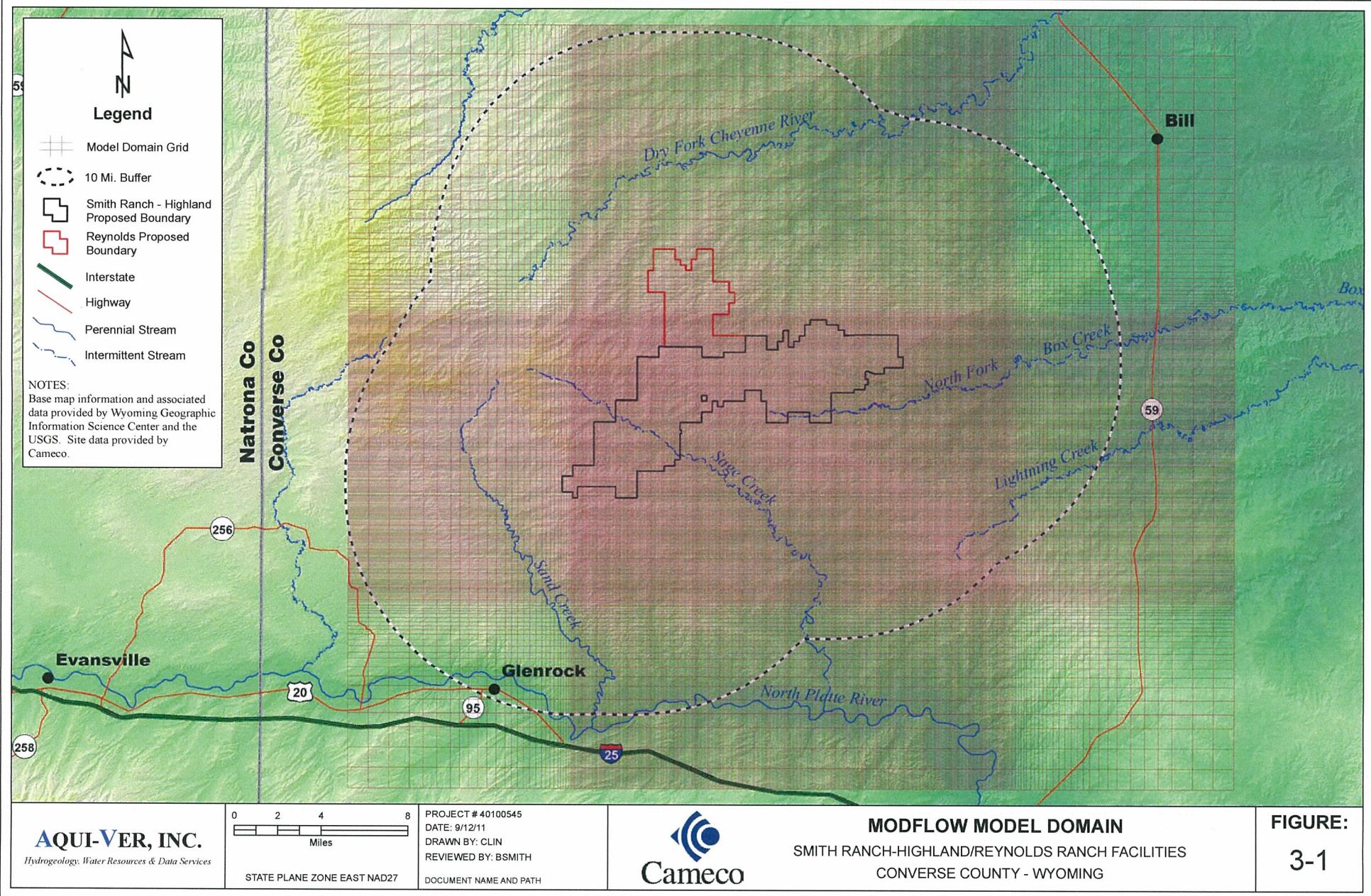
Applicant	Easting (ft)	Northing (ft)	Owner	Uses	Surface Elevation (ft-MSL)	Static Water Level (ft)	Groundwater Elevation (ft-MSL)	Top Screen (ft-MSL)	Bot Screen (ft-MSL)	Water Column (ft)
James W. & Catherine M. Strock	403488	846428	SHORTY SPEAR #1	STK	5326	80	5246.2	5166.2	5136.2	110
SMITH SHEEP CO.	378543	851695	SMITH #47	STK	5270	20	5249.5	5240.5	5234.5	15
A.C. LAYTON	360125	829176	LAYTON #5	STK	5325	75	5249.9	5130.9	5109.9	140
SMITH LAND COMPANY	356074	837176	SMITH #21	STK	5337	85	5251.9	5236.9	5206.9	45
GARY GURWELL	316796	836073	GURWELL #1	DOM_GW	5373	120	5253.4	5058.4	5048.4	205
VOLLMAN RANCHES INC.	365276	835825	WINSINGER #1	STK	5275	21	5253.9	5164.9	5099.9	154
SMITH SHEEP CO.	364029	826502	SMITH #4	STK	5328	70	5257.6	5177.6	5147.6	110
Hornbuckle Ranch	366511	908620	HORNBUCKLE WELL #4	STK	5352	90	5262.0	5262.0	5227.0	35
WM. VALENTINE & SONS INC.	320744	837415	SPENCER #15	STK	5363	100	5263.0	5213.0	5183.0	80
SMITH LAND COMPANY	369274	830499	SMITH #9	STK	5315	50	5265.2	5205.2	5175.2	90
J & J DEVELOPMENT COMPANY INC.	312807	833500	J & J 1 - 69	DOM_GW	5449	180	5269.3	5269.3	5189.3	80
WARREN A. MANNING	397485	898135	MANNING #9	STK	5290	20	5269.8	5209.8	5189.8	80
SMITH SHEEP CO.	371845	843739	SMITH #48	STK	5310	35	5274.9	5274.9	5261.9	13
WM. VALENTINE & SONS INC.	318108	834747	SPENCER PASTURE #16	STK	5367	90	5277.2	5077.2	5047.2	230
JOE PATTERSON RANCH CORP.	337554	839427	OLD BRANDING CORRAL	STK	5381	100	5280.7	5090.7	5060.7	220
SMITH LAND COMPANY	350857	846467	SMITH #24	STK	5423	140	5283.4	5283.4	5233.4	50
WILLIAM M. HENRY III	342769	909890	HOOPER HOUSE WELL	STK	5338	54	5283.8	5122.8	5092.8	191
A.C. LAYTON	358813	829184	LAYTON #1	DOM_GW; STK	5324	40	5284.2	5174.2	5144.2	140
WILLIAM R. VOLLMAN	352200	830531	LAYTON #1	STK	5364	80	5284.5	5264.5	5246.5	38
WILLIAM M. HENRY III	349447	920439	SOUTH PAST. SOLAR	STK	5325	39	5286.2	5208.2	5176.2	110
JOE PATTERSON RANCH CORP.	342818	940218	SPEAR K RANCH #1	DOM_GW; STK	5325	30	5295.3	5050.3	5035.3	260
DE PATTERSON RANCH CORPORATIC	329616	919120	BEAR CREEK	STK	5388	90	5297.6	5067.6	5037.6	260
JOE PATTERSON RANCH CORP.	342863	948131	TIN CAKE HOUSE	STK	5343	40	5303.1	5023.1	4993.1	310
AUBREY MANNING INC.	346752	928349	MANNING #13 B C	STK	5343	39	5304.2	4873.2	4793.2	511
HORNBUCKLE RANCH INC.	322910	900777	RESERVOIR PASTURE #1	STK	5426	120	5306.2	5276.2	5261.2	45
JOE PATTERSON RANCH CORP.	333648	946820	ELEC. WELL-RICK	STK	5395	87	5307.7	5054.7	5024.7	283
55 Ranch - Werner, Inc.	332218	917807	WIND #55 1	STK	5337	25	5311.7	5066.7	5036.7	275
DUCK CREEK RANCHES INC.	369055	897463	REYNOLDS #32	STK	5442	130	5311.7	5306.7	5278.7	33
Hornbuckle Ranch	326881	903388	HORNBUCKLE #18	STK	5455	140	5315.2	5255.2	5208.2	107
SMITH LAND CO.	357437	859673	SOLAR PANEL 2	STK	5328	12	5316.0	5304.0	5275.0	41
DAVID VAN BUSKIRK	315490	842695	VAN BUSKIRK #1	DOM_GW	5387	70	5317.3	5317.3	5267.3	50
TILLARD 55-LIMITED PARTNERSHIP	316867	892942	SAGE CREEK GAS PLANT WATER WELL #1	MIS; STK	5534	216	5318.3	5214.3	5194.3	124
WILLIAM R. VOLLMAN	390262	867587	VOLLMAN #3	STK	5334	15	5319.3	5114.3	5084.3	235
ARTHUR A. & SHIRLEY C. LEYRER	316807	840020	LEYRER #1	DOM_GW; STK	5360	40	5319.5	5239.5	5209.5	110
PEABODY COAL COMPANY (PRCC)	318981	906024	BUCK PASTURE #1	STK	5482	160	5321.9	4966.9	4861.9	460
JOE PATTERSON RANCH CORP.	336265	941538	RED WINDMILL-JANE	STK	5376	50	5325.7	5095.7	5065.7	260
Hornbuckle Ranch	323333	895467	HORNBUCKLE #22	STK	5567	236	5330.7	5286.7	5226.7	104
FIRST INTERSTATE BANK OF CASPER	318118	838694	SCHOLTZ #2	DOM_GW; IRR_GW; STK	5348	16	5331.9	5331.9	5305.9	26
FIRST INTERSTATE BANK OF CASPER	318118	838694	SCHOLTZ #1	IRR_GW	5348	15	5332.9	5334.9	5300.9	32
WILLIAM M HENRY III	338850	921691	WES DIPPING VAT	STK	5371	36	5335.0	5286.0	5256.0	79
NUMRICH RANCH	398647	887579	NUMRICH #3	STK	5405	70	5335.3	5325.3	5125.3	210
JOE PATTERSON RANCH CORP.	327074	929626	SCHOOL PATTERSON 36-1	STK	5522	185	5336.9	5101.9	5071.9	265
HORNBUCKLE RANCH, INC.	334807	904706	HORNBUCKLE #21	STK	5514	175	5338.5	5078.5	4928.5	410
SMITH LAND COMPANY	346922	847842	SMITH #36	STK	5480	140	5340.3	5260.3	5243.3	97
AMERICAN QUASAR PETROLEUM	332235	920424	FEDERAL 12 7	MIS; STK	5414	74	5340.3	5134.3	5046.3	294
SMITH SHEEP COMPANY	353436	846414	ONIEL #3	STK	5401	60	5341.5	5316.5	5300.5	41
James W. & Catherine M. Strock	399619	853034	STROCK #2	STK	5424	80	5343.5	5183.5	5173.5	170
SMITH LAND COMPANY	349515	839858	SMITH #22	STK	5419	75	5344.1	5299.1	5293.1	51
SMITH LAND COMPANY	354736	846406	SMITH #25	STK	5380	35	5344.6	5279.6	5249.6	95
MELVIN H. SEIDEL	315491	844033	SEIDEL #1	STK	5391	45	5345.9	5250.9	5220.9	125
SMITH SHEEP COMPANY	344280	839890	WEST DOWNS #1	STK	5482	135	5347.2	5267.2	5242.2	105

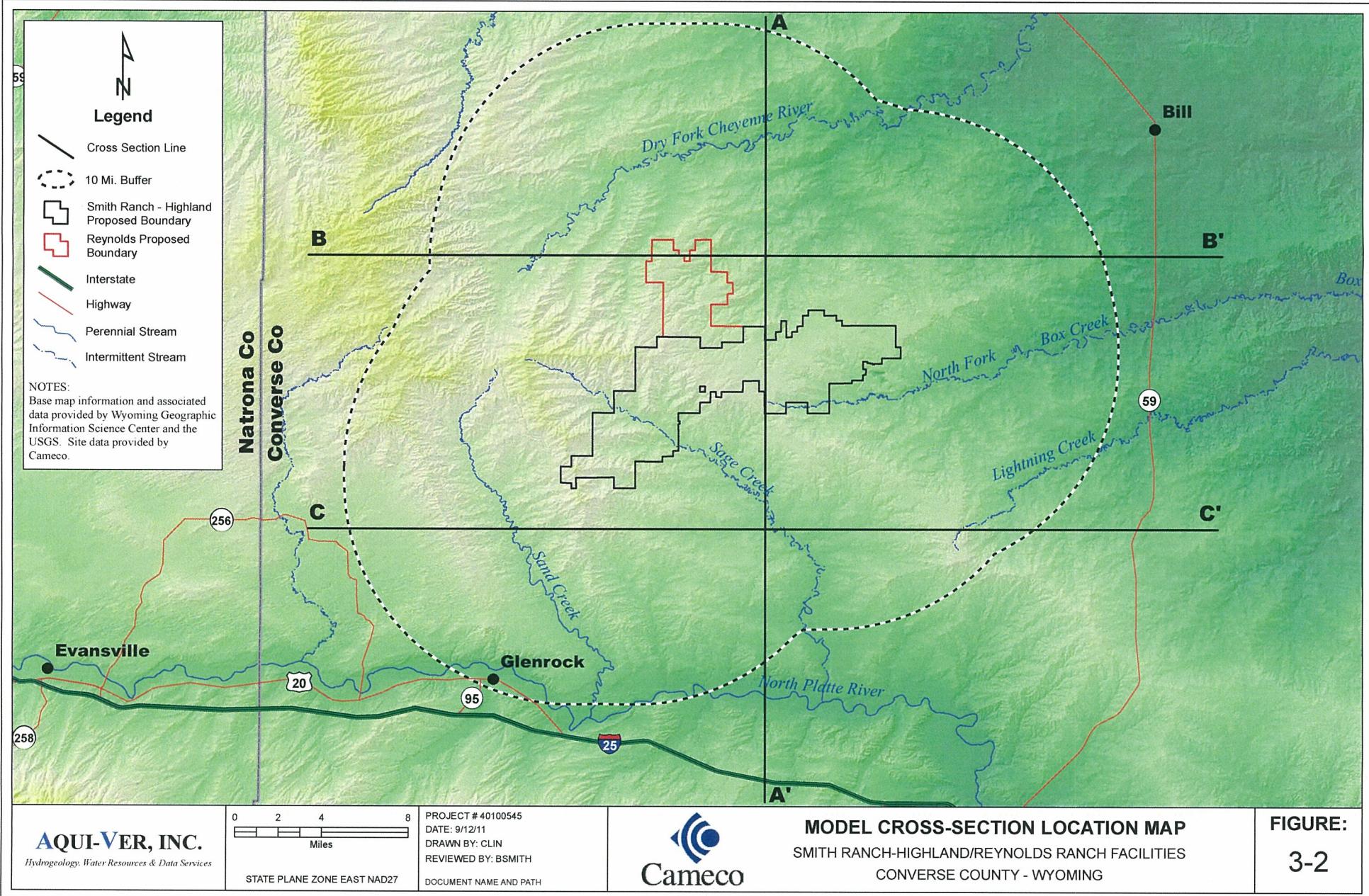
**Table 3-2 (Cont'd). Stock and Domestic Well User Information**

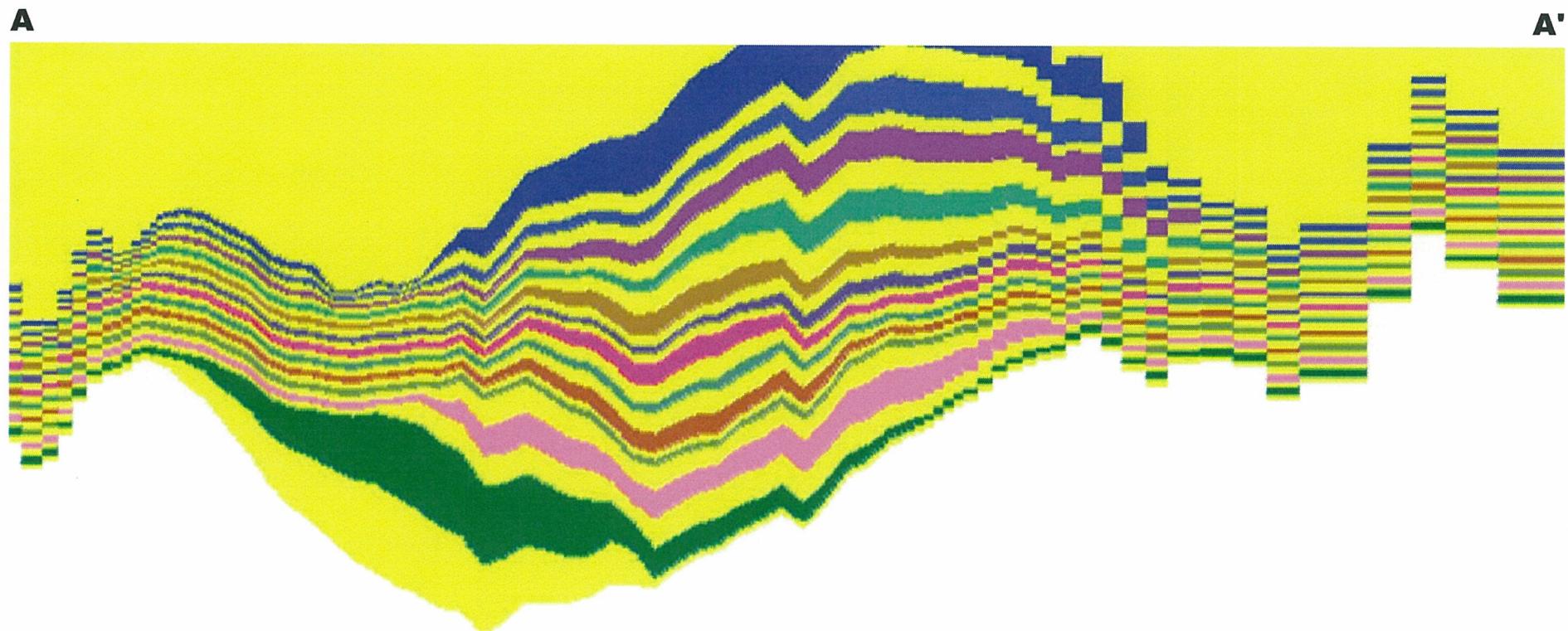
Applicant	Easting (ft)	Northing (ft)	Owner	Uses	Surface Elevation (ft-MSL)	Static Water Level (ft)	Groundwater Elevation (ft-MSL)	Top Screen (ft-MSL)	Bot Screen (ft-MSL)	Water Column (ft)
HENRY J. KEENAN	344246	834601	HENRY KEENAN #4	STK	5436	85	5351.4	5336.4	5306.4	45
NUMRICH RANCH	381112	882169	TERRELL NO. 1	STK	5437	85	5351.7	5321.7	5302.7	49
WILLIAM R. VOLLMAN	388958	874208	VOLLMAN #5	STK	5447	94	5353.3	5067.3	5037.3	316
AUBREY MANNING INC.	348082	932316	MANNING 6 B C	STK	5449	95	5354.5	5299.5	5288.5	66
SMITH SHEEP CO.	362648	850401	SMITH #30	DOM_GW; STK	5435	80	5354.8	5284.8	5254.8	100
DUCK CREEK RANCHES INC.	377148	880827	REYNOLDS #21-3	STK	5504	148	5355.6	5206.6	5186.6	169
GARY SHIDELER	315449	834363	SHIDELER #1	DOM_GW	5446	90	5356.2	5076.2	5046.2	310
A.C. LAYTON	364037	829156	LAYTON #4	DOM_GW; STK	5398	40	5357.6	5247.6	5227.6	130
LEON E. & BERTIE M. HOWE	314073	832188	HOWE #1	DOM_GW	5508	150	5357.9	5307.9	5177.9	180
DE PATTERSON RANCH CORPORATIC	325656	919122	JUDSON	STK	5451	90	5360.6	5130.6	5100.6	260
SMITH SHEEP COMPANY	352190	858774	POTTS #1	STK	5419	58	5361.4	5299.4	5259.4	102
TILLARD 55 LTD. PARTNERSHIP	315488	845356	TILLARD 55 #3	STK	5382	20	5362.0	5362.0	5322.0	40
ROBERT H. & ANNA MAE KEENAN	338984	832394	KEENAN #36	STK	5408	45	5362.7	5362.7	5327.7	35
DAMON J & GRETCHEN C ENGEL	312859	840093	EMY #1	DOM_GW	5424	60	5363.7	5028.7	5003.7	360
55 Ranch - Werner, Inc.	325263	913877	DOM #55 1	DOM_GW; STK	5415	50	5365.0	5045.0	5015.0	350
SMITH SHEEP CO.	361327	850420	SMITH #29	STK	5421	55	5365.7	5270.7	5240.7	125
SMITH SHEEP COMPANY	354774	864257	HAY MEADOW #1	STK	5388	21	5366.9	5287.9	5257.9	109
MARY L MANES	315449	833463	MARY #1	DOM_GW	5446	77	5369.2	5046.2	5023.2	346
WILLIAM R. VOLLMAN	383666	875533	VOLLMAN #6	DOM_GW	5535	165	5369.8	5114.8	5084.8	285
J & J DEVELOPMENT COMPANY INC.	312845	836127	J & J #1-A 15	DOM_GW	5482	110	5372.1	5372.1	5252.1	120
WILLIAM H. MASON	350652	898114	MASON #2	STK	5493	120	5373.5	5293.5	5238.5	135
SMITH LAND COMPANY	349547	857053	SMITH #28	STK	5412	35	5376.9	5241.9	5211.9	165
DUCK CREEK RANCHES INC.	370514	884779	DUCK CREEK #17-2	STK	5483	106	5377.1	5338.1	5300.1	77
Hornbuckle Ranch	318063	895538	HORNBUCKLE WELL #26	STK	5519	140	5379.4	5119.4	5044.4	335
DUCK CREEK RANCHES INC.	363877	902057	DUCK CREEK #31	STK	5507	125	5382.0	5369.0	5347.0	35
VOLLMAN WILLIAM R.	378444	876858	VOLLMAN #4	STK	5510	127	5383.4	5360.4	5310.4	73
TILLARD 55 L. T. D.	319464	850590	HERMA #3	STK	5459	75	5384.1	5304.1	5284.1	100
DUCK CREEK RANCHES INC.	373171	884771	DUCK CREEK #17	STK	5488	102	5385.5	5324.5	5262.5	123
DE PATTERSON RANCH CORPORATIC	321701	919146	WEST 11	STK	5426	40	5386.1	5106.1	5076.1	310
WILLIAM H. MASON	354625	899422	MASON #3	DOM_GW; STK	5572	180	5391.6	5281.6	5261.6	130
J & J DEVELOPMENT COMPANY INC.	311525	834823	J & J #1 A 20	DOM_GW	5526	130	5395.6	5395.6	5285.6	110
TILLARDS 55 LTD.	323403	848062	TILLARDS 55 #3	STK	5548	150	5397.8	5237.8	5197.8	200
TILLARD'S 55 RANCH	315593	888983	ENL LO #1	STK	5534	135	5398.7	5108.7	5088.7	310
SMITH SHEEP CO.	352140	864970	SMITH #31	STK	5435	36	5398.8	5314.8	5284.8	114
SMITH SHEEP COMPANY	381068	864908	TAYLOR # 3	STK	5491	87	5403.7	5255.7	5235.7	168
WILLIAM M. HENRY	317684	911272	HENRY #6	STK	5469	65	5404.3	5269.3	5238.3	166
J & J DEVELOPMENT COMPANY INC.	312743	832210	J & J 1 - 57	DOM_GW	5516	110	5406.1	5406.1	5216.1	190
VOLLMAN RANCHES INC.	383667	871546	VOLLMAN #1	STK	5550	142.3	5407.3	5389.6	5377.6	30
DUCK CREEK RANCHES INC.	362561	900742	REYNOLDS #36 (DEEPENED)	STK	5468	58	5409.9	5327.9	5297.9	112
BURTON O. BARBER	340343	849754	BOWMAN #1	STK	5586	175	5411.0	5426.0	5408.0	3
WILLIAM R. & ALICE L. VOLLMAN	367849	880810	ADAMS #1	STK	5515	100	5415.1	5305.1	5265.1	150
SMITH SHEEP CO.	344280	839890	SMITH #42	STK	5482	60	5422.2	5392.2	5379.2	43
SMITH LAND COMPANY	387632	862268	SMITH #16	STK	5484	60	5423.5	5373.5	5343.5	80
SMITH SHEEP CO.	387632	862268	SMITH 16	STK	5484	60	5423.5	5293.5	5363.5	60
JOE PATTERSON RANCH CORP.	325794	940181	KENNY	STK	5554	130	5424.1	5094.1	5064.1	360
DUCK CREEK RANCHES INC.	363869	898114	DUCK CREEK #1	STK	5466	40	5426.4	5346.4	5316.4	110
VAN IRVINE	316888	890296	LO #1 (DEEPENED)	STK	5572	135	5437.1	5382.1	5232.1	205
DE PATTERSON RANCH CORPORATIC	331045	934884	SCOTTIE	STK	5500	60	5440.3	5140.3	5110.3	330
PEABODY DEVELOPMENT COMPANY	313813	923179	QUICK DRAW #1	MIS; STK	5616	175	5441.0	4856.0	4826.0	615
HORNBUCKLE RANCH, INC.	338765	900752	LOWER BROWN SPRINGS #1	STK	5527	86	5441.2	5414.2	5381.2	60
WM. VALENTINE & SONS INC.	307611	845422	BAKER #14	STK	5522	80	5441.6	5261.6	5231.6	210

**Table 3-2 (Cont'd). Stock and Domestic Well User Information**

Applicant	Easting (ft)	Northing (ft)	Owner	Uses	Surface Elevation (ft-MSL)	Static Water Level (ft)	Groundwater Elevation (ft-MSL)	Top Screen (ft-MSL)	Bot Screen (ft-MSL)	Water Column (ft)
SMITH SHEEP CO.	363956	863616	SMITH #35	STK	5484	40	5444.5	5414.5	5384.5	60
SMITH SHEEP CO.	350840	872924	SMITH #32	STK	5569	115	5453.8	5453.8	5403.8	50
WILLIAM H. MASON	355951	898112	MASON #1	-DOM_GW	5533	75	5458.4	5426.4	5415.4	43
FLORENCE P. COATES	335051	833297	BUD HALL #1	STK	5578	120	5458.4	5338.4	5198.4	260
SMITH SHEEP COMPANY	363956	863616	HAY MEADOW #1	STK	5484	21	5463.5	5439.5	5399.5	64
DUCK CREEK RANCHES INC.	371132	880821	REYNOLDS #20	STK	5500	26	5473.5	5473.5	5454.5	19
Hornbuckle Ranch	345649	894172	HORNBUCKLE #20	DOM_GW; STK	5487	13	5473.8	5396.8	5368.8	105
SMITH LAND COMPANY	341646	855810	SMITH #27	STK	5511	36	5475.0	5211.0	5181.0	294
DUCK CREEK RANCHES INC.	360036	886168	REYNOLDS #13	STK	5625	150	5475.3	5500.3	5437.3	38
Cole Creek Sheep Co.	301174	865240	CHEYENNE RIVER #1	STK	5611	130	5480.7	5395.7	5300.7	180
FRED AND NANCY LINDIG	312743	832210	LINDIG #1	DOM_GW	5516	30	5486.1	5246.1	5216.1	270
HORNBUCKLE RANCH, INC.	344334	888878	UPPER BROWN SPRING #1	STK	5517	29	5488.4	5407.4	5365.4	123
55 Ranch - Werner, Inc.	323333	895467	PEN #55 1	STK	5567	75	5491.7	5266.7	5236.7	255
SMITH SHEEP CO.	361365	878178	SMITH #34	STK	5602	110	5492.0	5442.0	5412.0	80
WILLIAM R. VOLLMAN	369218	874195	VOLLMAN #2	STK	5581	85	5496.2	5461.2	5431.2	65
Hornbuckle Ranch	327342	890140	HORNBUCKLE #19	STK	5669	162	5507.5	5489.5	5404.5	103
Cole Creek Sheep Co.	295991	892955	LO #1000W	STK	5751	240	5510.7	5400.7	5340.7	170
SMITH LAND COMPANY	345622	845187	SMITH #26	STK	5565	38	5526.8	5514.8	5508.8	18
WM. VALENTINE & SONS INC.	304978	845470	BECK-IN-SMITHS #17	STK	5621	90	5531.5	5311.5	5281.5	250
RALPH J. & MARY-LEIGH WILLIAMS	315461	865162	WILLIAMS #1	DOM_GW; STK	5644	110	5534.4	5284.4	5269.4	265
SMITH SHEEP COMPANY	357416	876202	WW109 A	STK	5629	90	5538.8	5568.8	5458.8	80
SMITH SHEEP CO.	343004	886230	SMITH #51	STK	5637	78	5559.0	5517.0	5487.0	72
SMITH SHEEP CO.	356087	876874	SMITH #33	STK	5632	60	5571.6	5501.6	5471.6	100
GEORGE C. KINTD	314214	857241	JOAN #2	DOM_GW; STK	5693	60	5632.6	5442.6	5412.6	220
SMITH SHEEP CO.	327302	876924	SMITH 61	STK	5763	125	5638.0	5623.0	5593.0	45
SMITH SHEEP CO.	342975	878252	SMITH #41	STK	5744	60	5684.3	5674.3	5659.3	25
SMITH SHEEP CO.	327315	883514	SMITH #49	STK	5837	140	5697.0	5627.0	5597.0	100
SMITH SHEEP CO.	327277	871650	SMITH #50	STK	5766	50	5715.8	5715.8	5700.8	15
LUCETTA LENZEN	336378	876867	LENZEN #1	STK	5824	102	5721.6	5678.6	5658.6	63
LUCETTA M. LENZEN	335078	883499	NORTH	DOM_GW; STK	5765	30	5734.6	5574.6	5544.6	190
LENZEN RANCH CO.	335066	880846	LENZEN RANCH CO #3	STK	5881	60	5820.6	5660.6	5640.6	180

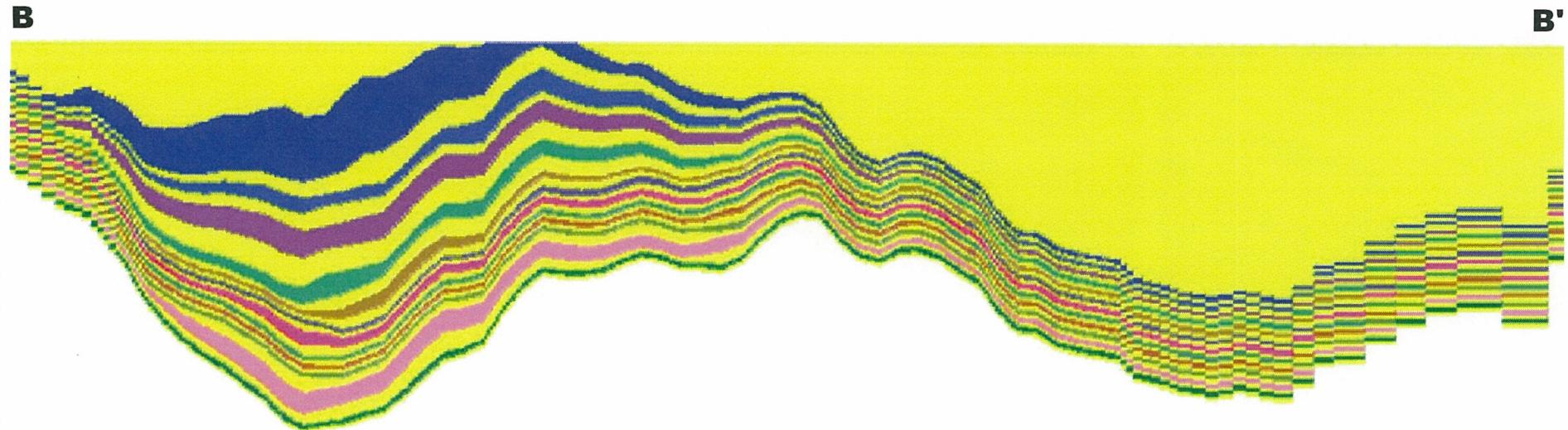






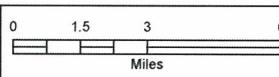
NOTES:  
Vertical exaggeration = 100x.  
Data interpretation by AQUI-VER, INC.

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NOTES:  
Vertical exaggeration = 100x.  
Data interpretation by AQUI-VER, INC.

**AQUI-VER, INC.**  
*Hydrogeology. Water Resources & Data Services*

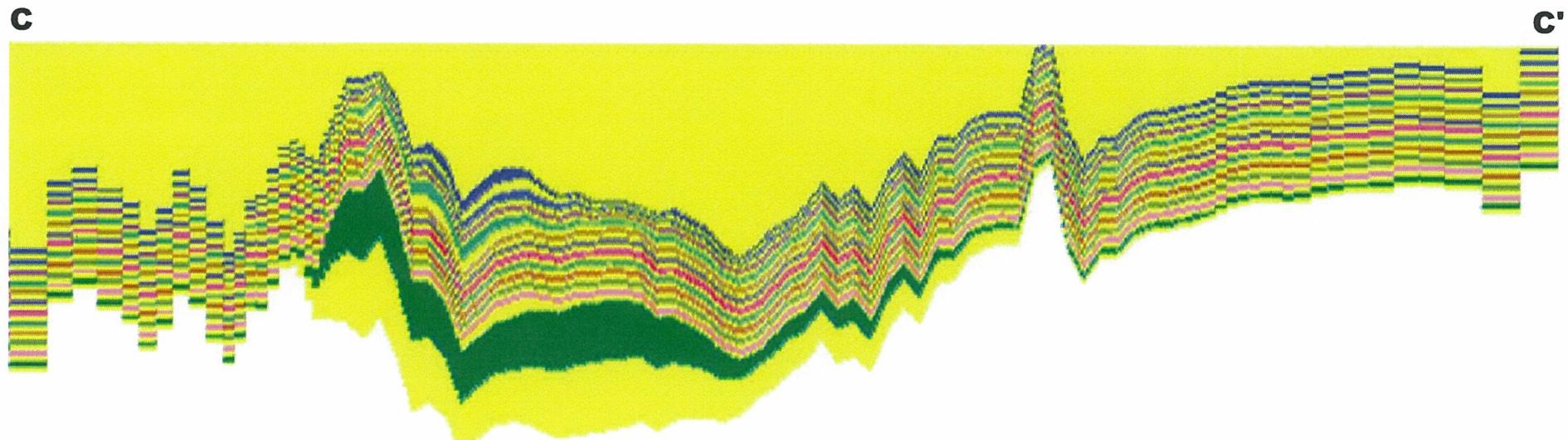


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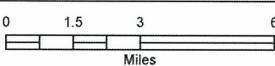


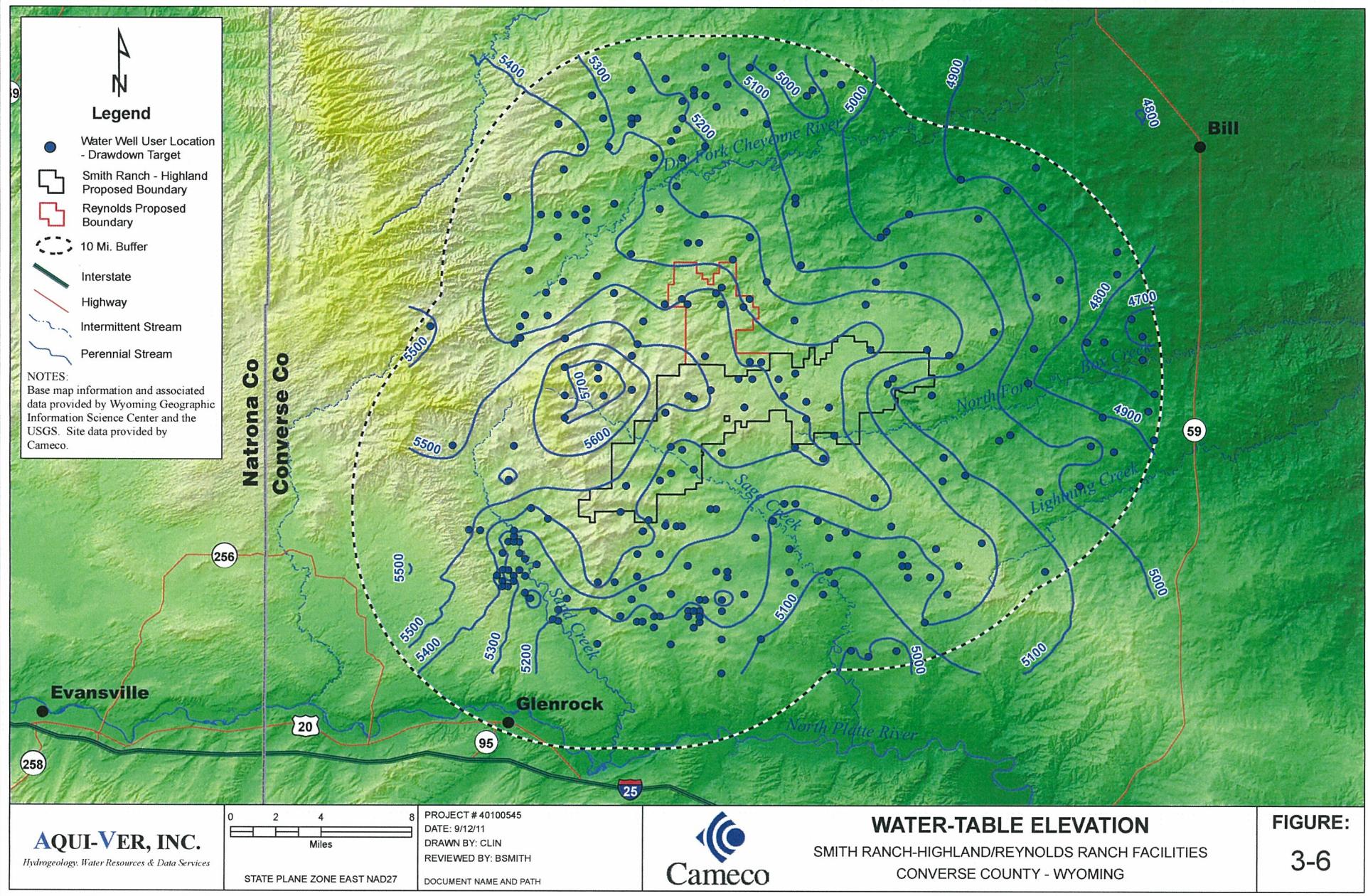
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SMITH RANCH-HIGHLAND/REYNOLDS RANCH FACILITIES  
CONVERSE COUNTY - WYOMING

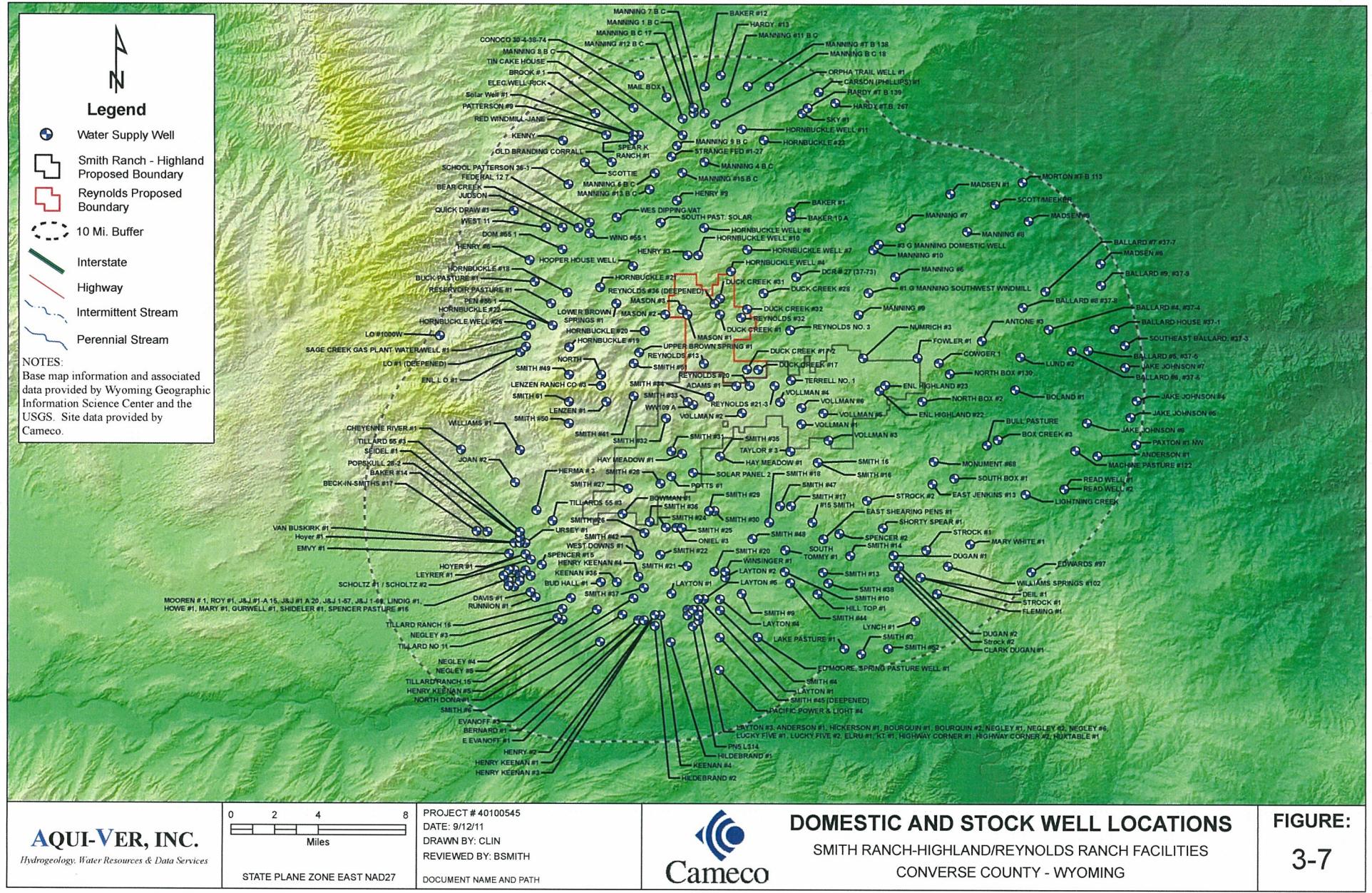
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**3-4**

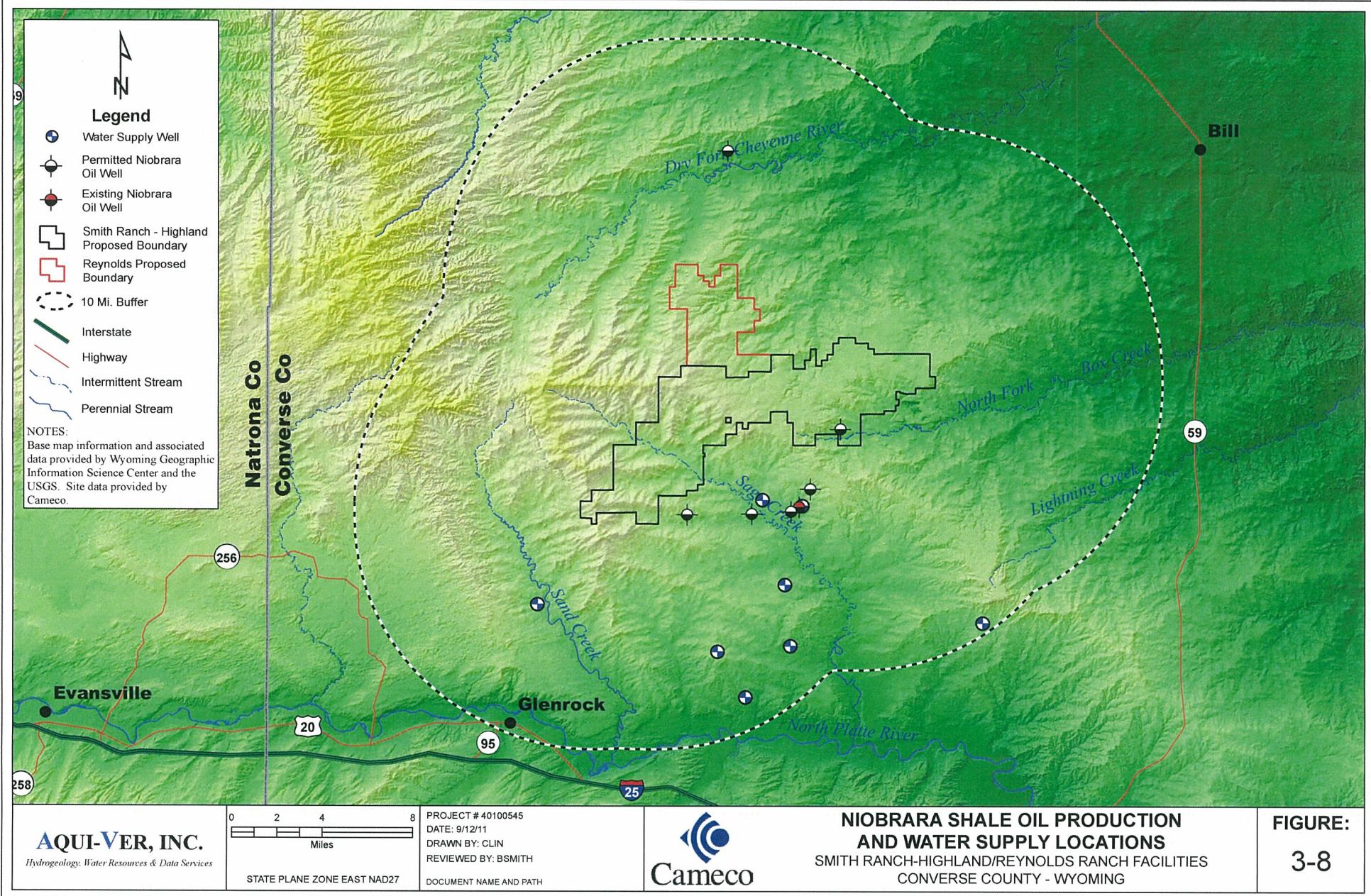


NOTES:  
Vertical exaggeration = 100x.  
Data interpretation by AQUI-VER, INC.

AQUI-VER, INC. <small>Hydrogeology, Water Resources &amp; Data Services</small>		PROJECT # 40100545 DATE: 9/12/11 DRAWN BY: CLIN REVIEWED BY: BSMITH DOCUMENT NAME AND PATH	 <b>MODEL CROSS-SECTION C-C'</b> SMITH RANCH-HIGHLAND/REYNOLDS RANCH FACILITIES CONVERSE COUNTY - WYOMING	<b>FIGURE:</b> <b>3-5</b>
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## 4. HYDROLOGIC IMPACT SIMULATIONS

Independent hydrologic impact simulations were completed using for the SRH-RR ISR development and for Niobrara Shale oil well drilling and fracing operations. The cumulative hydrologic impact was then simulated by combining impacts of both operations into a single model simulation.

Hydrologic impacts were simulated over a 33-year future ISR development period, beginning in the first quarter of 2011 (Development Year 1). Niobrara Shale oil well drilling and fracing operations were assumed to begin simultaneously in Development Year 1 and continue through Development Year 2.

### 4.1 SRH-RR ISR IMPACT ASSESSMENT

Hydrologic impacts due to the operation of the SRH-RR ISR facility were simulated over an estimated 33-year development and restoration period beginning in the 1<sup>st</sup> quarter of 2011 and continuing through the last quarter of 2053. The SRH-RR impact simulation includes 24 existing and planned future mine units, as shown on **Figure 4-1**.

#### 4.1.1 SRH-RR Operations

Groundwater withdrawals for the SRH-RR impact simulations were developed from wellfield production and restoration bleed rates (net pumping rates) presented in water balance information provided by Cameco Resources for existing and future mine units (**Attachment C**).

Groundwater withdrawals due to ISR production are assumed to be one percent of total wellfield production (one percent bleed). The ISR production bleed is expected to vary from 60 to 140 gallons per minute (gpm) over the life of the mine, with maximum production occurring in Development Year 3.

Groundwater withdrawals due to ISR restoration are assumed to be 25 percent of total restoration flow (25 percent bleed), equivalent to a 75 percent Reverse Osmosis treatment efficiency with 25 percent brine reject (for disposal). The ISR restoration bleed is expected to vary from 163 to 856 gpm over the life of the mine, with maximum restoration withdrawals occurring in Development Year 7. Total groundwater withdrawals due to ISR production and restoration varies from 163 gpm at the end of the mine life, to a maximum of 963 gpm in Development Year 7.

Groundwater withdrawals were simulated in the groundwater flow model as a series of three pumping centers spread uniformly across each mine unit, which should provide an adequate spatial distribution given the scale of this study.

#### 4.1.2 SRH-RR Impact Assessment Results

Projected hydrologic impacts (drawdown) associated with the SRH-RR ISR operation are summarized in **Table 4-1**. **Figures 4-2 and 4-3** illustrate the model drawdown distribution in Development Year 18 in the water-table aquifer and the S-Sand production aquifer (model Layer 5), respectively. The majority of stock and domestic wells in this study are completed in multiple sand units (model layers). Drawdown values

shown in **Table 4-1** for wells completed in multiple sand intervals represents the flow-weighted average of the drawdown observed in each individual sand unit.

Drawdown in the shallow water-table aquifer due to ISR operations is predicted to be less than 10 feet at stock and domestic well locations over the life of the mine. ISR impacts greater than 10 feet are predicted in one stock watering and domestic supply well completed in the deeper production sand aquifer located nearest to the SRH-RR facilities. A maximum impact of 21.85 feet was computed in stock watering and domestic supply well Mason #3 in Development Year 18, located adjacent to the Reynolds Ranch satellite ISR facilities and completed in the deeper production sand interval. In general, maximum impacts occur toward the end of the mine life, but the timing of maximum impacts at individual stock and domestic wells varies significantly based on their relative proximity to the SRH-RR property and the well completion interval (depth). The predicted drawdown due to ISR development should not have an adverse impact on water resources in the area.

## 4.2 NIOBRARA SHALE DEVELOPMENT IMPACT ASSESSMENT

Hydrologic impacts due to recent Niobrara Shale oil well drilling and fracing operations were simulated over a limited two-year development period. The simulation accounts for the development of a shallow groundwater supply needed to support existing and permitted Niobrara Shale horizontal well drilling and fracing operations within a 10-mile radius of the facility. It is recognized that Niobrara Shale oil well development may be significantly larger and of greater longevity than simulated in this study. However, the Niobrara Shale oil play is in an early stage of exploration and development, and there are no definitive data to suggest what the actual level of development activity will be in the long term. Therefore, this assessment is limited to existing and permitted wells in the WYOGC database.

As described in Section 3.4, it is estimated that 4-5 million gallons of water will be needed to drill and frac a single horizontal shale oil well. There are currently eight existing or permitted Niobrara Shale horizontal oil wells within a 10-mile radius of the SRH-RR facility (**Figure 3-8**). Therefore, it is conservatively estimated 40 million gallons of groundwater will be needed to support the drilling and fracing operations over an estimated two-year development period. The impact assessment assumes that water for the drilling and fracing operations will be supplied by eight water supply wells permitted by the oil field operator (Chesapeake Operating, Inc.), as shown in **Figure 3-8**. Each well is assumed to pump at a constant rate of 4.76 gpm for a period of two years (equivalent to a total volume of 40 million gallons).

### 4.2.1 Niobrara Shale Development Results

Projected hydrologic impacts (drawdown) associated with Niobrara Shale well drilling and fracing operations are summarized in **Table 4-1**. Maximum hydrologic impacts occur in wells closest to water supply wells and those that are completed in the water-table aquifer (Layer 1). Drawdown in the shallow water-table aquifer due to limited Niobrara Shale development is very limited and less 1-foot at all stock and domestic well locations over the two-year development period. A maximum drawdown of 0.09 foot was computed at stock watering well Smith #17 at the end of impact simulation (Development Year 2).

#### **4.3 CUMULATIVE HYDROLOGIC IMPACT ASSESSMENT RESULTS**

The cumulative hydrologic impact (drawdown) associated with ISR and limited Niobrara Shale development was computed by simulating the simultaneous development of ISR and Niobrara Shale impacts. For this assessment, it was assumed that ISR and Niobrara Shale development activities begin simultaneously at the beginning of Development Year 1.

Projected cumulative hydrologic impacts (drawdown) are summarized in **Table 4-1**. Because the drawdown associated with the limited Niobrara Shale development are very small, cumulative hydrologic impacts are very similar to SRH-RR impacts. In general, maximum cumulative impacts occur toward the end of the ISR mine life, but the timing of maximum impacts at individual stock and domestic wells vary somewhat based on their relative proximity to the SRH-RR property and the well completion interval (depth). The predicted drawdown due to cumulative ISR and limited Niobrara Shale development should not have an adverse impact on water resources in the area.

#### **4.4 SUMMARY AND CONCLUSIONS**

As a practical matter, predicted hydrologic impacts associated with ISR development should not adversely impact water resources in the area. Predicted drawdown due to ISR development are generally small and less than 10 percent of the available water column at all but one stock watering and domestic supply well location (Mason #3). The same basic conclusion applies to hydrologic impacts associated with limited Niobrara Shale oil well development, where drawdown impacts to local stock and domestic wells are very small over the two-year limited development period. It is likely, however, that Niobrara Shale oil well development will be more extensive and of greater longevity than simulated in this study, and hydrologic impacts associated with shale oil development may therefore be more significant than predicted in this study.

In the worse case, a small decrease in well yield may be observed due to a decreased pumping level in wells having the highest potential drawdown impacts. In the event this should cause a significant concern, the problem may be overcome by lowering the pump, or in the worse case, by installing an additional supply well (and pump) to make up for lost production.

Table 4-1. Hydrologic Impact Assessment Summary

Applicant	Easting (ft)	Northing (ft)	Well ID	Uses	SRH-RR ISR Drawdown (ft)	Max Impact Year	Niobrara Shale Drawdown (ft)	Max Impact Year	Cumulative Drawdown (ft)	Max Impact Year
WILLIAM H. MASON	354625	899422	MASON #3	DOM_GW; STK	21.85	18	<0.01	2	21.85	18
U.S.A. Exxon, Co.	402605	879692	ENL HIGHLAND #22	STK	8.73	13	<0.01	2	8.73	13
WILLIAM R. VOLLMAN	383666	875533	VOLLMAN #6	DOM_GW	7.55	6	<0.01	2	7.55	6
WILLIAM H. MASON	350652	898114	MASON #2	STK	6.41	21	<0.01	2	6.41	21
DUCK CREEK RANCHES INC.	363877	902057	DUCK CREEK #31	STK	6.09	25	<0.01	2	6.09	25
WILLIAM M. HENRY	356009	912520	HENRY #3	STK	5.58	20	<0.01	2	5.58	20
DUCK CREEK RANCHES INC.	362561	900742	REYNOLDS #36 (DEEPENED)	STK	4.45	26	<0.01	2	4.45	26
WILLIAM H. MASON	355951	898112	MASON #1	DOM_GW	3.54	25	<0.01	2	3.54	25
Hornbuckle Ranch	366511	908620	HORNBUCKLE WELL #4	STK	3.50	25	<0.01	2	3.50	25
Hornbuckle Ranch	358645	912539	HORNBUCKLE WELL #10	STK	2.49	24	<0.01	2	2.49	24
DUCK CREEK RANCHES INC.	369055	897463	REYNOLDS #32	STK	2.40	25	<0.01	2	2.40	25
U.S.A. Exxon, Co.	403931	881020	ENL HIGHLAND #23	STK	2.27	13	<0.01	2	2.27	13
DUCK CREEK RANCHES INC.	370465	899427	DUCK CREEK #32	STK	2.24	24	<0.01	2	2.24	24
SMITH LAND COMPANY	341646	855810	SMITH #27	STK	1.92	7	<0.01	2	1.92	7
DUCK CREEK RANCHES INC.	363869	898114	DUCK CREEK #1	STK	1.85	28	<0.01	2	1.85	28
DUCK CREEK RANCHES	374440	903377	DUCK CREEK #28	STK	1.60	25	<0.01	2	1.60	25
WILLIAM M. HENRY III	342769	909890	HOOPER HOUSE WELL	STK	1.47	24	<0.01	2	1.47	24
Hornbuckle Ranch	359978	919128	HORNBUCKLE WELL #6	STK	1.27	26	<0.01	2	1.27	26
Hornbuckle Ranch	370498	913889	HORNBUCKLE WELL #7	STK	1.23	26	<0.01	2	1.23	26
Hornbuckle Ranch	327342	890140	HORNBUCKLE #19	STK	1.01	3	<0.01	2	1.01	3
DUCK CREEK RANCHES INC.	360036	886168	REYNOLDS #13	STK	0.96	27	<0.01	2	0.96	27
Hornbuckle Ranch	345649	894172	HORNBUCKLE #20	DOM_GW; STK	0.73	33	<0.01	2	0.73	33
SMITH LAND COMPANY	346922	847842	SMITH #36	STK	0.59	10	<0.01	2	0.59	10
Hornbuckle Ranch	326881	903388	HORNBUCKLE #18	STK	0.55	4	<0.01	2	0.55	4
SMITH SHEEP CO.	350840	872924	SMITH #32	STK	0.55	11	<0.01	2	0.55	11
SMITH LAND COMPANY	349547	857053	SMITH #28	STK	0.53	12	<0.01	2	0.53	12
SMITH SHEEP CO.	352140	864970	SMITH #31	STK	0.47	12	<0.01	2	0.47	12
FLORENCE P. COATES	335051	833297	BUD HALL #1	STK	0.42	16	<0.01	2	0.42	16
DUCK CREEK RANCHES INC.	370514	884779	DUCK CREEK #17-2	STK	0.40	32	<0.01	2	0.40	32
SMITH SHEEP CO.	327302	876924	SMITH 61	STK	0.37	2	<0.01	2	0.37	2
DUCK CREEK RANCHES INC.	373171	884771	DUCK CREEK #17	STK	0.36	31	<0.01	2	0.36	31
SMITH SHEEP CO.	327277	871650	SMITH #50	STK	0.34	16	<0.01	2	0.34	16
WILLIAM R. & ALICE L. VOLLMAN	367849	880810	ADAMS #1	STK	0.32	33	<0.01	2	0.32	33
SMITH SHEEP CO.	361365	878178	SMITH #34	STK	0.31	32	<0.01	2	0.31	32
TILLARD 55 L. T. D.	319464	850590	HERMA #3	STK	0.28	17	<0.01	2	0.28	17
BURTON O. BARBER	340343	849754	BOWMAN #1	STK	0.27	12	<0.01	2	0.27	12
WILLIAM M. HENRY III	349447	920439	SOUTH PAST. SOLAR	STK	0.27	29	<0.01	2	0.27	29
SMITH SHEEP CO.	356087	876874	SMITH #33	STK	0.27	33	<0.01	2	0.27	33
SMITH SHEEP COMPANY	352190	858774	POTTS #1	STK	0.26	14	<0.01	2	0.26	14
James W. & Catherine M. Strock	399619	853034	STROCK #2	STK	0.26	20	<0.01	2	0.26	20
SMITH SHEEP CO.	327315	883514	SMITH #49	STK	0.26	6	<0.01	2	0.26	6
DUCK CREEK RANCHES INC.	380930	894401	REYNOLDS NO. 3	STK	0.25	32	<0.01	2	0.25	32
SMITH SHEEP COMPANY	357416	876202	WW109 A	STK	0.25	33	<0.01	2	0.25	33
TILLARDS 55 LTD.	323403	848062	TILLARDS 55 #3	STK	0.25	23	<0.01	2	0.25	23

Table 4-1. Hydrologic Impact Assessment Summary (Cont'd)

Applicant	Easting (ft)	Northing (ft)	Well ID	Uses	SRH-RR ISR Drawdown (ft)	Max Impact Year	Niobrara Shale Drawdown (ft)	Max Impact Year	Cumulative Drawdown (ft)	Max Impact Year
SMITH SHEEP COMPANY	354774	864257	HAY MEADOW #1	STK	0.24	15	<0.01	2	0.24	15
SMITH LAND COMPANY	350857	846467	SMITH #24	STK	0.23	14	<0.01	2	0.23	14
HORNBUCKLE RANCH, INC.	344334	888878	UPPER BROWN SPRING #1	STK	0.23	33	<0.01	2	0.23	33
SMITH SHEEP COMPANY	344280	839890	WEST DOWNS #1	STK	0.22	10	<0.01	2	0.22	10
TILLARD 55 RANCH	334141	826536	TILLARD RANCH 15	STK	0.19	16	<0.01	2	0.19	16
SMITH SHEEP CO.	343004	886230	SMITH #51	STK	0.16	33	<0.01	2	0.16	33
SMITH SHEEP CO.	342975	878252	SMITH #41	STK	0.14	33	<0.01	2	0.14	33
LUCETTA M. LENZEN	335078	883499	NORTH	DOM_GW; STK	0.12	33	<0.01	2	0.12	33
NUMRICH RANCH	381112	882169	TERRELL NO. 1	STK	0.11	33	<0.01	2	0.11	33
WARREN A. MANNING	401042	913919	MANNING #10	STK	0.11	21	<0.01	2	0.11	21
Roy C. & Ferol Baker	381080	921772	BAKER 10 A	DOM_GW	0.11	31	<0.01	2	0.11	31
WILLIAM R. VOLLMAN	369218	874195	VOLLMAN #2	STK	0.11	33	<0.01	2	0.11	33
Boner Bros. Partnership	427378	891793	ANTONE #3	STK	0.11	21	<0.01	2	0.11	21
SMITH SHEEP CO.	363956	863616	SMITH #35	STK	0.09	16	<0.01	2	0.09	16
SMITH SHEEP COMPANY	363956	863616	HAY MEADOW #1	STK	0.09	16	<0.01	2	0.09	16
DUCK CREEK RANCHES INC.	377148	880827	REYNOLDS #21-3	STK	0.08	33	<0.01	2	0.08	33
LUCETTA LENZEN	336378	876867	LENZEN #1	STK	0.08	33	<0.01	2	0.08	33
GEORGE C. KINTD	314214	857241	JOAN #2	DOM_GW; STK	0.08	33	<0.01	2	0.08	33
VOLLMAN WILLIAM R.	378444	876858	VOLLMAN #4	STK	0.08	33	<0.01	2	0.08	33
WARREN A. & JUDITH Y. MANNING	402352	915254	#3 G MANNING DOMESTIC WELL	DOM_GW; STK	0.08	21	<0.01	2	0.08	21
RALPH J. & MARY-LEIGH WILLIAMS	315461	865162	WILLIAMS #1	DOM_GW; STK	0.07	33	<0.01	2	0.07	33
AUBREY MANNING INC.	354743	932359	MANNING #15 B C	STK	0.07	31	<0.01	2	0.07	31
HENRY LAND COMPANY	353380	925727	HENRY #9	DOM_GW	0.06	31	<0.01	2	0.06	31
Boner Bros. Partnership	412996	877069	NORTH BOX #2	STK	0.05	33	<0.01	2	0.05	33
DAMON J & GRETCHEN C ENGEL	312859	840093	EMVY #1	DOM_GW	0.05	20	<0.01	2	0.05	20
LEE FOWLER	411819	887687	FOWLER #1	DOM_GW	0.05	33	<0.01	2	0.05	33
AUBREY MANNING INC.	360043	935041	MANNING 4 B C	STK	0.05	31	<0.01	2	0.05	31
DAMON J & GRETCHEN C ENGEL	314179	842713	Hoyer #1	DOM_GW; STK	0.05	20	<0.01	2	0.05	20
WILLIAM M HENRY III	338850	921691	WES DIPPING VAT	STK	0.05	31	<0.01	2	0.05	31
ROY SHIDELER	314165	836109	ROY #1	DOM_GW; STK	0.05	19	<0.01	2	0.05	19
AUBREY MANNING INC.	348082	932316	MANNING 6 B C	STK	0.04	32	<0.01	2	0.04	32
55 Ranch - Werner, Inc.	332218	917807	WIND #55 1	STK	0.04	6	<0.01	2	0.04	6
FOWLER RANCH PARTNERSHIP	416937	886377	COWGER 1	STK	0.04	33	<0.01	2	0.04	33
Boner Brothers Partnership	419563	883754	NORTH BOX #130	STK	0.03	33	<0.01	2	0.03	33
ROY C. BAKER	381073	923092	BAKER #1	DOM_GW	0.03	31	<0.01	2	0.03	31
DUCK CREEK RANCHES INC.	382398	907307	DCR # 27 (37-73)	STK	0.03	33	<0.01	2	0.03	33
LENZEN RANCH CO.	335066	880846	LENZEN RANCH CO #3	STK	0.03	33	<0.01	2	0.03	33
DUCK CREEK RANCHES INC.	371132	880821	REYNOLDS #20	STK	0.03	33	<0.01	2	0.03	33
WM. VALENTINE & SONS INC.	307611	845422	BAKER #14	STK	0.02	33	<0.01	2	0.02	33
SMITH SHEEP COMPANY	381068	864908	TAYLOR # 3	STK	0.02	33	<0.01	2	0.02	33
WILLIAM R. VOLLMAN	388958	874208	VOLLMAN #5	STK	0.02	33	<0.01	2	0.02	33
HORNBUCKLE RANCH INC.	322910	900777	RESERVOIR PASTURE #1	STK	0.02	33	<0.01	2	0.02	33
AUBREY MANNING INC.	353422	938921	MANNING 9 B C	STK	0.02	32	<0.01	2	0.02	32
NUMRICH RANCH	398647	887579	NUMRICH #3	STK	0.02	33	<0.01	2	0.02	33
JERRY/CAROLINE MOOREN	315476	834772	MOOREN # 1	DOM_GW; STK	0.01	20	<0.01	2	0.01	20

Table 4-1. Hydrologic Impact Assessment Summary (Cont'd)

Applicant	Easting (ft)	Northing (ft)	Well ID	Uses	SRH-RR ISR Drawdown (ft)	Max Impact Year	Niobrara Shale Drawdown (ft)	Max Impact Year	Cumulative Drawdown (ft)	Max Impact Year
WM. VALENTINE & SONS INC.	304978	845470	BECK-IN-SMITHS #17	STK	0.01	33	<0.01	2	0.01	33
WILLIAM J. SMITH	357464	822589	PN5 L314	MIS; STK	0.01	33	<0.01	2	0.01	33
Hornbuckle Ranch	323333	895467	HORNBUCKLE #22	STK	0.01	33	<0.01	2	0.01	33
55 Ranch - Werner, Inc.	323333	895467	PEN #55 1	STK	0.01	33	<0.01	2	0.01	33
VOLLMAN RANCHES INC.	383667	871546	VOLLMAN #1	STK	0.01	33	<0.01	2	0.01	33
VAN IRVINE	316888	890296	LO #1 (DEEPPENED)	STK	0.01	33	<0.01	2	0.01	33
AMERICAN QUASAR PETROLEUM	332235	920424	FEDERAL 12 7	MIS; STK	0.01	7	<0.01	2	0.01	7
HORNBUCKLE RANCH, INC.	334807	904706	HORNBUCKLE #21	STK	0.01	33	<0.01	2	0.01	33
SMITH LAND CO.	357437	859673	SOLAR PANEL 2	STK	0.01	33	<0.01	2	0.01	33
TILLARD'S 55 RANCH	315593	888983	ENL L O #1	STK	0.01	33	<0.01	2	0.01	33
WARREN A. & JUDITH Y. MANNING	399882	903409	#1 G MANNING SOUTHWEST WINDMILL	STK	0.01	33	<0.01	2	0.01	33
TILLARD 55-LIMITED PARTNERSHIP	316867	892942	SAGE CREEK GAS PLANT WATER WELL #*	MIS; STK	<0.01	33	<0.01	2	<0.01	33
Hornbuckle Ranch	318063	895538	HORNBUCKLE WELL #26	STK	<0.01	33	<0.01	2	<0.01	33
Colo Creek Sheep Co.	301174	865240	CHEYENNE RIVER #1	STK	<0.01	33	<0.01	2	<0.01	33
SMITH SHEEP COMPANY	353436	846414	ONIEL #3	STK	<0.01	33	<0.01	2	<0.01	33
HORNBUCKLE RANCH, INC.	338765	900752	LOWER BROWN SPRINGS #1	STK	<0.01	33	<0.01	2	<0.01	33
SMITH LAND COMPANY	354736	846406	SMITH #25	STK	<0.01	33	<0.01	2	<0.01	33
Canon Land & Livestock Ltd.	419235	837189	WILLIAMS SPRINGS #102	STK	<0.01	26	<0.01	2	<0.01	26
SMITH LAND COMPANY	345622	845187	SMITH #26	STK	<0.01	33	<0.01	2	<0.01	33
SMITH SHEEP CO.	361327	850420	SMITH #29	STK	<0.01	33	<0.01	2	<0.01	33
PEABODY COAL COMPANY (PRCC)	318981	906024	BUCK PASTURE #1	STK	<0.01	33	<0.01	2	<0.01	33
WILLIAM R. VOLLMAN	390262	867587	VOLLMAN #3	STK	<0.01	33	<0.01	2	<0.01	33
SMITH SHEEP CO.	362648	850401	SMITH #30	DOM_GW; STK	<0.01	33	<0.01	2	<0.01	33
SMITH LAND COMPANY	349515	839858	SMITH #22	STK	<0.01	33	<0.01	2	<0.01	33
SMITH SHEEP CO.	344280	839890	SMITH #42	STK	<0.01	33	<0.01	2	<0.01	33
55 Ranch - Werner, Inc.	325623	913877	DOM #55 1	DOM_GW; STK	<0.01	33	<0.01	2	<0.01	33
WILLIAM M. HENRY	317684	911272	HENRY #6	STK	<0.01	33	<0.01	2	<0.01	33
JOE PATTERSON RANCH CORPORATION	329616	919120	BEAR CREEK	STK	<0.01	33	<0.01	2	<0.01	33
SMITH LAND COMPANY	356074	837176	SMITH #21	STK	<0.01	33	<0.01	2	<0.01	33
WARREN A. & JUDITH Y. MANNING	406298	907350	MANNING #6	STK	<0.01	33	<0.01	2	<0.01	33
JOE PATTERSON RANCH CORPORATION	325656	919122	JUDSON	STK	<0.01	33	<0.01	2	<0.01	33
HENRY J. KEENAN	344246	834601	HENRY KEENAN #4	STK	<0.01	33	<0.01	2	<0.01	33
JOE PATTERSON RANCH CORPORATION	321701	919146	WEST 11	STK	<0.01	33	<0.01	2	<0.01	33
SMITH LAND COMPANY	386390	847696	#15 SMITH	STK	<0.01	33	<0.01	2	<0.01	33
ROBERT H. & ANNA MAE KEENAN	338984	833294	KEENAN #36	STK	<0.01	33	<0.01	2	<0.01	33
SMITH LAND COMPANY	345593	831924	SMITH #37	STK	<0.01	33	<0.01	2	<0.01	33
AUBREY MANNING INC.	346752	928349	MANNING #13 B C	STK	<0.01	33	<0.01	2	<0.01	33
Boner Bros. Partnership	424612	842524	MARY WHITE #1	STK	<0.01	33	<0.01	2	<0.01	33
SMITH SHEEP CO.	362674	835837	SMITH #20	STK	<0.01	33	<0.01	2	<0.01	33
Boner Brothers Partnership	438004	854550	LIGHTNING CREEK	STK	<0.01	33	<0.01	2	<0.01	33
AUBREY MANNING INC.	354766	941566	MANNING 8 B C	STK	<0.01	33	<0.01	2	<0.01	33
VOLLMAN RANCHES INC.	365276	835825	WINSINGER #1	STK	<0.01	33	<0.01	2	<0.01	33

Table 4-1. Hydrologic Impact Assessment Summary (Cont'd)

Applicant	Easting (ft)	Northing (ft)	Well ID	Uses	SRH-RR ISR Drawdown (ft)	Max Impact Year	Niobrara Shale Drawdown (ft)	Max Impact Year	Cumulative Drawdown (ft)	Max Impact Year
JOE PATTERSON	342822	941538	Solar Well #1	DOM_GW; STK	<0.01	15	<0.01	2	<0.01	15
James W. & Catherine M. Strock	403488	846428	SHORTY SPEAR #1	STK	<0.01	33	<0.01	2	<0.01	33
SMITH SHEEP CO.	392937	845040	SPENCER #2	STK	<0.01	33	<0.01	2	<0.01	33
WILLIAM R. VOLLMAN	352200	830531	LAYTON #1	STK	<0.01	33	<0.01	2	<0.01	33
AUBREY MANNING INC.	360096	946857	MANNING 7 B C	STK	<0.01	33	<0.01	2	<0.01	33
PEABODY DEVELOPMENT COMPANY	313813	923179	QUICK DRAW #1	MS; STK	<0.01	33	<0.01	2	<0.01	33
Cole Creek Sheep Co.	295991	892955	LO #1000W	STK	<0.01	33	<0.01	2	<0.01	33
HENRY J. KEENAN	342969	829296	HENRY KEENAN #5	STK	<0.01	33	<0.01	2	<0.01	33
SMITH SHEEP CO.	375875	847697	SMITH #18	STK	<0.01	33	<0.01	2	<0.01	33
MELVIN H. SR. & E. LOUISE SEIDEL	315491	844033	POPSKULL 28-2	DOM_GW; STK	<0.01	33	<0.01	2	<0.01	33
JOE PATTERSON RANCH CORP.	327074	929626	SCHOOL PATTERSON 36-1	STK	<0.01	33	<0.01	2	<0.01	33
Hornbuckle Ranch	374451	940287	HORNBUCKLE #23	STK	<0.01	33	<0.01	2	<0.01	33
A.C. LAYTON	365274	834495	LAYTON #2	STK	<0.01	33	<0.01	2	<0.01	33
SMITH SHEEP CO.	371845	843739	SMITH #48	STK	<0.01	33	<0.01	2	<0.01	33
LEONE E. & BERTIE M. HOWE	314073	832188	HOWE #1	DOM_GW	<0.01	33	<0.01	2	<0.01	33
J & J DEVELOPMENT COMPANY INC.	312743	832210	J & J 1 - 57	DOM_GW	<0.01	33	<0.01	2	<0.01	33
FRED AND NANCY LINDIG	312743	832210	LINDIG #1	DOM_GW	<0.01	33	<0.01	2	<0.01	33
JOE PATTERSON RANCH CORP.	337554	934927	OLD BRANDING CORRALL	STK	<0.01	33	<0.01	2	<0.01	33
Boner Bros. Partnership	420790	858420	SOUTH BOX #1	STK	<0.01	33	<0.01	2	<0.01	33
J & J DEVELOPMENT COMPANY INC.	311525	834823	J & J #1 A 20	DOM_GW	<0.01	33	<0.01	2	<0.01	33
JOE PATTERSON RANCH CORPORATION	331045	934884	SCOTTIE	STK	<0.01	33	<0.01	2	<0.01	33
USDI - BLM	362698	944227	ORPHA TRAIL WELL #1	STK	<0.01	33	<0.01	2	<0.01	33
SMITH SHEEP CO.	378543	851695	SMITH #47	STK	<0.01	33	<0.01	2	<0.01	33
A.C. LAYTON	358813	829184	LAYTON #1	DOM_GW; STK	<0.01	33	<0.01	2	<0.01	33
ALLEN USREY	316799	842674	URSEY #1	DOM_GW	<0.01	33	<0.01	2	<0.01	33
JOE PATTERSON RANCH	342822	941538	PATTERSON #9	DOM_GW; STK	<0.01	33	<0.01	2	<0.01	33
WARREN A. MANNING	397485	898135	MANNING #9	STK	<0.01	33	<0.01	2	<0.01	33
A.C. LAYTON	360125	829176	LAYTON #5	STK	<0.01	33	<0.01	2	<0.01	33
TILLARD 55 LTD. PARTNERSHIP	315488	845356	TILLARD 55 #3	STK	<0.01	33	<0.01	2	<0.01	33
J & J DEVELOPMENT COMPANY INC.	312807	833500	J & J 1 - 69	DOM_GW	<0.01	33	<0.01	2	<0.01	33
WM. VALENTINE & SONS INC.	320744	837415	SPENCER #15	STK	<0.01	33	<0.01	2	<0.01	33
MARK A & ARDITH A. HICKERSON	356161	826555	HICKERSON #1	DOM_GW	<0.01	33	<0.01	2	<0.01	33
MELVIN H. SEIDEL	315491	844033	SEIDEL #1	STK	<0.01	33	<0.01	2	<0.01	33
ROY G. HOYER	316807	840020	HOYER #1	DOM_GW; STK	<0.01	33	<0.01	2	<0.01	33
ARTHUR A. & SHIRLEY C. LEYRER	316807	840020	LEYRER #1	DOM_GW; STK	<0.01	33	<0.01	2	<0.01	33
ROBERT W. MANNING	352080	936277	STRANGE FED #1-27	STK	<0.01	33	<0.01	2	<0.01	33
EVERT L. BOURQUIN	357492	826546	BOURQUIN #2	STK	<0.01	33	<0.01	2	<0.01	33
J.S. NEGLEY	357492	826546	NEGLEY #1	DOM_GW; STK	<0.01	33	<0.01	2	<0.01	33
EVERT L. BOURQUIN	357492	826546	BOURQUIN #1	DOM_GW	<0.01	33	<0.01	2	<0.01	33
Boner Brothers Partnership	449996	865213	MACHINE PASTURE #122	STK	<0.01	33	<0.01	2	<0.01	33

Table 4-1. Hydrologic Impact Assessment Summary (Cont'd)

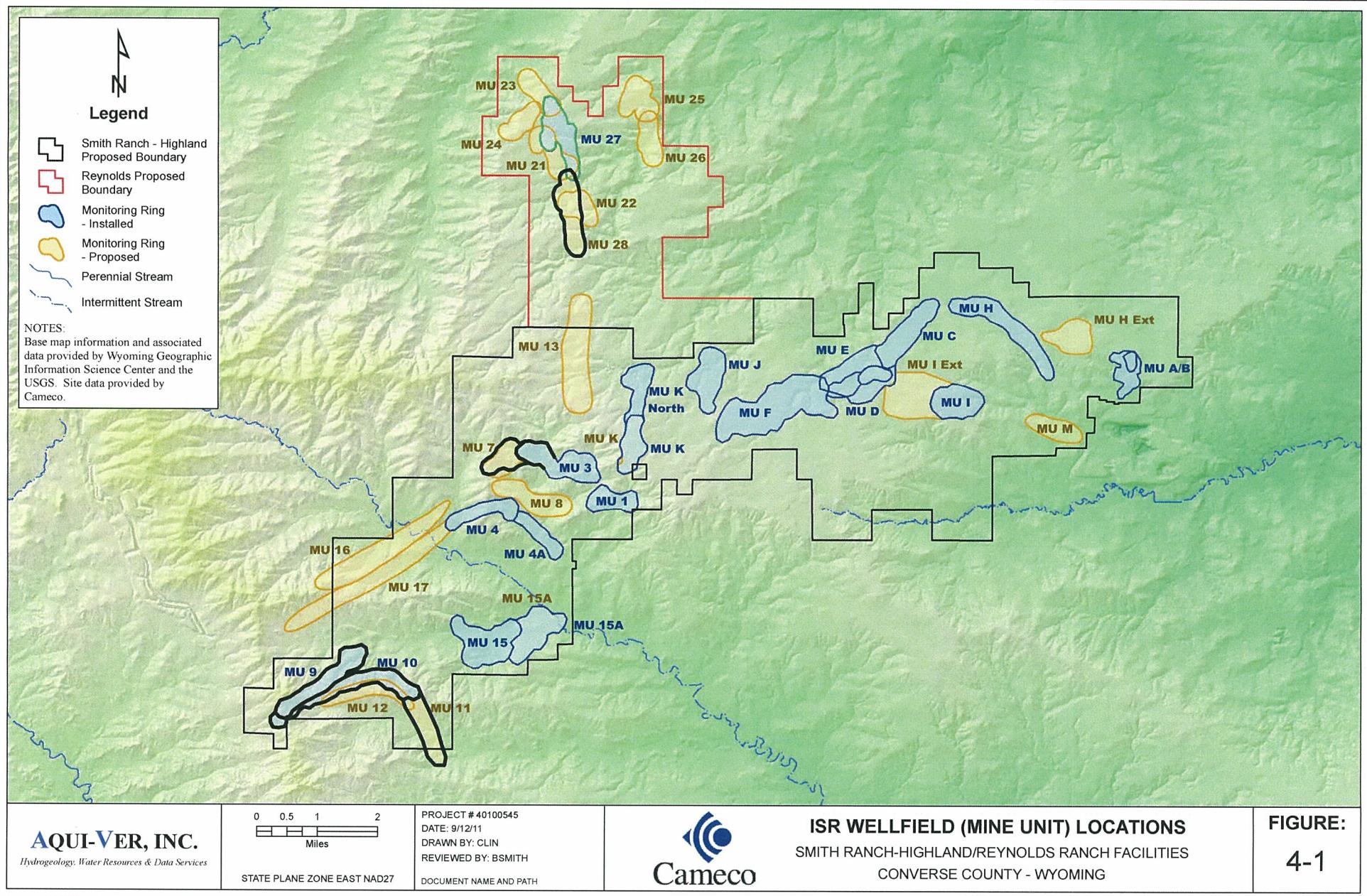
Applicant	Easting (ft)	Northing (ft)	Well ID	Uses	SRH-RR ISR Drawdown (ft)	Max Impact Year	Niobrara Shale Drawdown (ft)	Max Impact Year	Cumulative Drawdown (ft)	Max Impact Year
JOE PATTERSON RANCH	344154	941536	BROOK # 1	DOM_GW; STK	<0.01	33	<0.01	2	<0.01	33
TILLARD 55 LTD	324558	824564	TILLARD NO 11	STK	<0.01	33	<0.01	2	<0.01	33
JOE PATTERSON RANCH CORP.	342818	940218	SPEAR K RANCH #1	DOM_GW; STK	<0.01	33	<0.01	2	<0.01	33
SMITH LAND COMPANY	381175	851695	SMITH #17	STK	<0.01	33	0.09	2	0.09	2
FRED & BEVERLY RUNNION	319324	829507	RUNNION #1	DOM_GW; STK	<0.01	33	0.02	2	0.02	2
DAVID VAN BUSKIRK	315490	842695	VAN BUSKIRK #1	DOM_GW	<0.01	33	<0.01	2	<0.01	33
JOE PATTERSON RANCH CORP.	336265	941538	RED WINDMILL-JANE	STK	<0.01	33	<0.01	2	<0.01	33
FIRST INTERSTATE BANK OF CASPER	318118	838694	SCHOLTZ #2	DOM_GW; IRR_GW; STK	<0.01	33	<0.01	2	<0.01	33
FIRST INTERSTATE BANK OF CASPER	318118	838694	SCHOLTZ #1	IRR_GW	<0.01	33	<0.01	2	<0.01	33
BRADLEY D. ANDERSON	358820	826534	ANDERSON #1	DOM_GW	<0.01	33	<0.01	2	<0.01	33
JOE R. KEENAN	349548	825261	KEENAN #4	DOM_GW; STK	<0.01	33	<0.01	2	<0.01	33
Boner Brothers Partnership	447368	855860	READ WELL #2	STK	<0.01	33	<0.01	2	<0.01	33
Boner Brothers Partnership	447368	855860	READ WELL #1	STK	<0.01	33	<0.01	2	<0.01	33
SMITH LAND COMPANY	387632	862268	SMITH #16	STK	<0.01	33	<0.01	2	<0.01	33
SMITH SHEEP CO.	387632	862268	SMITH 16	STK	<0.01	33	<0.01	2	<0.01	33
JOE PATTERSON RANCH CORP.	325794	940181	KENNY	STK	<0.01	33	<0.01	2	<0.01	33
HENRY J. KEENAN	348225	825273	HENRY KEENAN #1	DOM_GW; STK	<0.01	33	<0.01	2	<0.01	33
HENRY J. KEENAN	348225	825273	HENRY #2	DOM_GW; STK	<0.01	33	<0.01	2	<0.01	33
HENRY J. KEENAN	348225	825273	HENRY KEENAN #3	DOM_GW; STK	<0.01	33	<0.01	2	<0.01	33
A.C. LAYTON	356153	825243	LAYTON #3	STK	<0.01	33	<0.01	2	<0.01	33
JACOB S. NEGLEY	325811	824145	NEGLEY #4	DOM_GW	<0.01	33	<0.01	2	<0.01	33
JACOB S. NEGLEY	325811	824145	NEGLEY #5	DOM_GW	<0.01	33	<0.01	2	<0.01	33
PASTOR ROBT DAVIS	318033	830825	DAVIS #1	DOM_GW	<0.01	33	<0.01	2	<0.01	33
A.C. LAYTON	364037	829156	LAYTON #4	DOM_GW; STK	<0.01	33	<0.01	2	<0.01	33
Jake Johnson, Inc.	452756	871950	JAKE JOHNSON #6	STK	<0.01	33	<0.01	2	<0.01	33
EARL G. DOEGE	358817	825215	LUCK FIVE #2	DOM_GW	<0.01	33	<0.01	2	<0.01	33
ELMER DOEDE	358817	825215	ELRU #1	DOM_GW	<0.01	33	<0.01	2	<0.01	33
J. S. NEGLEY	358817	825215	NEGLEY #6	DOM_GW	<0.01	33	<0.01	2	<0.01	33
EARL G. DOEDE	358817	825215	LUCKY FIVE #1	DOM_GW	<0.01	33	<0.01	2	<0.01	33
ROBERT D. HAUN	358817	825215	KT #1	DOM_GW	<0.01	33	<0.01	2	<0.01	33
GARY GURWELL	316796	836073	GURWELL #1	DOM_GW	<0.01	33	<0.01	2	<0.01	33
SMITH SHEEP CO.	379775	841082	SOUTH TOMMY #1	STK	<0.01	33	<0.01	2	<0.01	33
WM. VALENTINE & SONS INC.	318108	834747	SPENCER PASTURE #16	STK	<0.01	33	<0.01	2	<0.01	33
ULYSSES H. & SHARON A. BERNARD	345528	824016	BERNARD #1	DOM_GW; STK	<0.01	33	<0.01	2	<0.01	33
E.L. EVANOFF	345528	824016	E EVANOFF #1	STK	<0.01	33	<0.01	2	<0.01	33
JACOB S. NEGLEY	325853	826784	NEGLEY #3	DOM_GW	<0.01	33	<0.01	2	<0.01	33
JOSEPH D. DONA	340339	825357	NORTH DONA #1	STK	<0.01	33	<0.01	2	<0.01	33
EUGENE L. EVANOFF	344197	824040	EVANOFF #3	DOM_GW	<0.01	33	<0.01	2	<0.01	33
TILLARD 55 RANCH	327875	829397	TILLARD RANCH 16	STK	<0.01	33	<0.01	2	<0.01	33
Boner Brothers Partnership	439358	835861	EDWARDS #97	STK	<0.01	33	<0.01	2	<0.01	33
GARY & KAREN HUXTABLE	358812	823892	HUXTABLE #1	DOM_GW	<0.01	33	<0.01	2	<0.01	33
J.S. NEGLEY	358812	823892	NEGLEY #2	DOM_GW; STK	<0.01	33	<0.01	2	<0.01	33
MERLE H. DUNHAM	358812	823892	HIGHWAY CORNER #1	DOM_GW	<0.01	33	<0.01	2	<0.01	33
MERLE H. DUNHAM	358812	823892	HIGHWAY CORNER #2	DOM_GW	<0.01	33	<0.01	2	<0.01	33

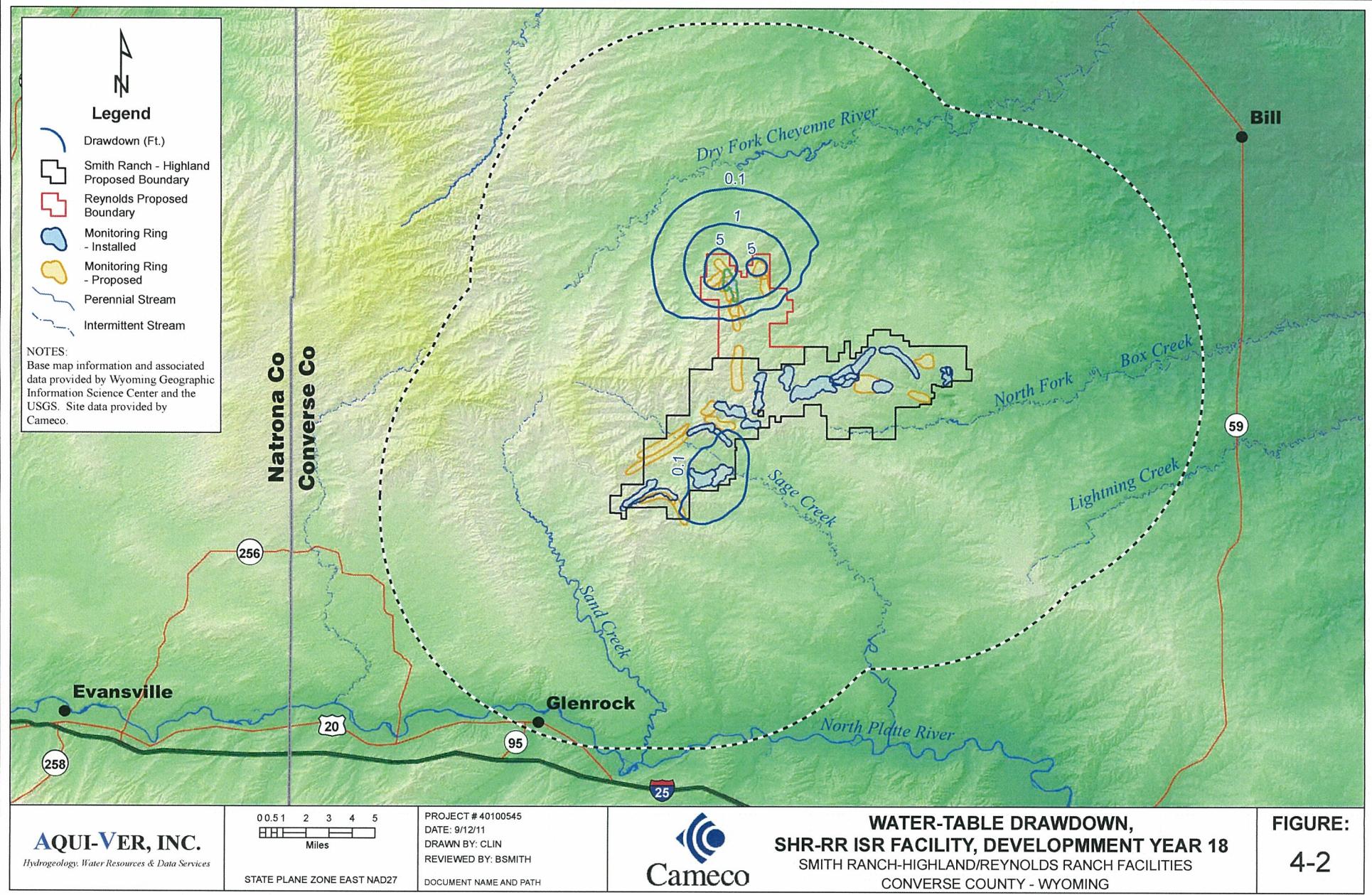
Table 4-1. Hydrologic Impact Assessment Summary (Cont'd)

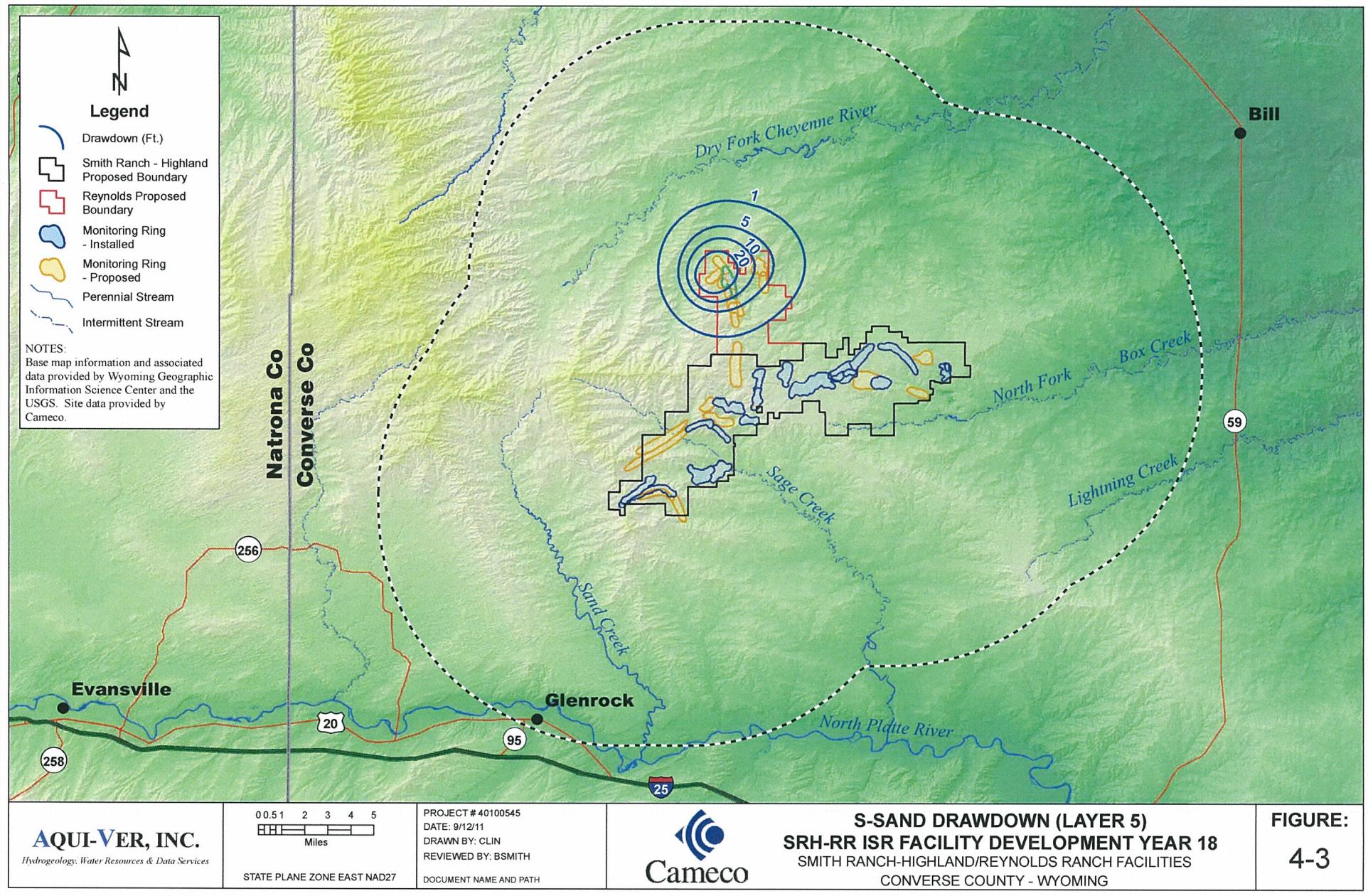
Applicant	Easting (ft)	Northing (ft)	Well ID	Uses	SRH-RR ISR Drawdown (ft)	Max Impact Year	Niobrara Shale Drawdown (ft)	Max Impact Year	Cumulative Drawdown (ft)	Max Impact Year
AUBREY MANNING INC.	354786	945506	MANNING #12 B C	STK	<0.01	33	<0.01	2	<0.01	33
SMITH LAND COMPANY	369274	830499	SMITH #9	STK	<0.01	33	<0.01	2	<0.01	33
HILDEBRAND INC.	348170	822657	HILDEBRAND #2	STK	<0.01	33	<0.01	2	<0.01	33
SMITH SHEEP CO.	364029	826502	SMITH #4	STK	<0.01	33	<0.01	2	<0.01	33
GARY SHIDELER	315449	833463	SHIDELER #1	DOM_GW	<0.01	33	<0.01	2	<0.01	33
MARY L MANES	315449	833463	MARY #1	DOM_GW	<0.01	33	<0.01	2	<0.01	33
SMITH SHEEP CO.	334945	818792	SMITH #6	DOM_GW; STK	<0.01	33	<0.01	2	<0.01	33
J & J DEVELOPMENT COMPANY INC.	312845	836127	J & J #1-A 15	DOM_GW	<0.01	33	<0.01	2	<0.01	33
Hardy Enterprises, LP	383741	946805	SKY #1	STK	<0.01	33	<0.01	2	<0.01	33
USDA - National Forest Service	385074	948110	HARDY #T.B. 139	STK	<0.01	33	<0.01	2	<0.01	33
USDA, NATIONAL FOREST SERVICE	391747	949392	HARDY #T.B. 267	STK	<0.01	33	<0.01	2	<0.01	33
Boner Brothers Partnership	455372	863882	ANDERSON #1	STK	<0.01	33	<0.01	2	<0.01	33
SMITH LAND COMPANY	379739	835769	SMITH #10	STK	<0.01	33	<0.01	2	<0.01	33
USDA - National Forest Service	370528	953427	MANNING #T B 138	STK	<0.01	33	<0.01	2	<0.01	33
Canon Land & Livestock Ltd.	415784	862520	MONUMENT #68	STK	<0.01	33	<0.01	2	<0.01	33
JOE PATTERSON RANCH CORP.	333648	946820	ELEC. WELL-RICK	STK	<0.01	33	<0.01	2	<0.01	33
SMITH SHEEP COMPANY	389019	843725	EAST SHEARING PENS #1	STK	<0.01	33	<0.01	2	<0.01	33
JAMES W. STROCK	413983	841155	STROCK #1	STK	<0.01	33	<0.01	2	<0.01	33
Canon Land & Livestock Ltd.	415477	857029	EAST JENKINS #13	STK	<0.01	33	<0.01	2	<0.01	33
JOE PATTERSON RANCH CORP.	342863	948131	TIN CAKE HOUSE	STK	<0.01	33	<0.01	2	<0.01	33
AUBREY MANNING INC.	365245	949475	MANNING #11 B C	STK	<0.01	33	<0.01	2	<0.01	33
HILDEBRAND INC.	352122	818672	HILDEBRAND #1	DOM_GW; STK	<0.01	33	<0.01	2	<0.01	33
ROBERT W. MANNING	357448	946856	MANNING B C 17	DOM_GW; STK	<0.01	33	<0.01	2	<0.01	33
AUBREY MANNING INC.	357462	948168	MANNING 1 B C	DOM_GW; STK	<0.01	33	<0.01	2	<0.01	33
SMITH LAND COMPANY	395554	839732	SMITH #14	STK	<0.01	33	<0.01	2	<0.01	33
SMITH LAND COMPANY	388985	835739	SMITH #13	STK	<0.01	33	<0.01	2	<0.01	33
WARREN A. MANNING	407666	919339	MANNING #7	STK	<0.01	33	<0.01	2	<0.01	33
SMITH SHEEP CO.	363970	819888	SMITH #45 (DEEPPENED)	STK	<0.01	33	<0.01	2	<0.01	33
SMITH LAND COMPANY	390273	833076	SMITH #38	DOM_GW; STK	<0.01	33	<0.01	2	<0.01	33
Harold Carlson	387771	952047	CARSON (PHILLIPS) #1	STK	<0.01	33	<0.01	2	<0.01	33
Boner Brothers Partnership	428630	866444	BULL PASTURE	DOM_GW	<0.01	33	<0.01	2	<0.01	33
ROBERT W. MANNING	375819	953426	MANNING B C 18	STK	<0.01	33	<0.01	2	<0.01	33
James W. & Catherine M. Strock	406045	839835	DUGAN #1	STK	<0.01	33	<0.01	2	<0.01	33
ROY A/SHIRLEY A STROCK	412662	834513	STROCK #1	STK	<0.01	33	<0.01	2	<0.01	33
James W. & Catherine M. Strock	412662	834513	DEIL #1	STK	<0.01	33	<0.01	2	<0.01	33
SMITH SHEEP CO.	387666	830461	HILL TOP #1	DOM_GW	<0.01	33	<0.01	2	<0.01	33
Boner Brothers Partnership	431232	867814	BOX CREEK #3	STK	<0.01	33	<0.01	2	<0.01	33
EDWARD D. MOORE	373183	819947	ED MOORE, SPRING PASTURE WELL #1	STK	<0.01	33	<0.01	2	<0.01	33
Roy A Strock	406072	837163	Strock #2	STK	<0.01	33	<0.01	2	<0.01	33
JOE PATTERSON RANCH CORP.	350834	950733	MAIL BOX	STK	<0.01	33	<0.01	2	<0.01	33
L. JOE WHITING	363901	811950	PACIFIC POWER & LIGHT #4	STK	<0.01	33	<0.01	2	<0.01	33
Roy C. & Ferol Baker	360132	953428	BAKER #12	STK	<0.01	33	<0.01	2	<0.01	33
James W. & Catherine M. Strock	407399	837161	DUGAN #2	STK	<0.01	33	<0.01	2	<0.01	33
L. RAYMOND ALLEMAND	344239	956038	CONOCO 30-4-38-74	STK	<0.01	33	<0.01	2	<0.01	33
James W. & Catherine M. Strock	416623	830558	FLEMING #1	STK	<0.01	33	<0.01	2	<0.01	33

Table 4-1. Hydrologic Impact Assessment Summary (Cont'd)

Applicant	Easting (ft)	Northing (ft)	Well ID	Uses	SRH-RR ISR Drawdown (ft)	Max Impact Year	Niobrara Shale Drawdown (ft)	Max Impact Year	Cumulative Drawdown (ft)	Max Impact Year
HARDY RANCH COMPANY	364009	956032	HARDY #13	STK	<0.01	2	<0.01	2	<0.01	2
MART MADSEN SHEEP COMPANY	430453	924928	SCOTT/MEEKER	STK	<0.01	31	<0.01	2	<0.01	31
MEISNER INC.	464696	866698	PAXTON #1 NW	STK	<0.01	33	<0.01	2	<0.01	33
James W. & Catherine M. Strock	407431	834490	CLARK DUGAN #1	STK	<0.01	33	<0.01	2	<0.01	33
FRED AND BETTY LUND	436678	887912	LUND #2	STK	<0.01	33	<0.01	2	<0.01	33
MICHAEL R. & THOMAS J. BOLAND	435392	879938	BOLAND #1	STK	<0.01	33	<0.01	2	<0.01	33
SMITH SHEEP COMPANY	394195	817251	LAKE PASTURE #1	STK	<0.01	8	<0.01	2	<0.01	8
WARREN A. MANNING	423717	918349	MANNING #8	STK	<0.01	33	<0.01	2	<0.01	33
Bone Brothers Partnership	437254	899956	BALLARD #8 #37-8	STK	<0.01	33	<0.01	2	<0.01	33
MART MADSEN SHEEP COMPANY	419677	927420	MADSEN #1	STK	<0.01	33	<0.01	2	<0.01	33
Canon Land & Livestock Ltd.	443470	894648	BALLARD #4, #37-4	STK	<0.01	33	<0.01	2	<0.01	33
Bone Brothers Partnership	442690	903911	BALLARD #7 #37-7	STK	<0.01	33	<0.01	2	<0.01	33
SMITH SHEEP CO.	398232	815902	SMITH #3	STK	<0.01	1	<0.01	2	<0.01	1
MART MADSEN SHEEP COMPANY	438625	921000	MADSEN #9	STK	<0.01	33	<0.01	2	<0.01	33
USDA - National Forest Service	437179	930207	MORTON #T B 113	STK	<0.01	33	<0.01	2	<0.01	33
Jake Johnson, Inc.	464772	877391	JAKE JOHNSON #4	STK	<0.01	6	<0.01	2	<0.01	6
Canon Land & Livestock Ltd.	461957	890800	SOUTHEAST BALLARD, #37-3	STK	<0.01	33	<0.01	2	<0.01	33
Canon Land & Livestock Ltd.	459398	894824	BALLARD HOUSE #37-1	STK	<0.01	33	<0.01	2	<0.01	33
Canon Land & Livestock Ltd.	453100	889494	BALLARD #5, #37-5	STK	<0.01	33	<0.01	2	<0.01	33
Canon Land & Livestock Ltd.	449083	889408	BALLARD #6, #37-6	STK	<0.01	33	<0.01	2	<0.01	33
Jake Johnson, Inc.	461999	885406	JAKE JOHNSON #7	STK	<0.01	33	<0.01	2	<0.01	33
Canon Land & Livestock Ltd.	456082	905345	BALLARD #9, #37-9	STK	<0.01	33	<0.01	2	<0.01	33
MART MADSEN SHEEP COMPANY	456057	910619	MADSEN #6	STK	<0.01	33	<0.01	2	<0.01	33
SMITH SHEEP CO.	404775	817233	SMITH #52	STK	<0.01	33	<0.01	2	<0.01	33
James W. & Catherine M. Strock	411378	823894	LYNCH #1	STK	<0.01	33	<0.01	2	<0.01	33







## 5. REFERENCES

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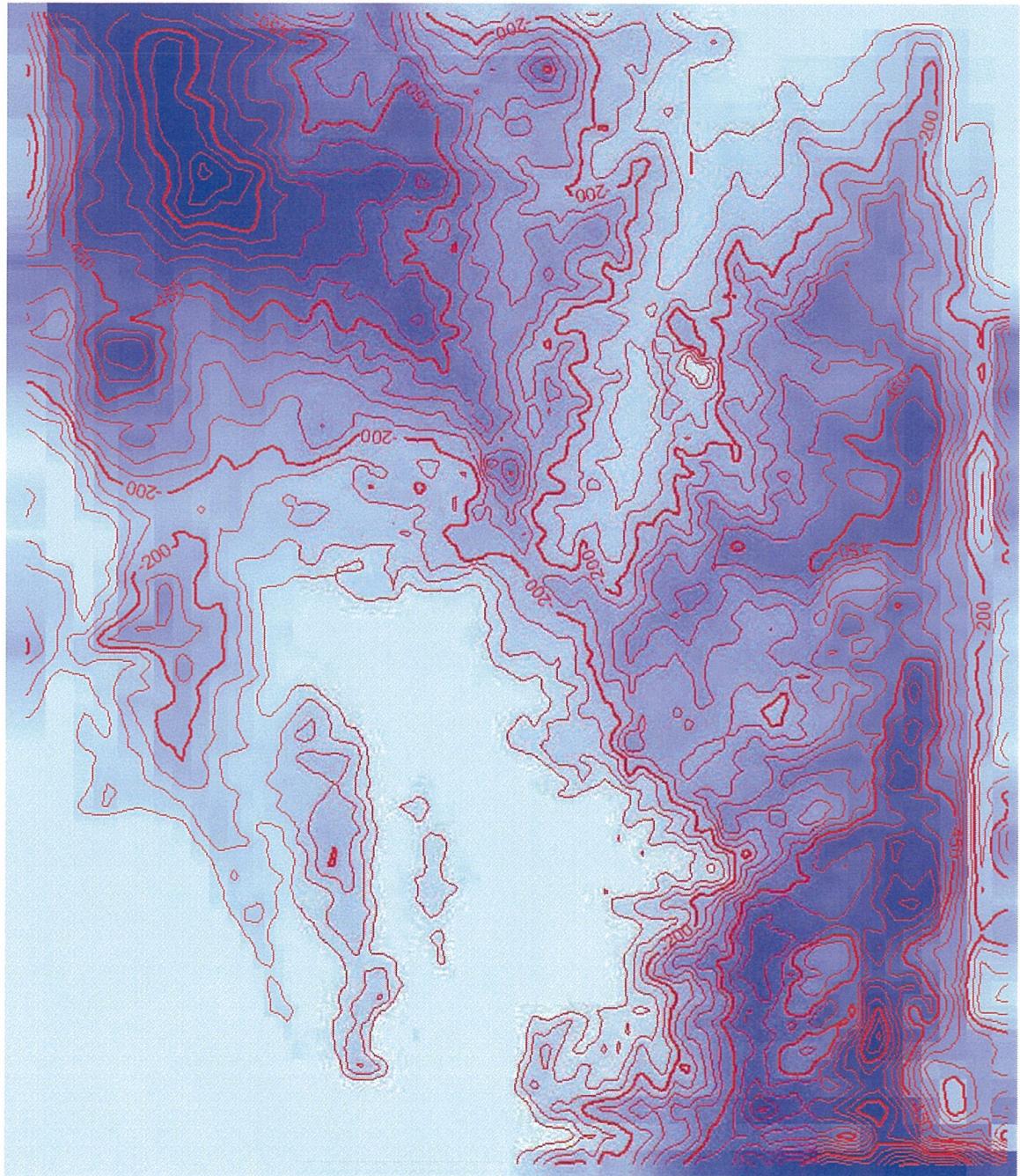
WyoFile (2011). Water for Oil, Wyoming Farmers Earn Cash Diverting Irrigation Water to Oil Rigs, [www.wyofile.com](http://www.wyofile.com), Wyoming On-line Newspaper, November 2010.

**AQUI-VER, INC.**

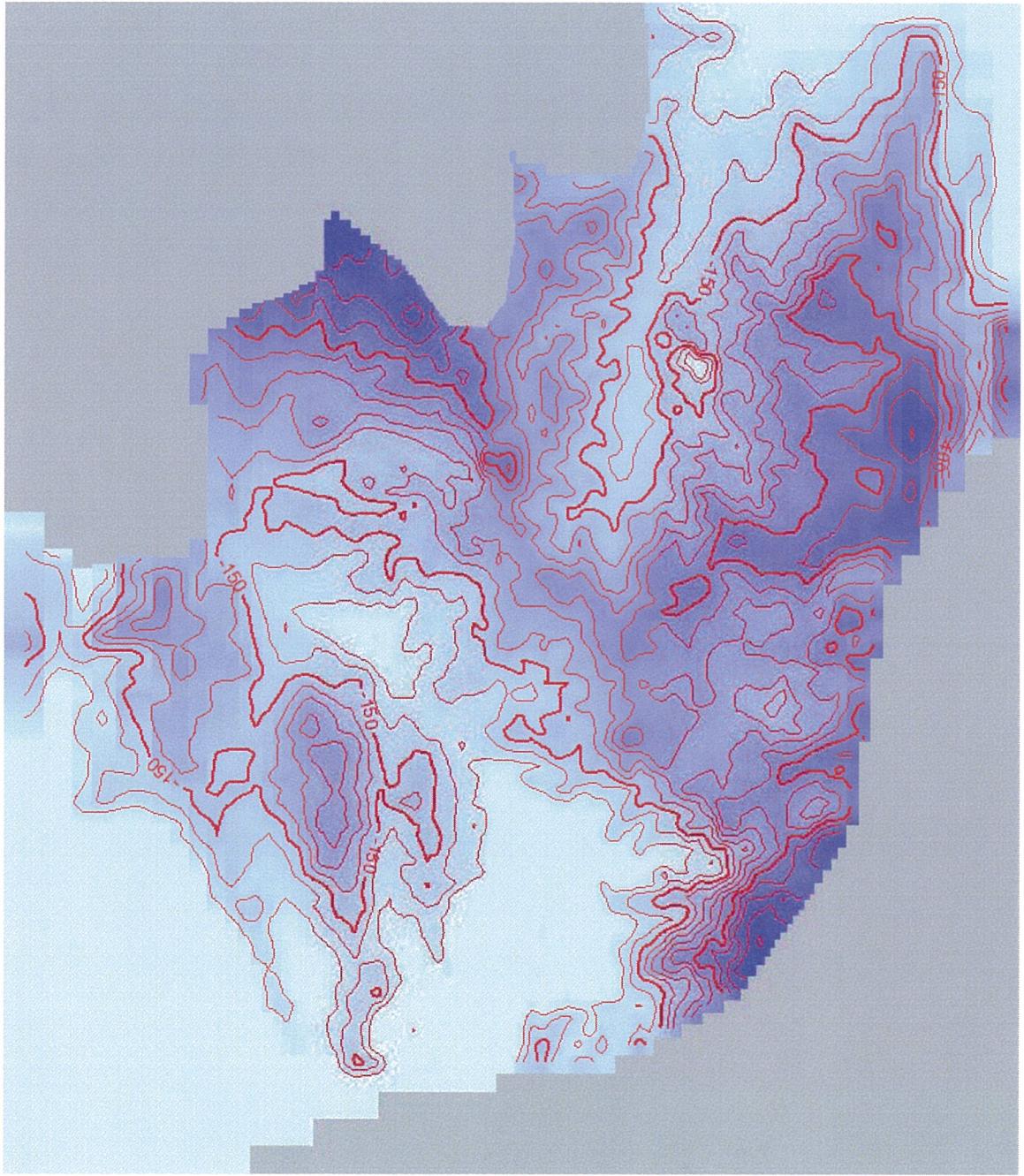


**ATTACHMENT A**  
**GROUNDWATER MODEL DESIGN INFORMATION**

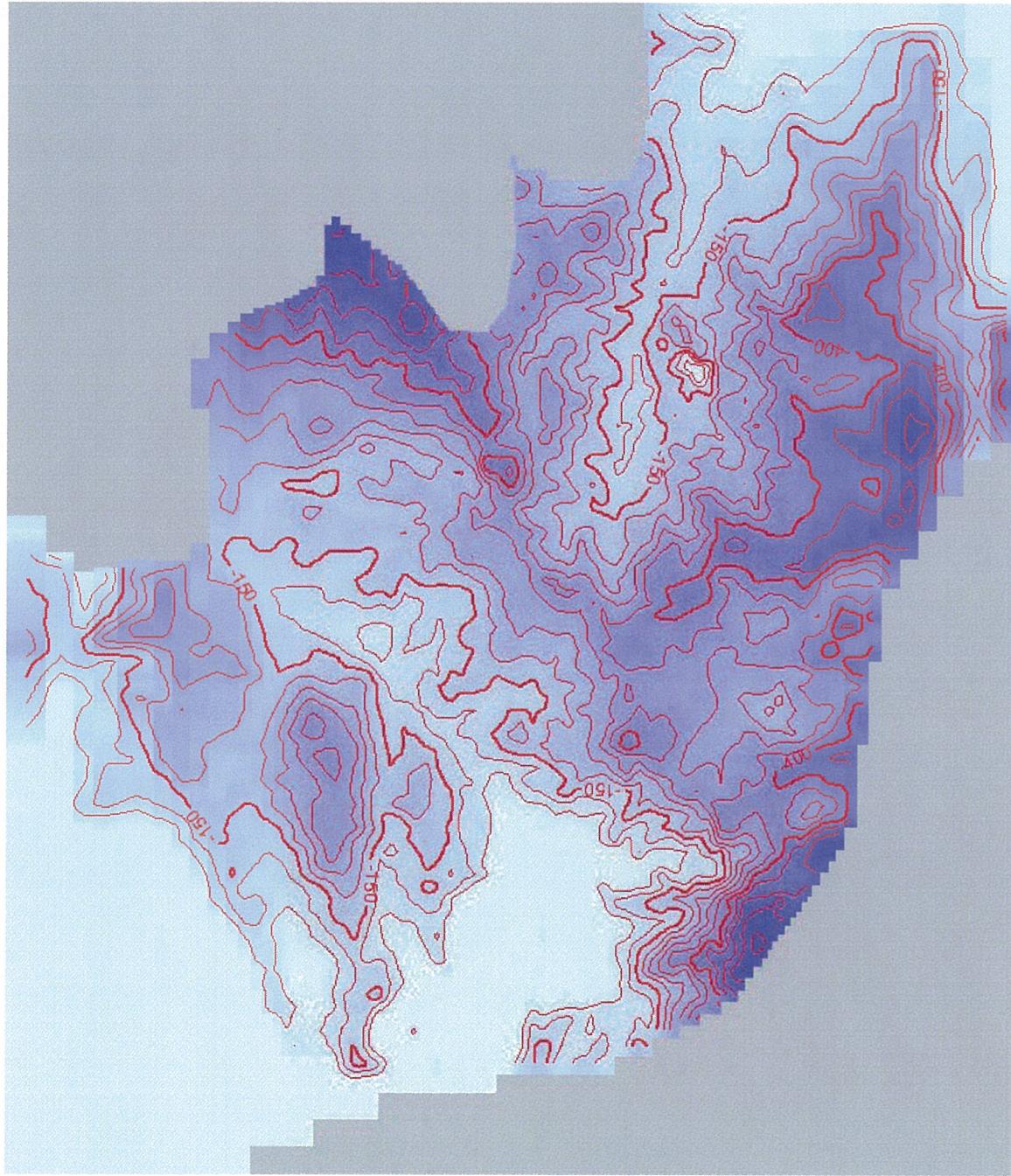
Bottom Elevation of Layer 1



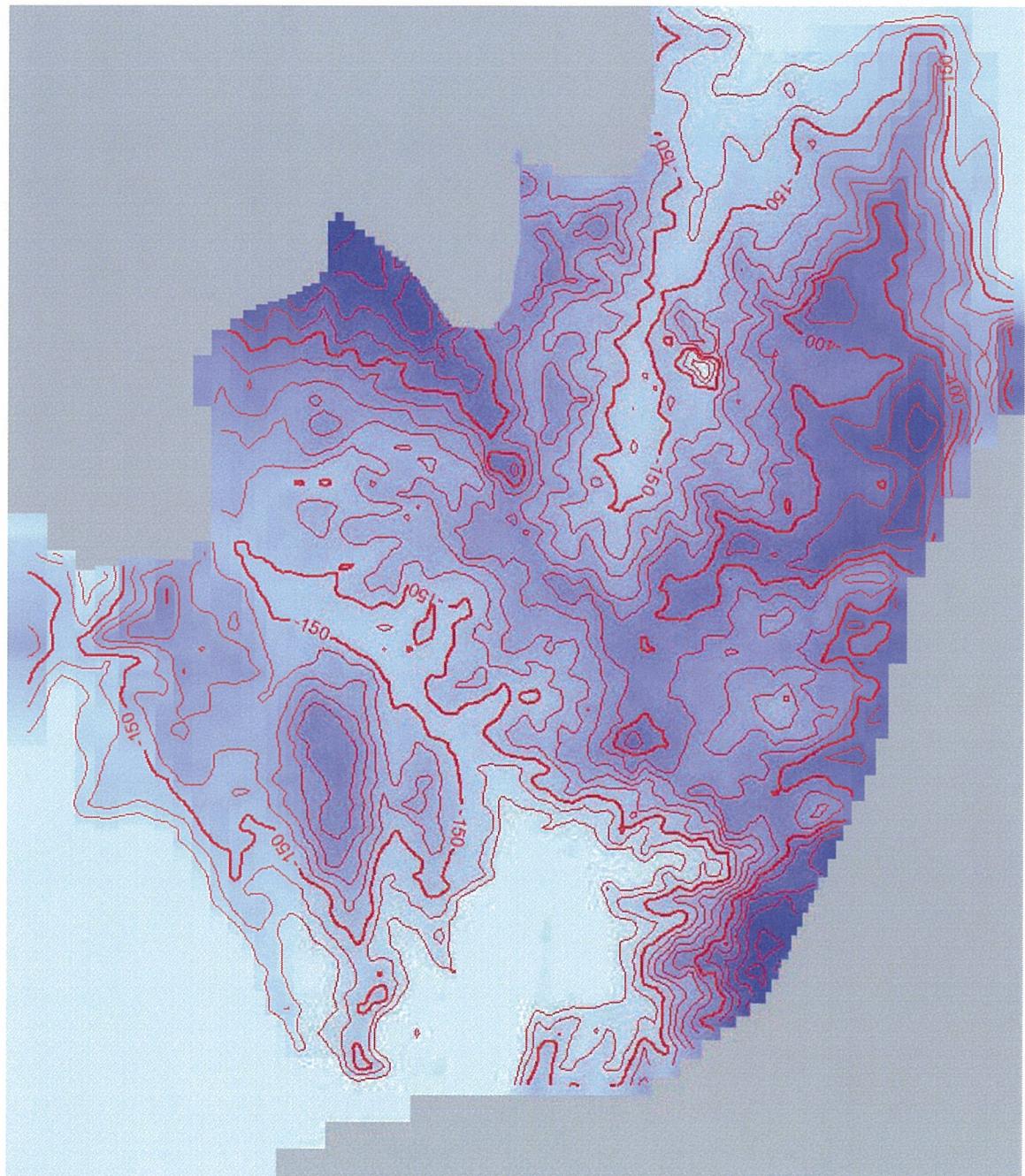
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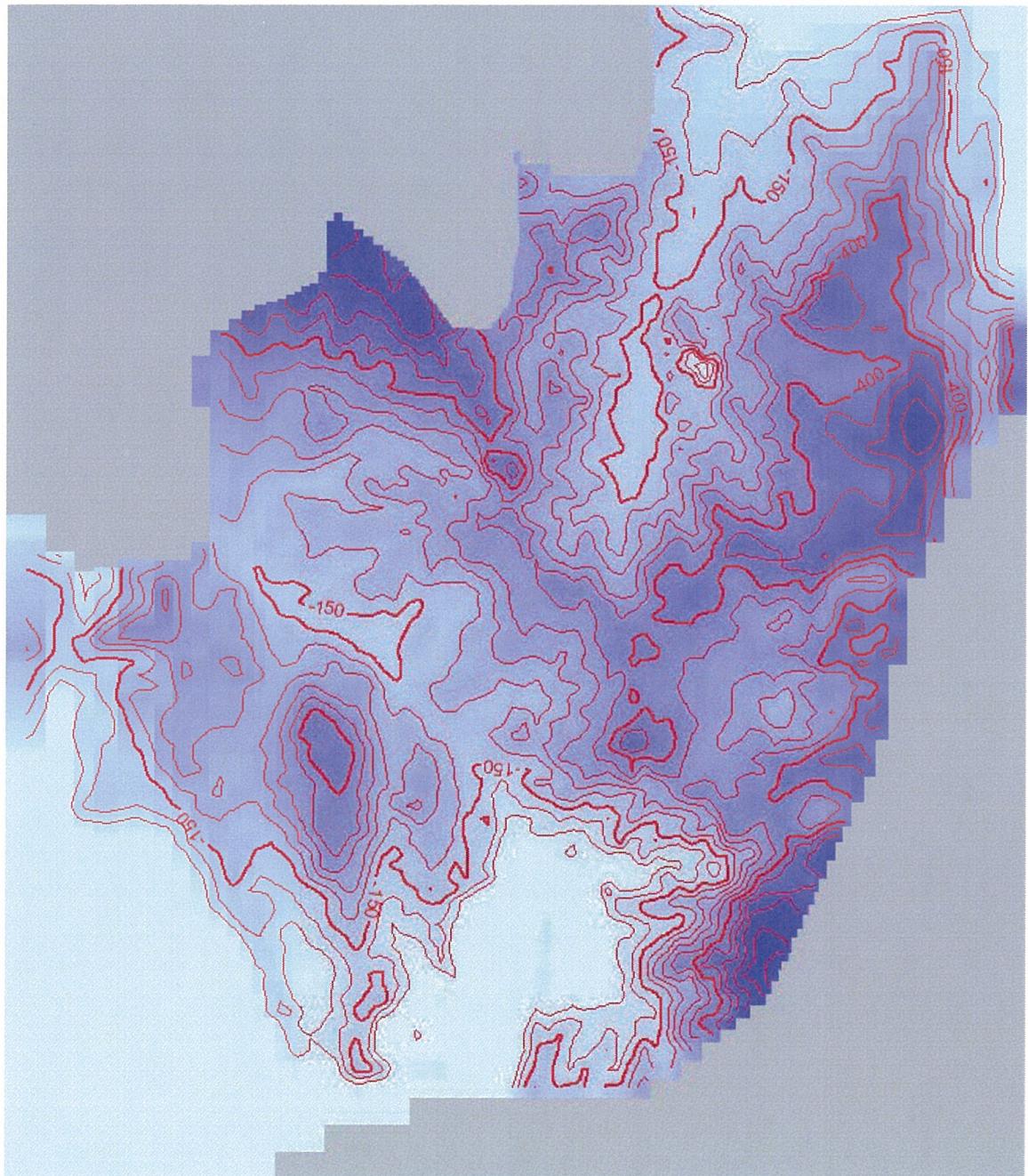
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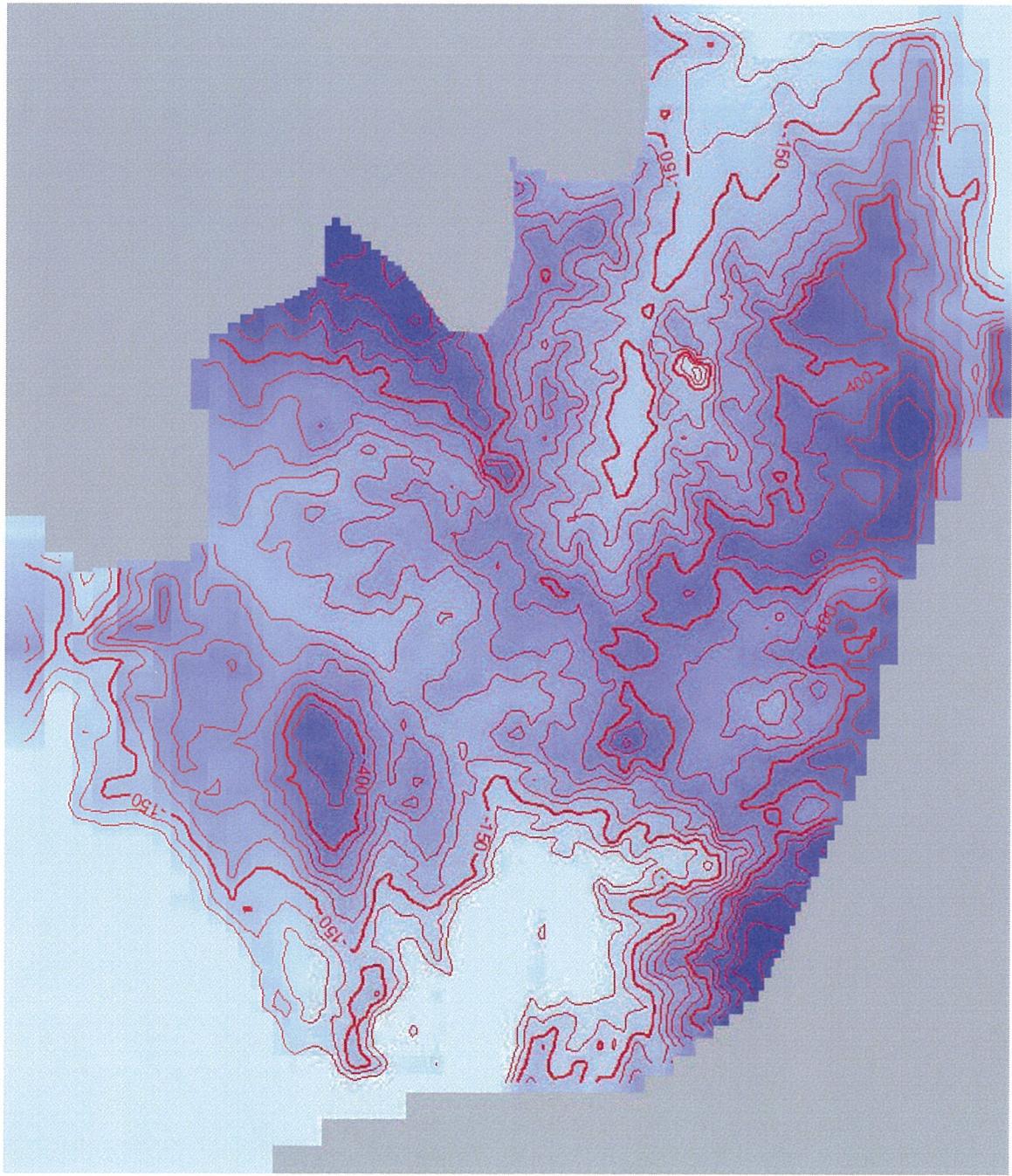
Bottom Elevation of Layer 4



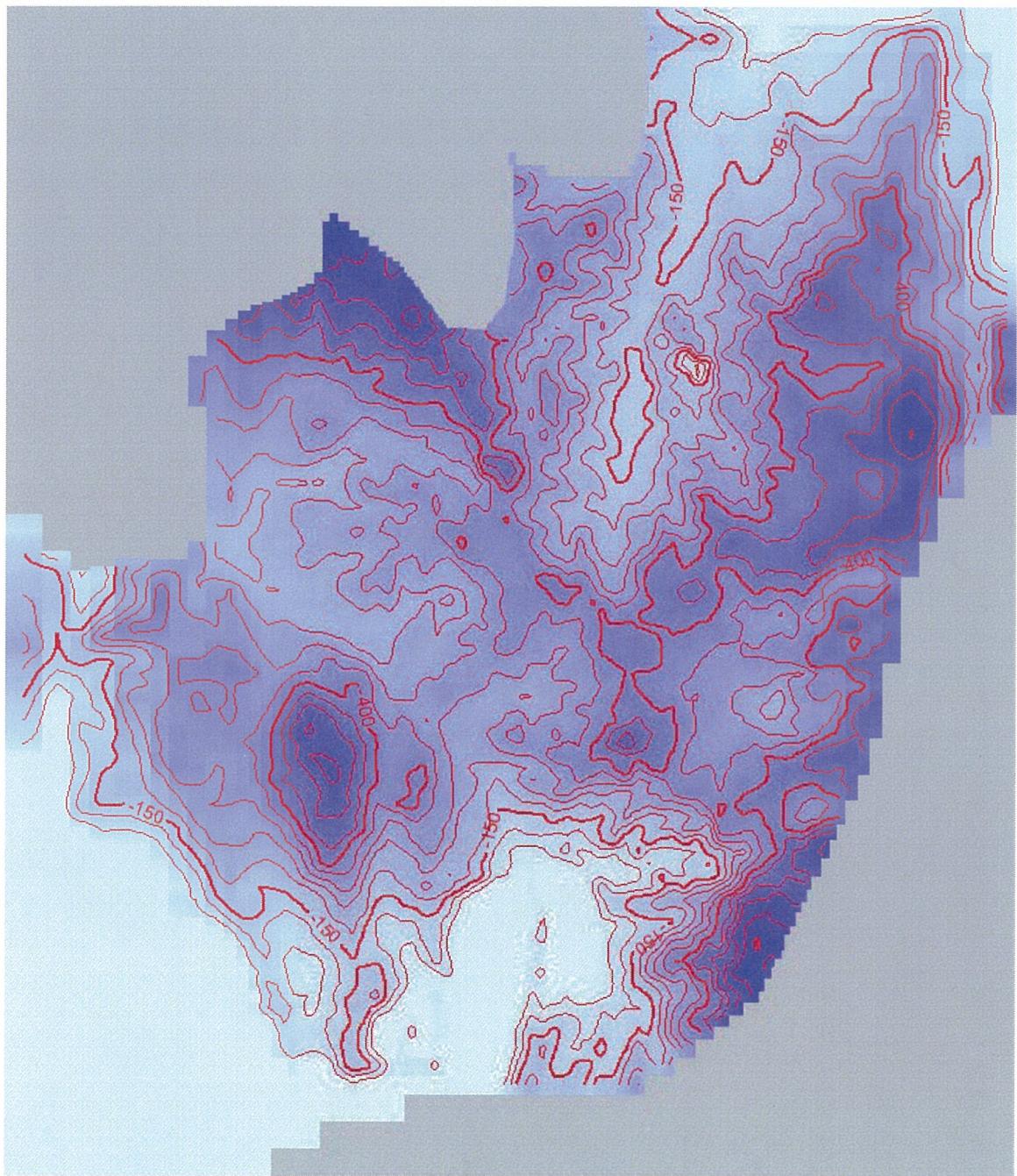
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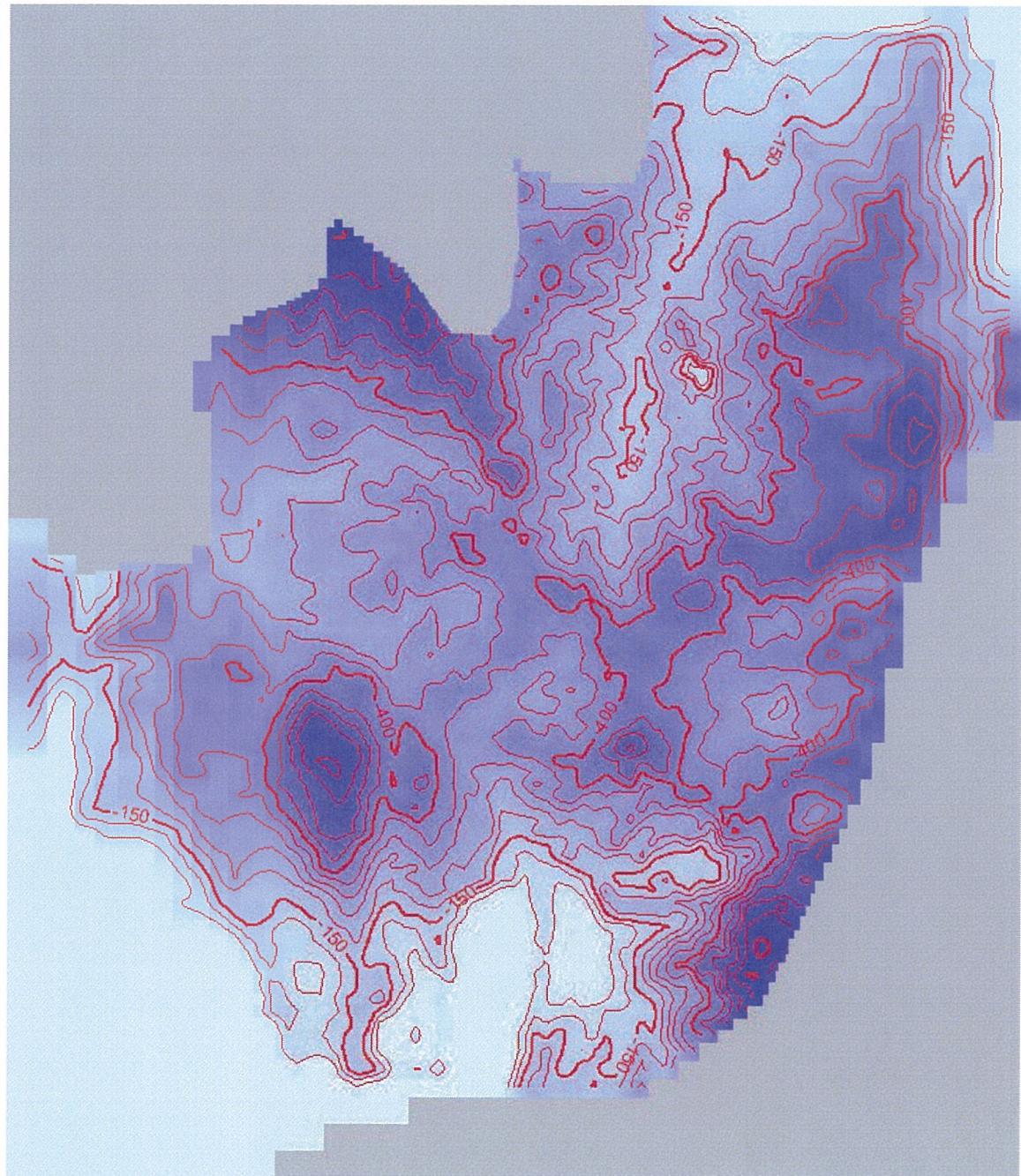
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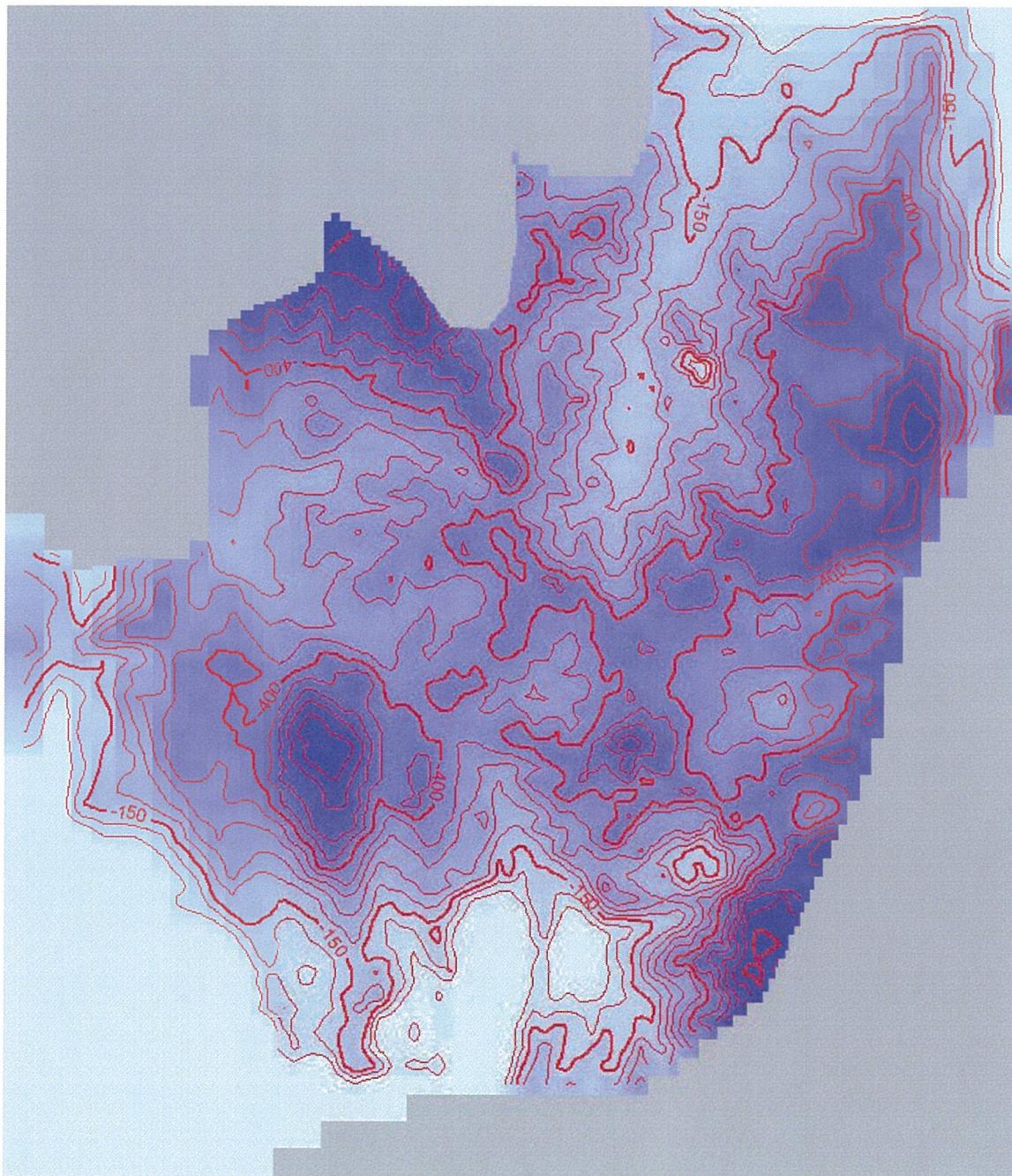
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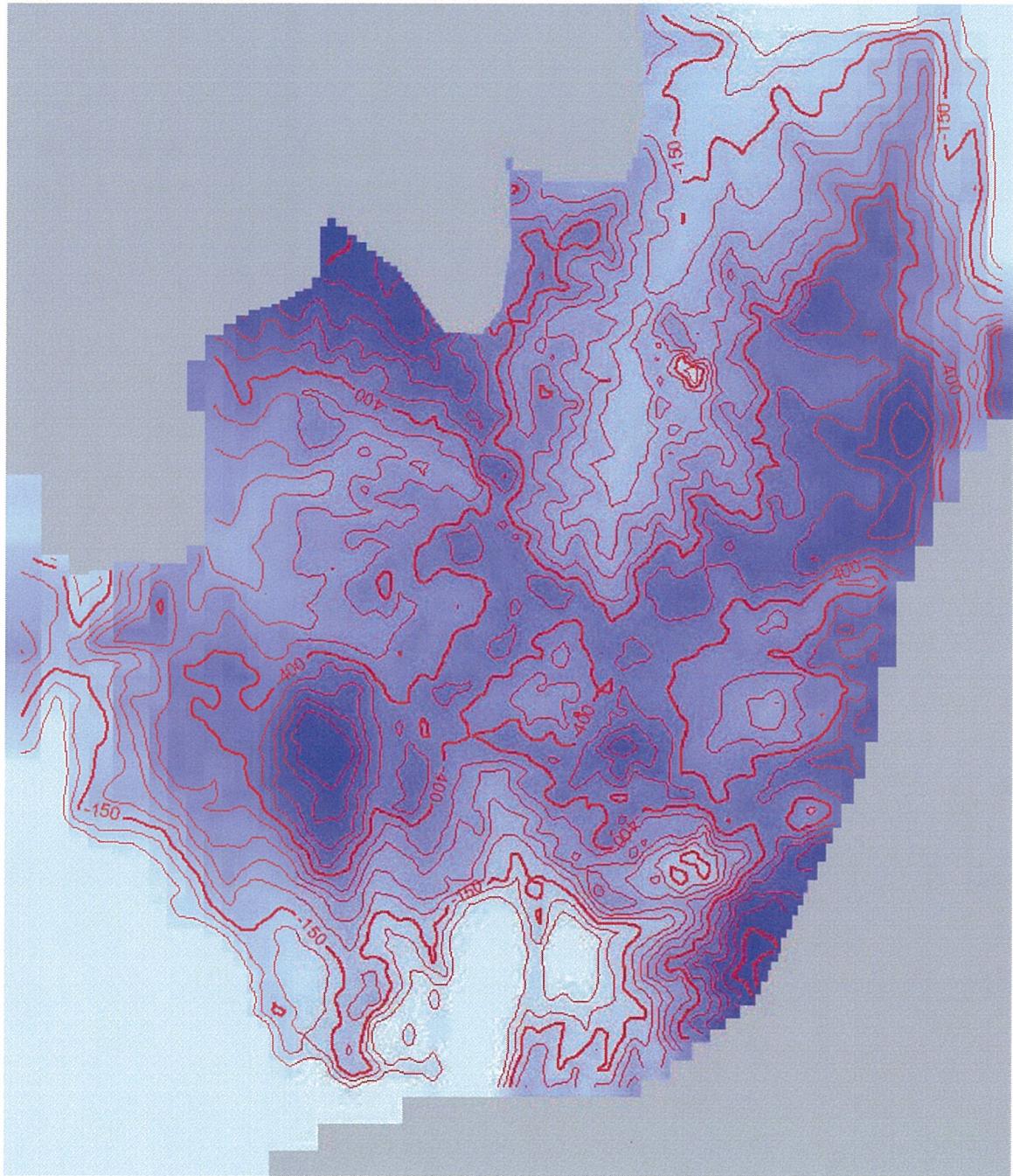
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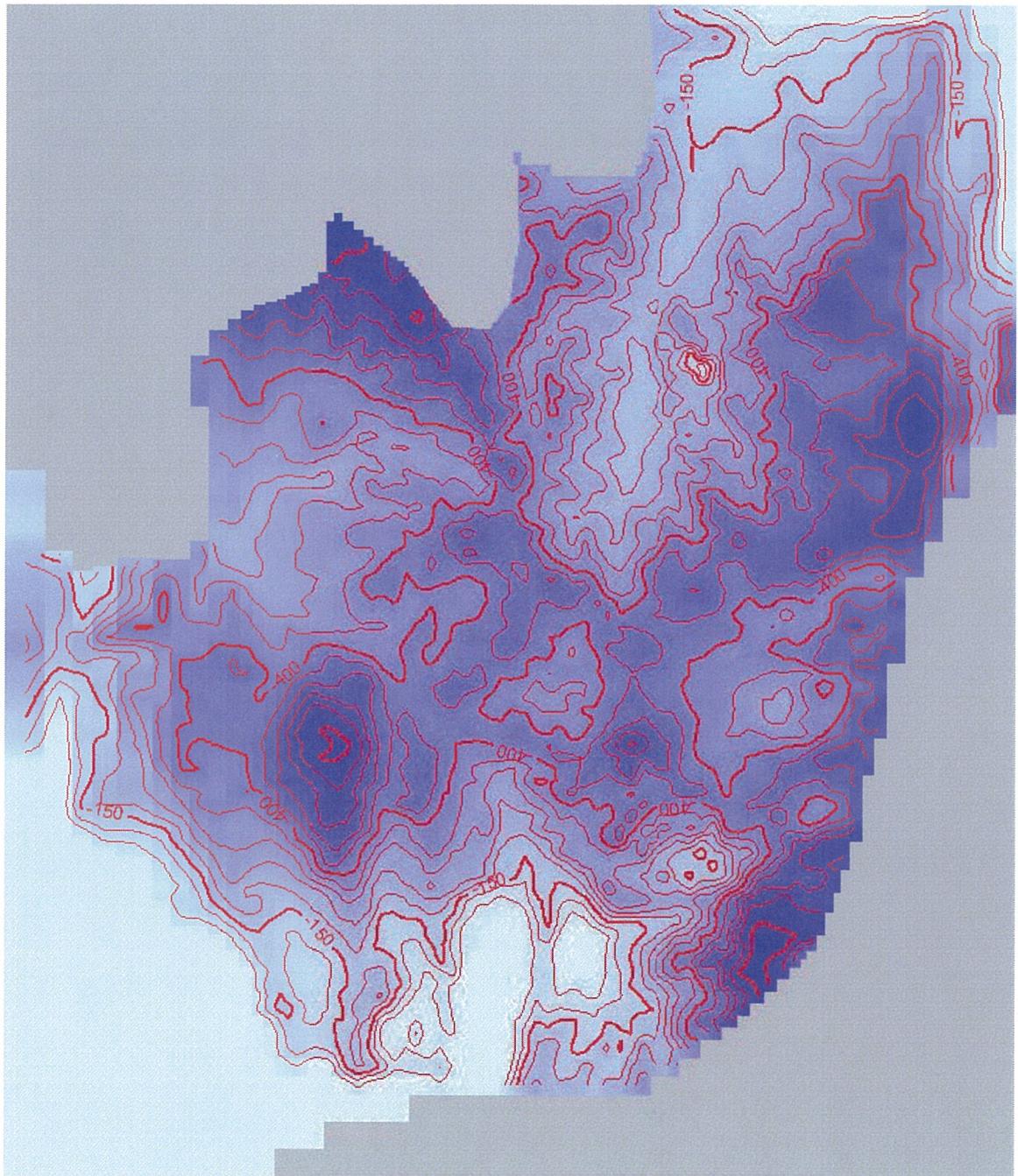
Bottom Elevation of Layer 9



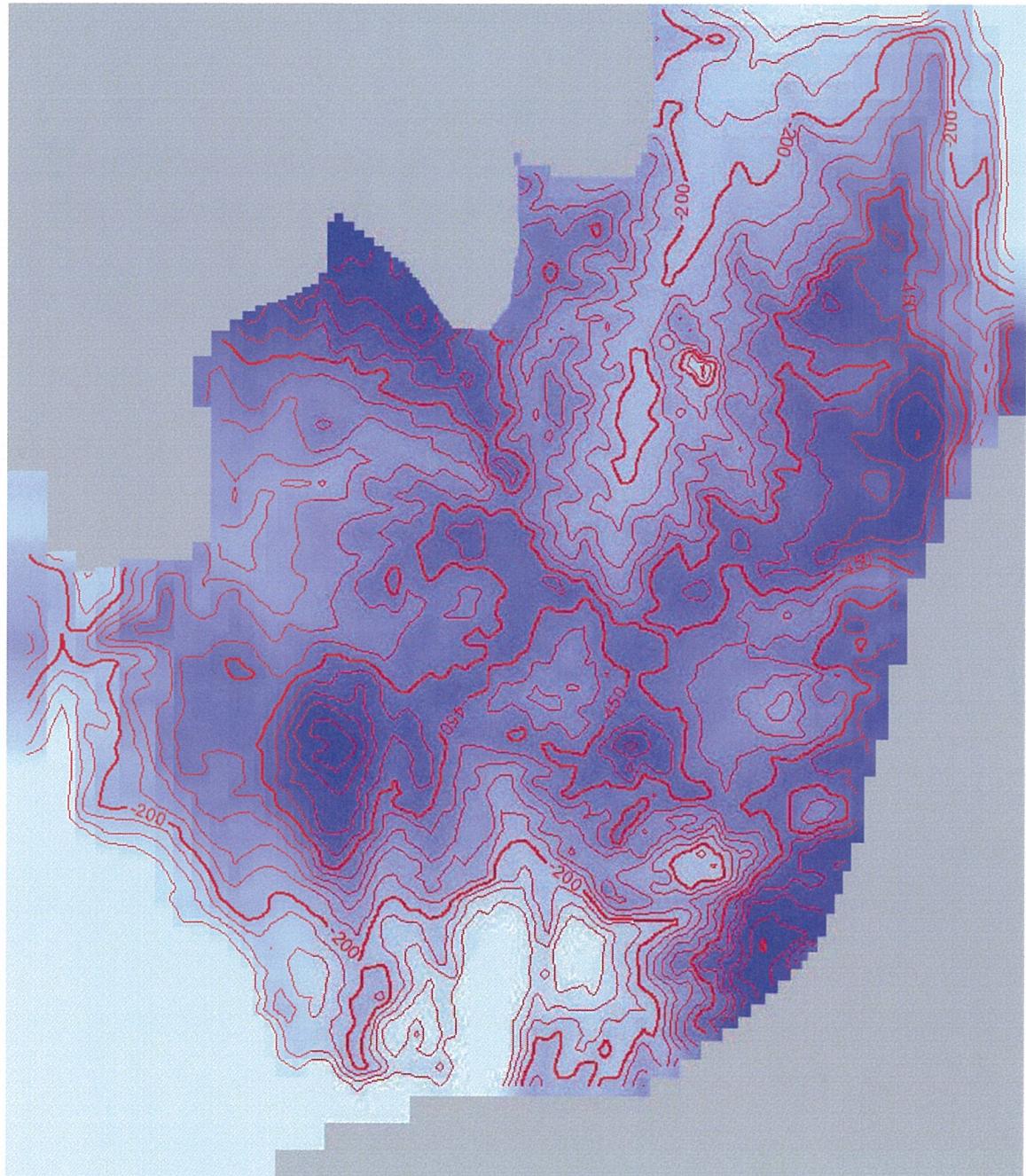
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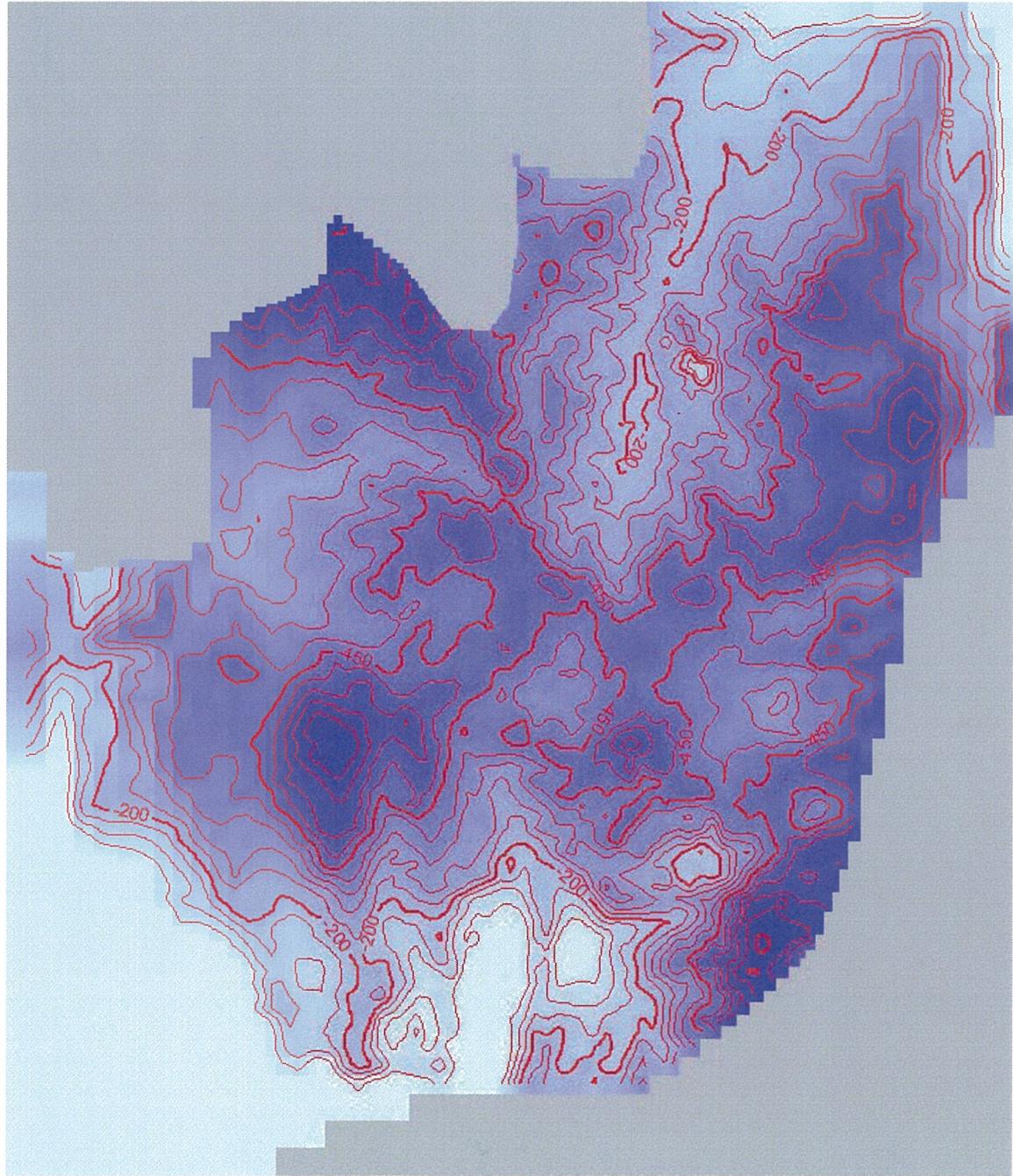
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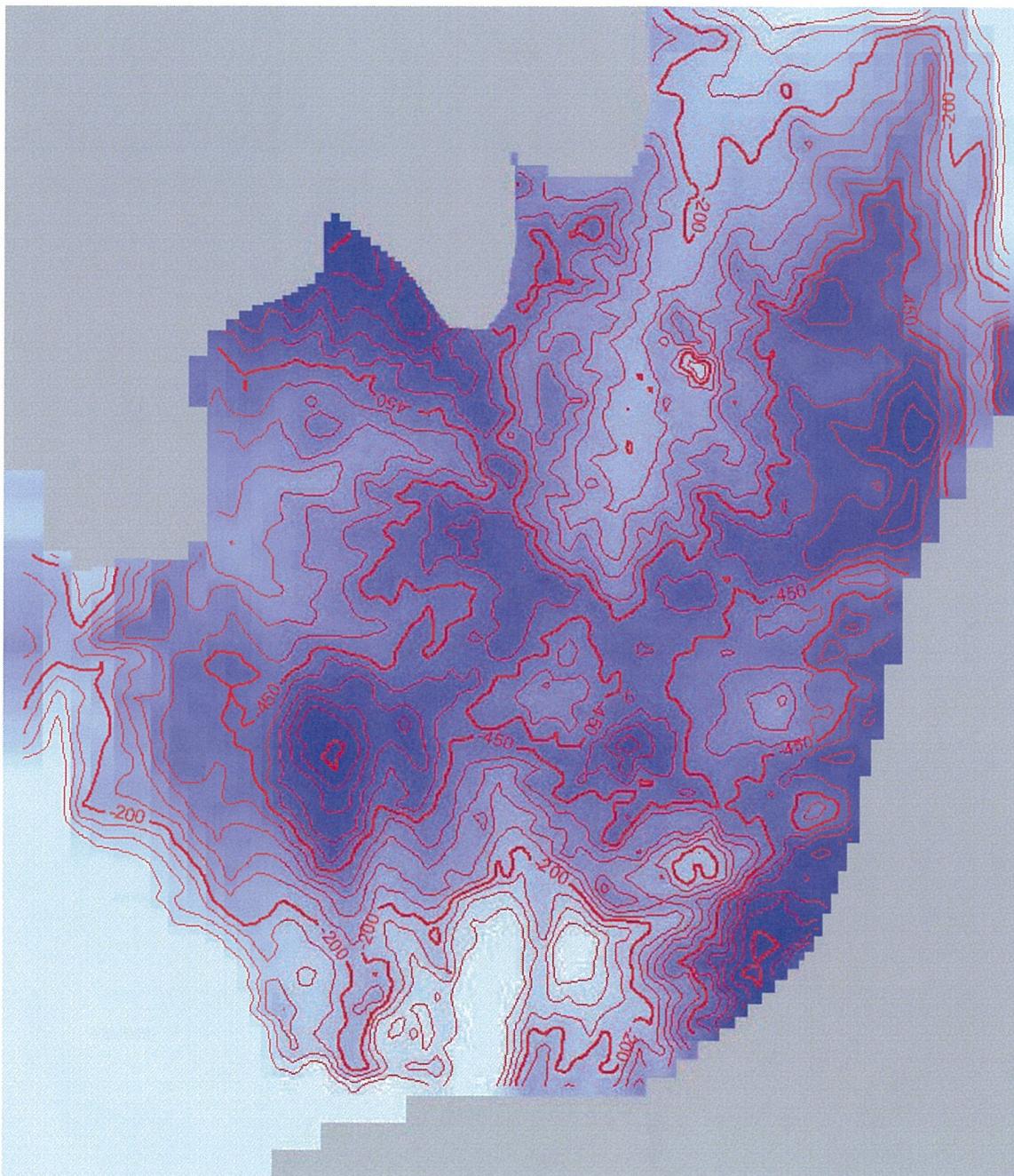
Bottom Elevation of Layer 12



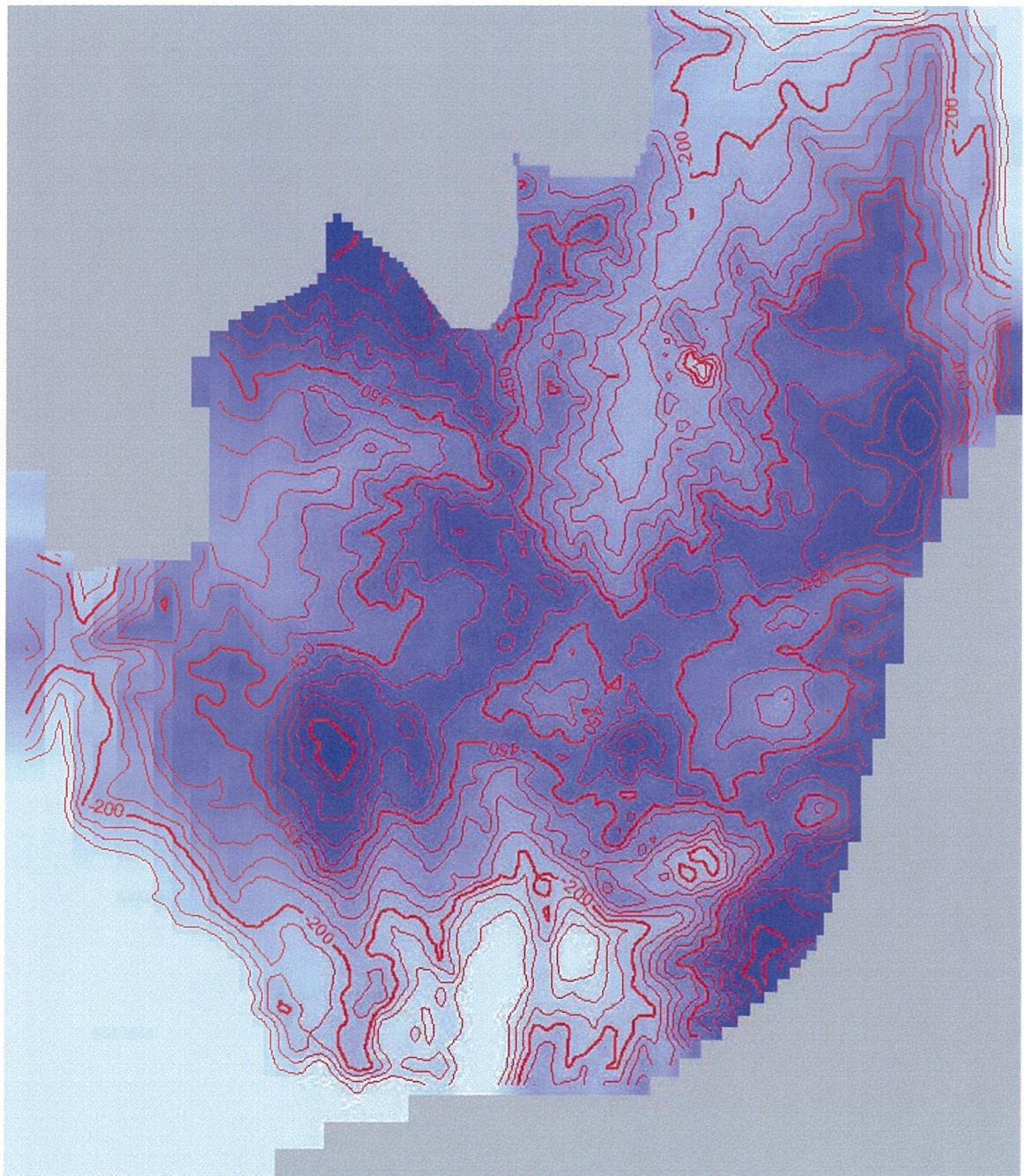
Bottom Elevation of Layer 13



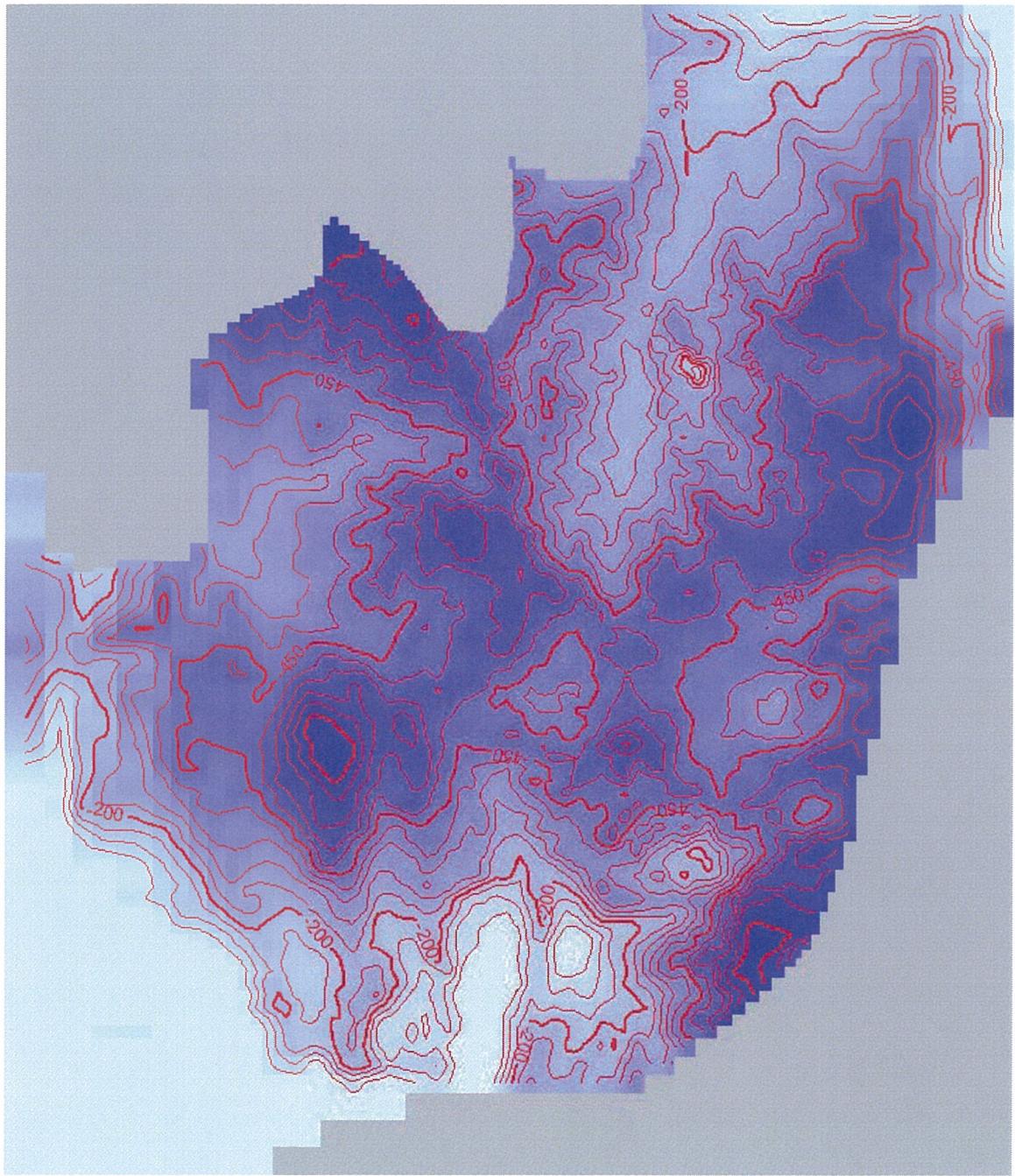
Bottom Elevation of Layer 14



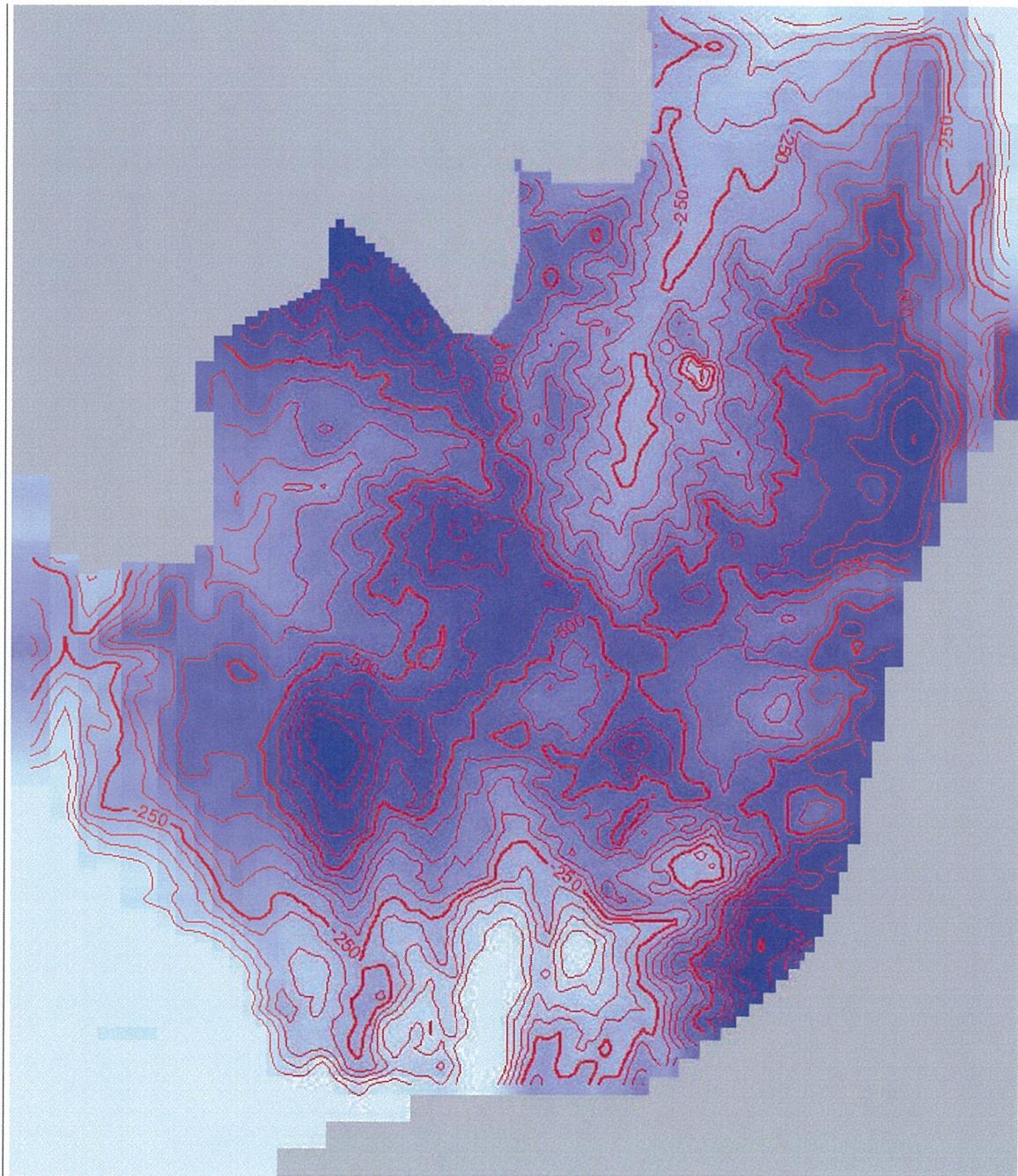
Bottom Elevation of Layer 15



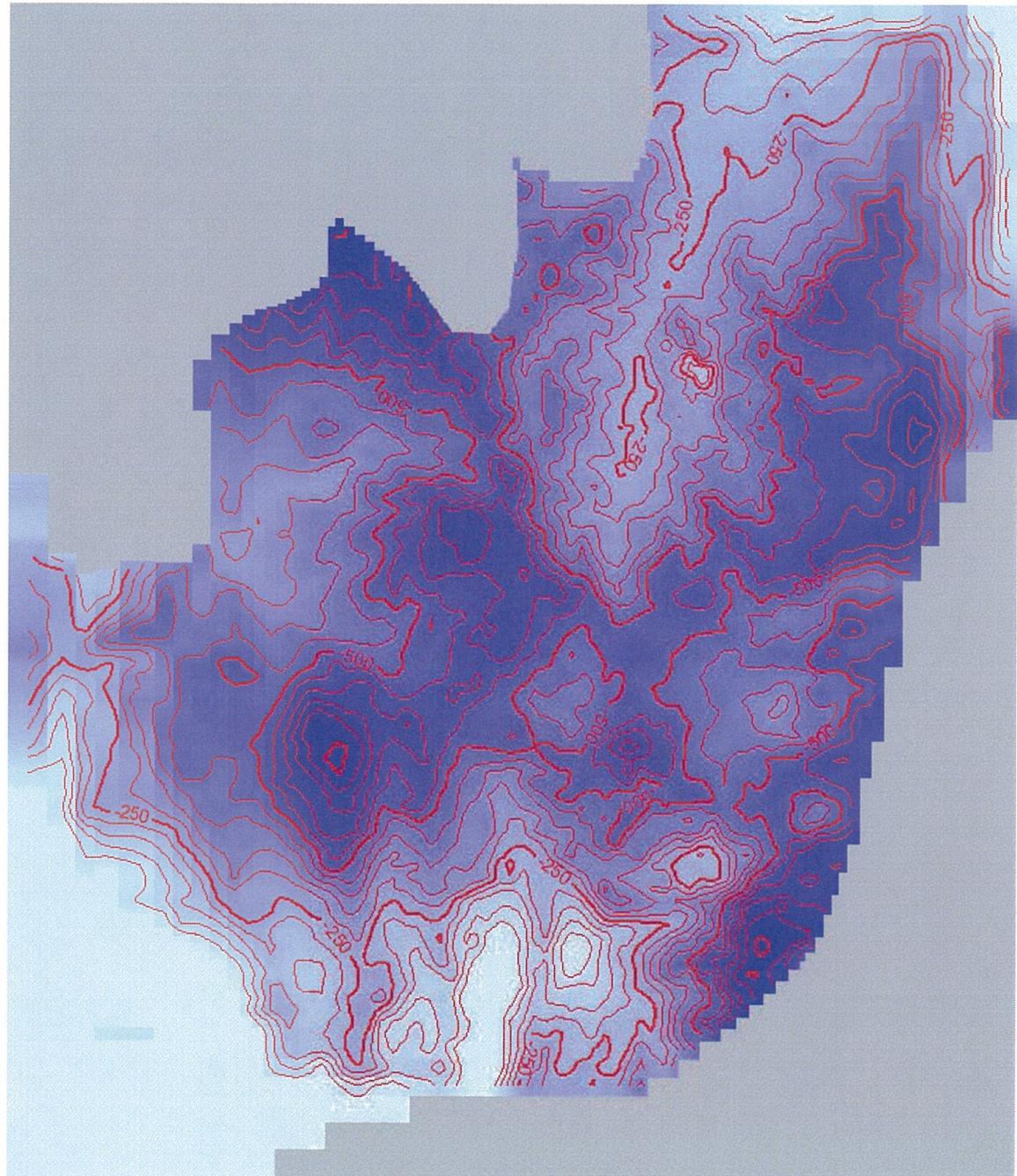
Bottom Elevation of Layer 16



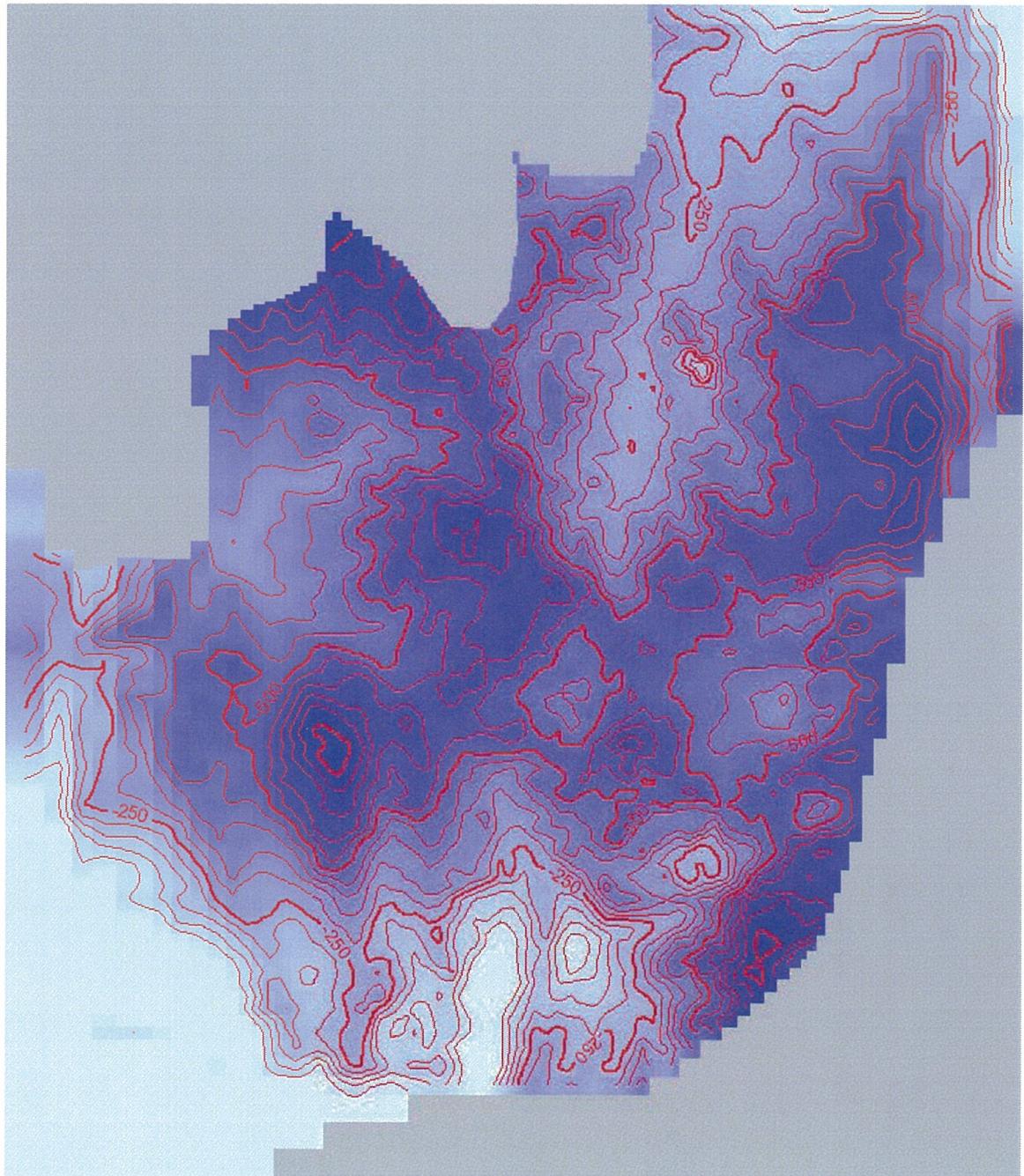
Bottom Elevation of Layer 17



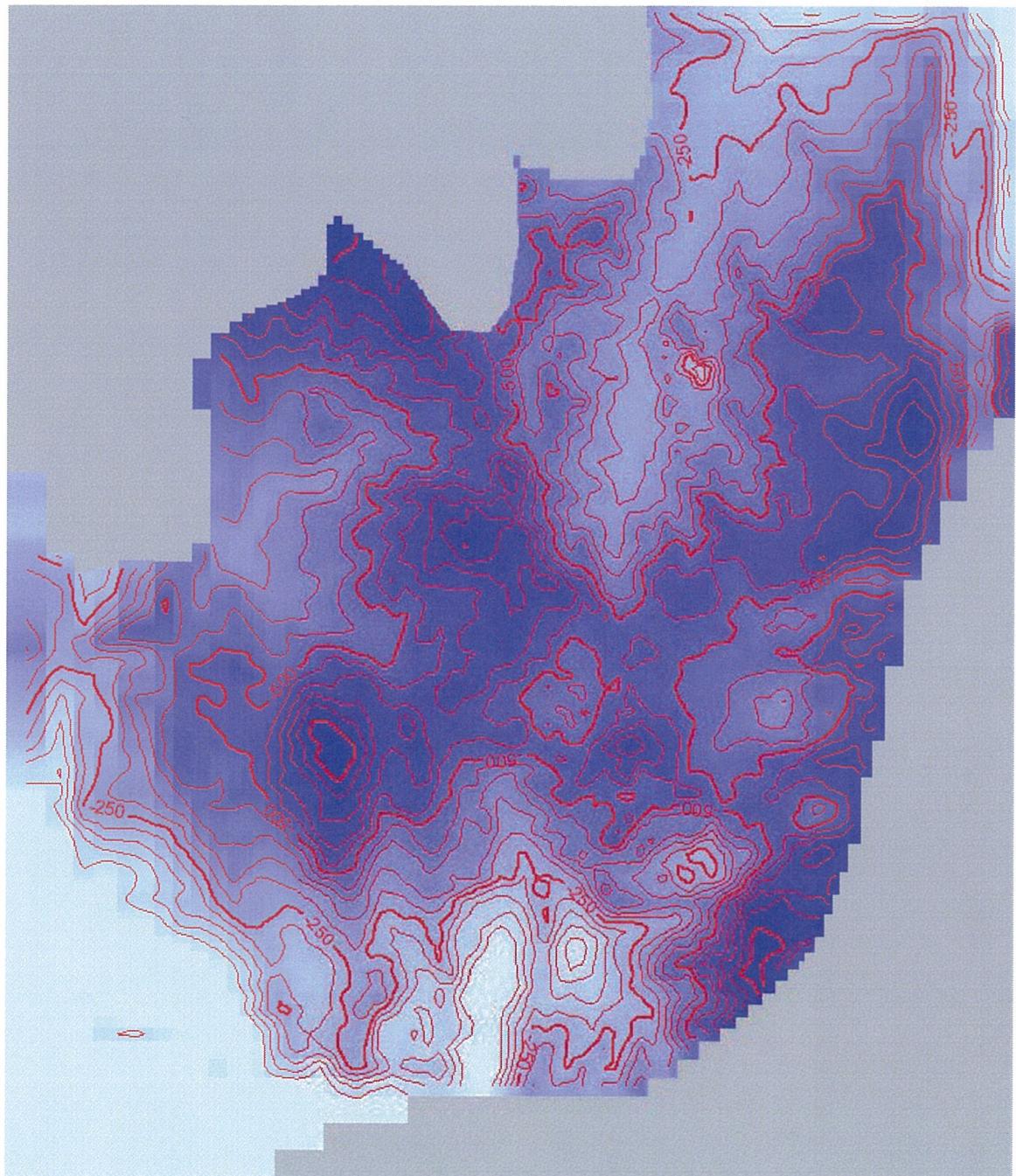
Bottom Elevation of Layer 18



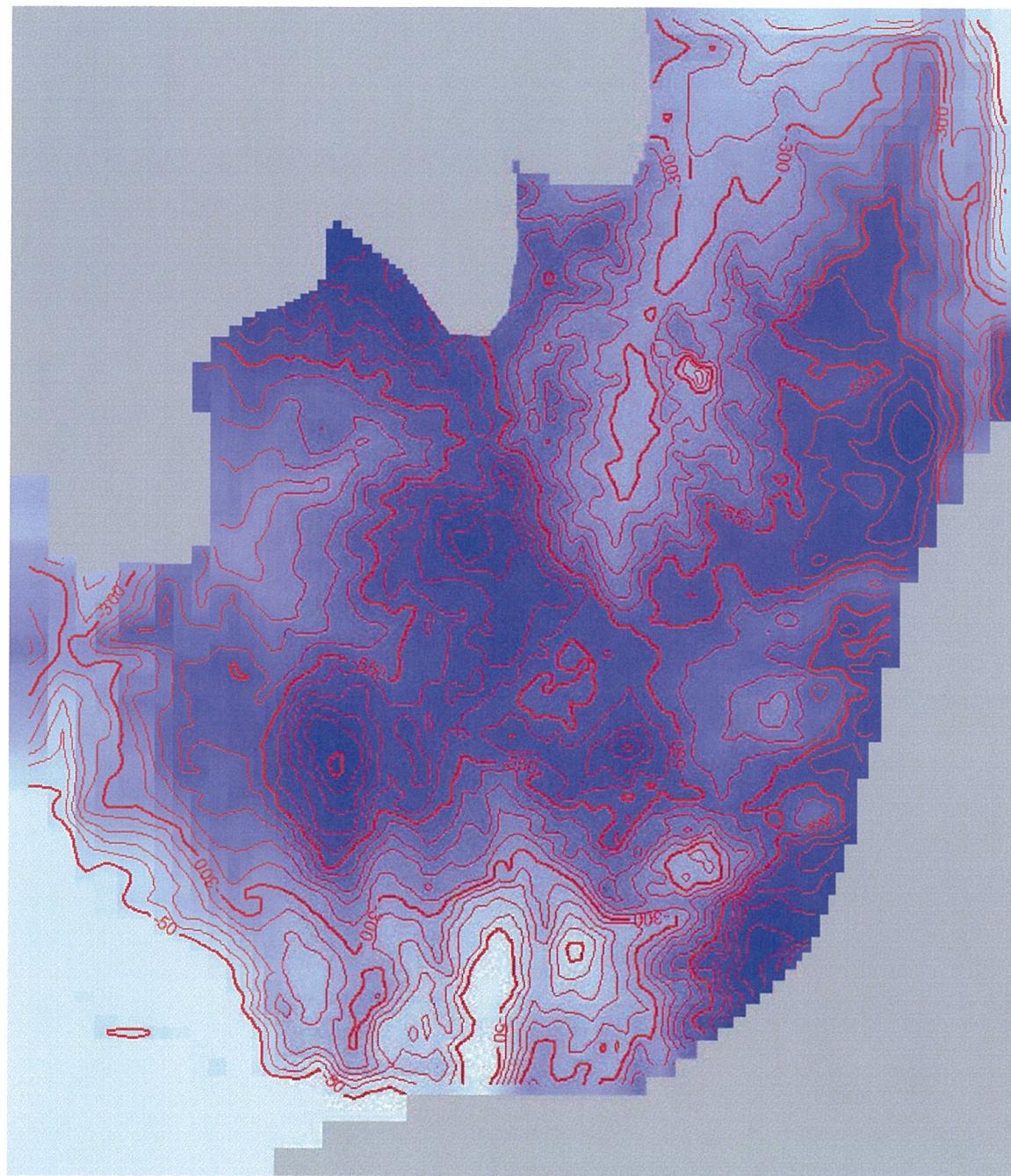
Bottom Elevation of Layer 19



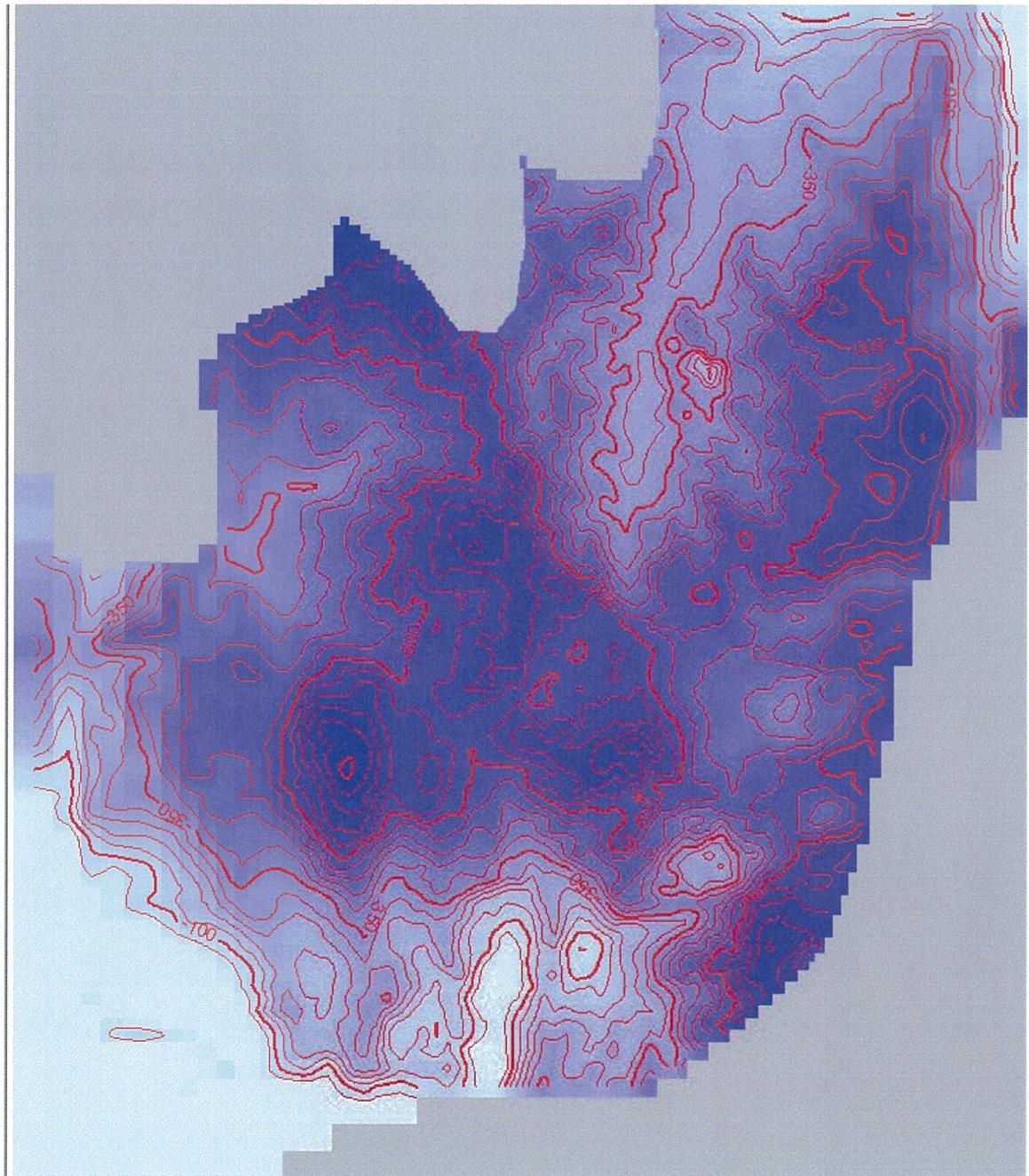
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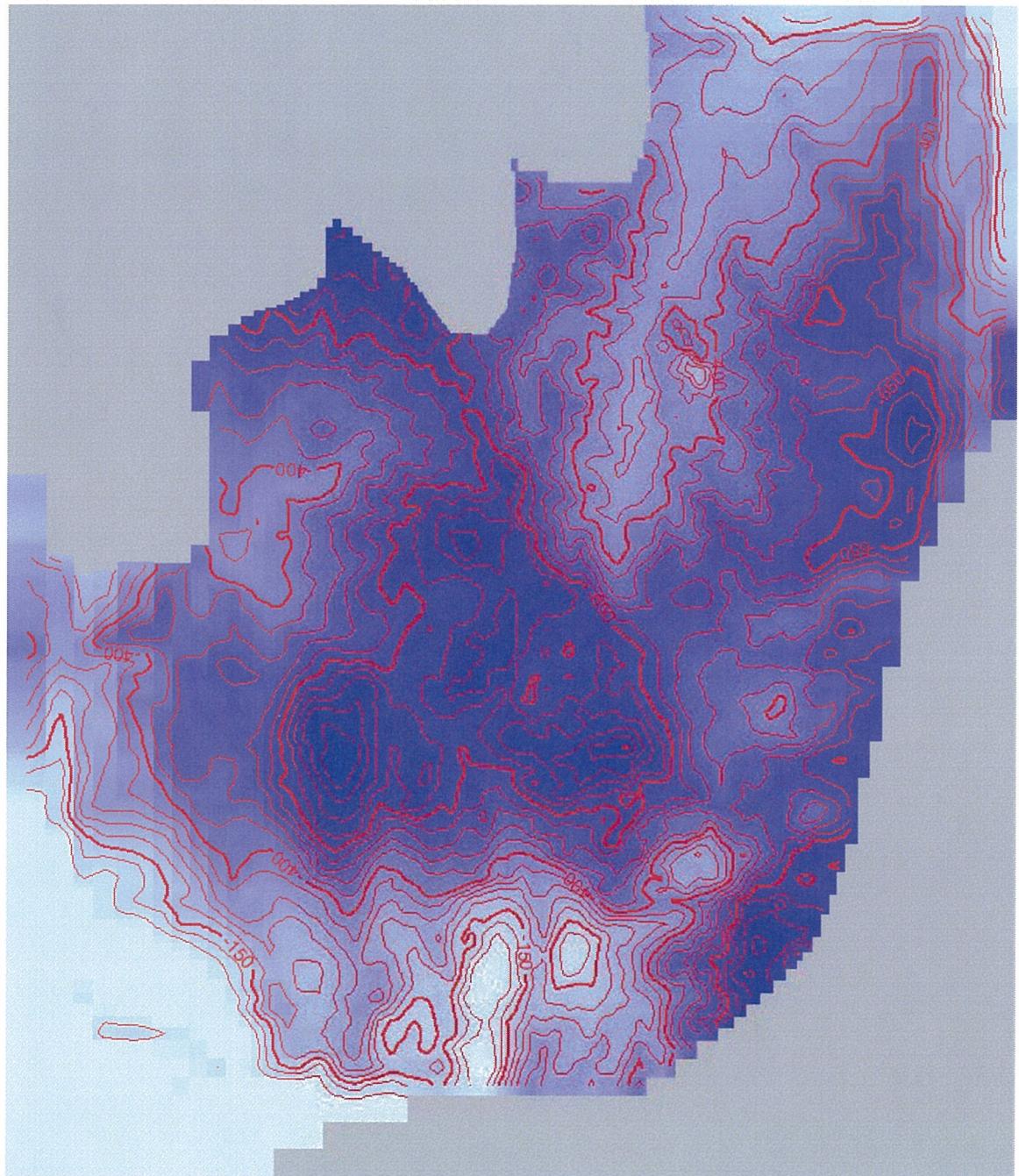
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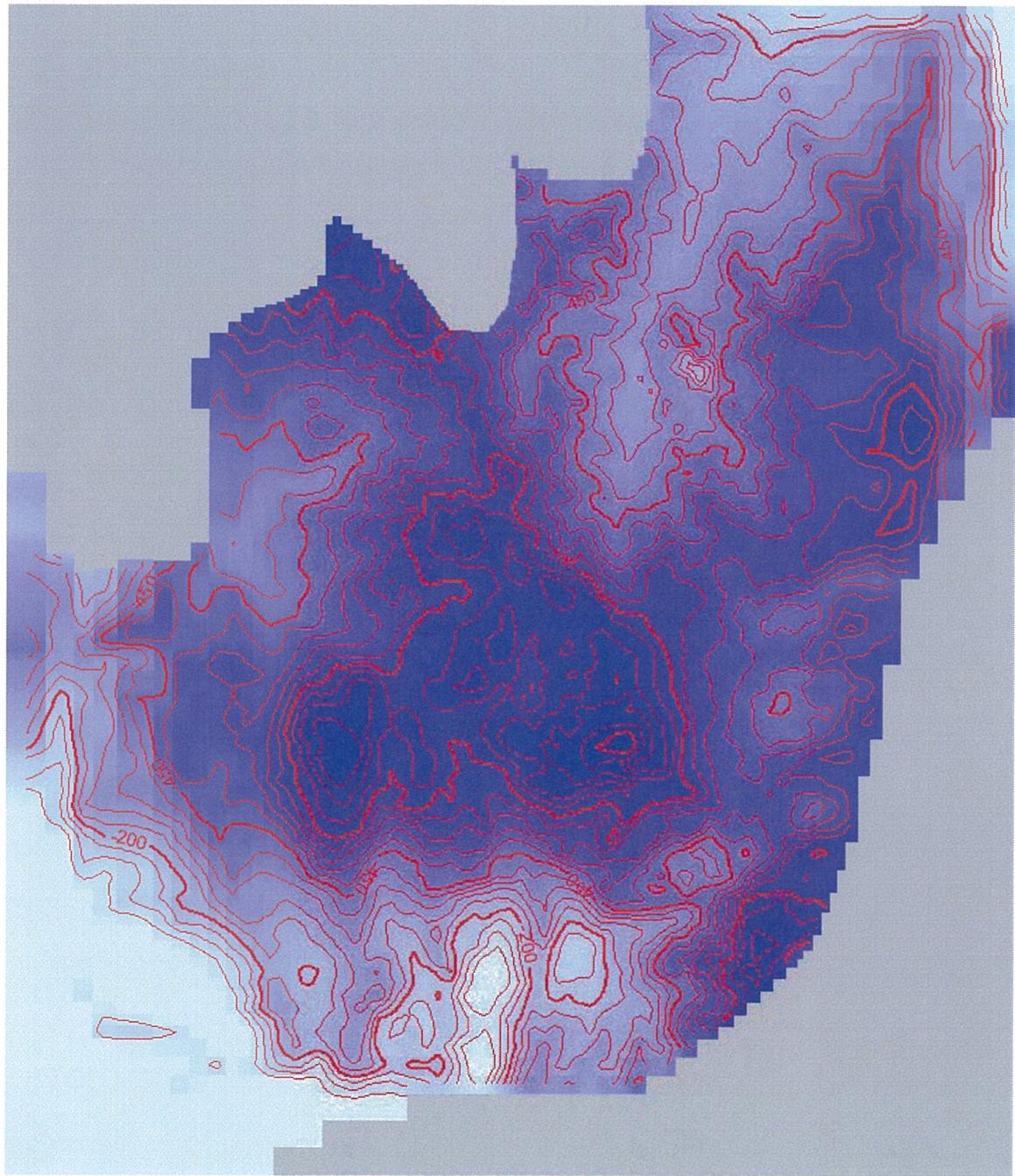
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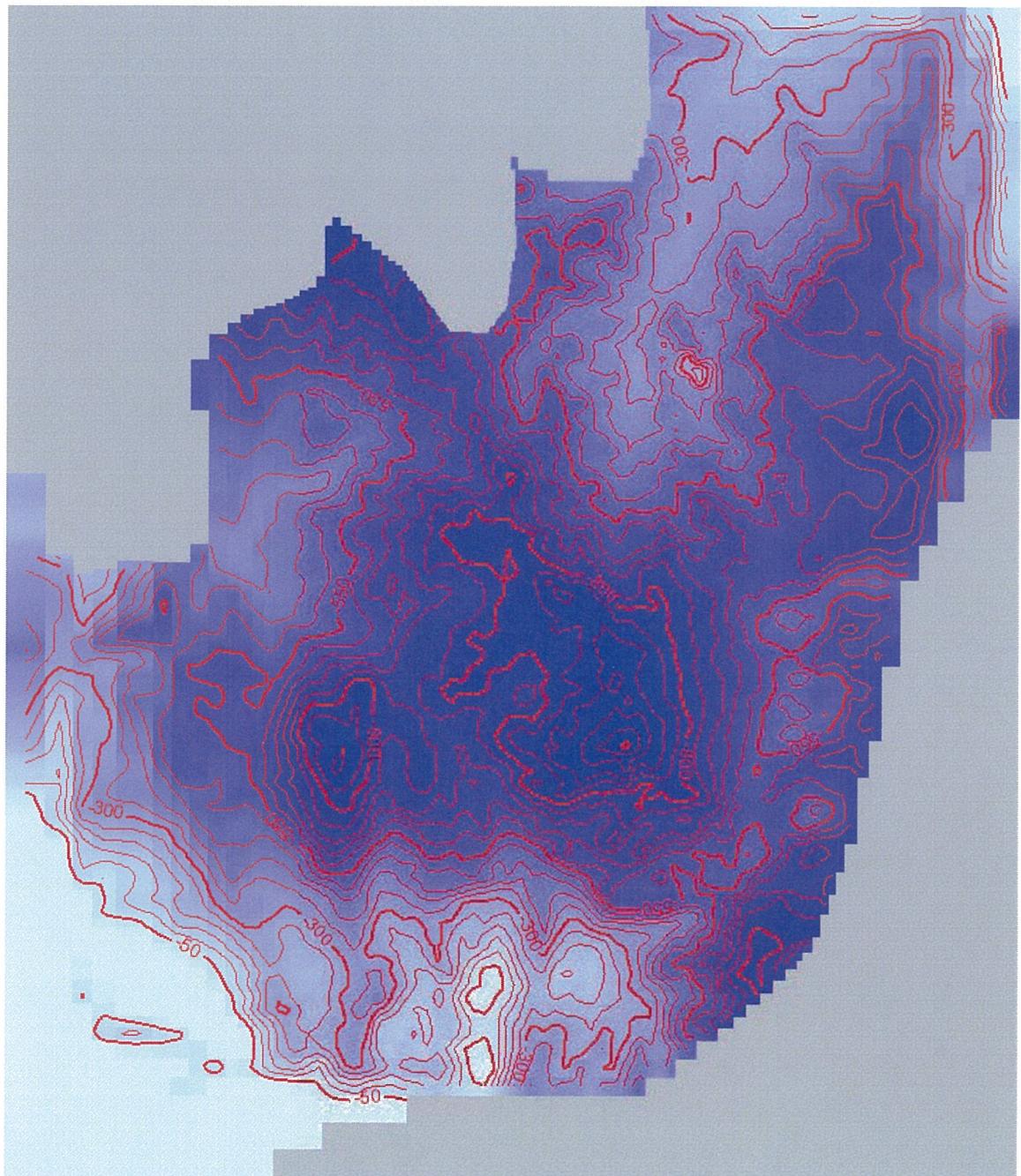
Bottom Elevation of Layer 23



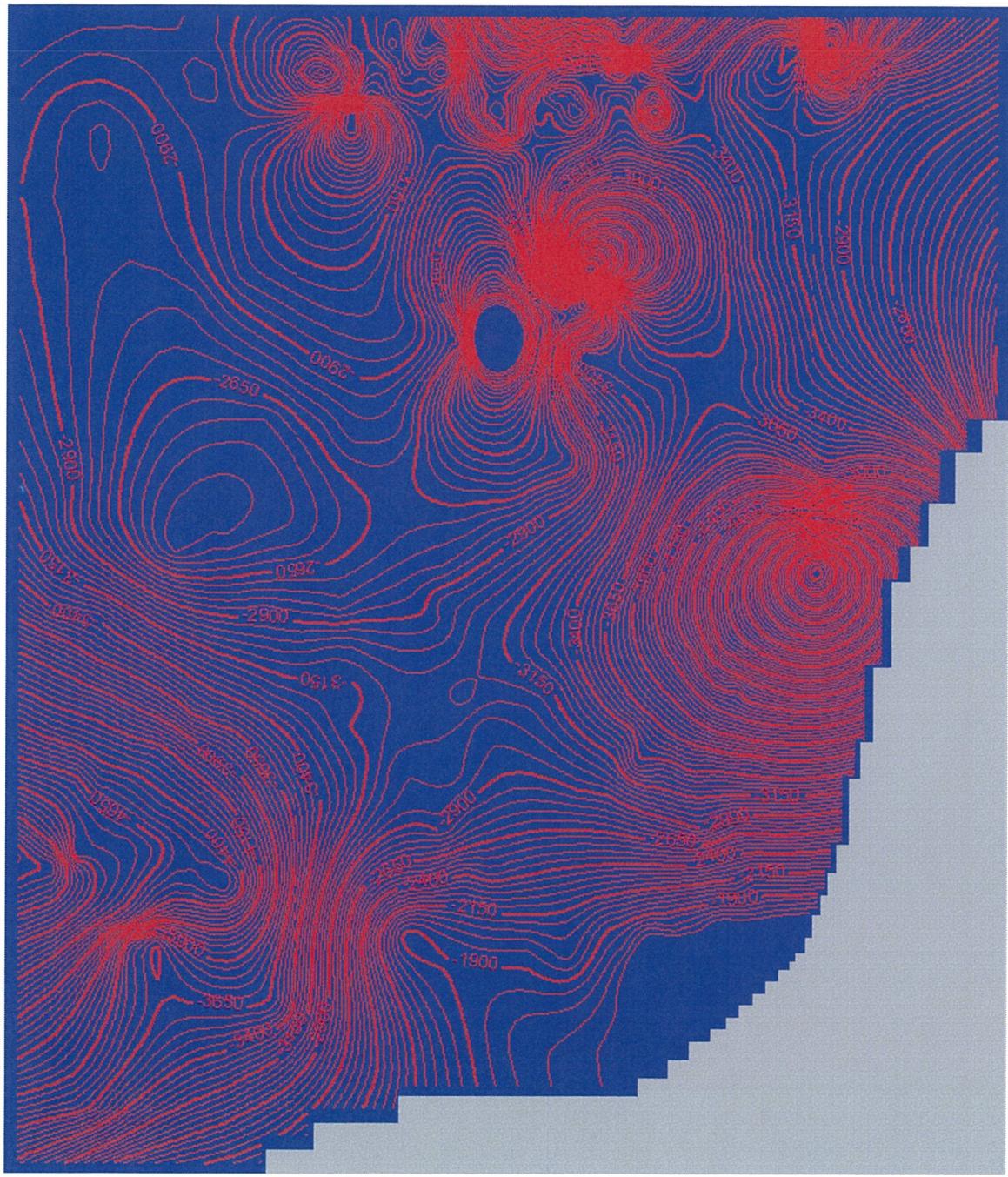
Bottom Elevation of Layer 24



Bottom Elevation of Layer 25



Bottom Elevation of Layer 26



Configuration of No Flow (Grey) and General Head Boundaries

