TECHNICAL MEMORANDUM

SUBJECT: **Green River Basin Plan II**
Municipal Water Use Projections

DATE: 5/28/2009

PREPARED BY: WWC Engineering

Introduction

The purpose of this technical memorandum is to project future water use for the following fourteen (14) Green River Basin cities, towns, and joint power boards that supply water to their citizens or customers:

Entities that obtain their primary water supply from surface water are:

- Town of Baggs-Little Snake River
- Bridger Valley Joint Powers Board-Smith's Fork and Black's Fork
- Dixon-Little Snake River
- Town of Granger-Green River
- Kemmerer-Diamondville Joint Powers Board-Hams Fork River
- Town of LaBarge-Green River
- Pinedale-Fremont Lake Dam
- Green River/ Rock Springs/Sweetwater County Joint Powers Board (JPB)-Green River

Entities that obtain their primary water supply from groundwater (and the source aquifer) are (Boyce, 2008):

- Town of Bairoil (Battle Springs Formation)
- Town of Big Piney (Wasatch Formation)
- Town of Marbleton (Wasatch Formation)
- Town of Opal (Green River Formation)
- Town of Superior (Erickson Sandstone)
- Town of Wamsutter (Wasatch Formation)

One entity outside the basin, the City of Cheyenne, obtains municipal water from the Little Snake River system in exchange for North Platte River water. This demand is included in this technical memorandum.

Methodology

In this technical memorandum, three possible development scenarios are addressed. They are the low growth, moderate growth and high growth scenarios. The three scenarios are

based on the population projections in the Population Projections technical memorandum (WWC, 2008). A detailed discussion of the three scenarios is contained in that technical memorandum. The municipal population projections were used in combination with the rural population projections to develop municipal service area populations. In the case of the Green River/Rock Springs/Sweetwater County Joint Powers Board, the populations of Green River and Rock Springs were combined with a portion of the rural population of Sweetwater County. The service area population estimate was based on the service area population reported in the Wyoming Water Development Commission (WWDC) 2007 Water System Survey (WWDC, 2007) or was based on information received from the system manager (Bracken, 2008). This method was applied to all the municipalities if they indicated in the municipal water system survey that they serve users outside their corporate boundaries.

Current municipal use is addressed in the Technical Memorandum, Green River Basin Plan II- Basin Water Use Profile – Municipal (WWC, 2008). In that technical memorandum per capita use rates presented were drawn from the WWDC Municipal Water System Survey reports (WWDC, 2007). These use rates were carried forward into this technical memorandum and used to estimate future water use by scenario.

As part of this analysis, a comparison of the results from the 2001 Green River Basin Plan to the results of this effort were made and are discussed later in this technical memorandum.

Conclusions

The results of the municipal use projections analysis are presented in Table 1 for the low growth scenario. Surface water use in 2055 is estimated to be 7,058 acre-feet annually while groundwater use is estimated to be 2,170 acre-feet annually for a total municipal use of 9,227 acre-feet.

Table 1 - Green River Basin Municipal Service Area Use Projections - Low Growth

City/Town Service Area	Current Population[1]	Current Use gpcpd[2, 3]	Current Use AF/Yr	2015 Pop	2015 Use AF/Yr	2035 Pop	2035 Use AF/Yr	2055 Pop	2055 Use AF/Yr
Surface Water Users									
Baggs	354	70	28	320	25	248	19	175	14
Bridger Valley JPB[4]	4,500	83	418	4,114	382	3,412	317	2,813	262
Dixon	81	279	25	72	23	56	18	38	12
Granger	146	120	20	148	20	137	18	129	17
GR/RS/SC JPB[5]	35,000	129	5,057	35,038	5,063	32,808	4,741	30,862	4,460
K/D JPB[6]	3,950	68	301	4,577	349	5,184	395	5,984	456
LaBarge	421	314	148	473	166	515	181	568	199
Pinedale	1,800	288	581	2,400	774	3,710	1,197	5,079	1,638
TOTAL	46,252	127	6,578	47,142	6,802	46,070	6,886	45,648	7,058
Groundwater Users									
Bairoil	96	350	38	97	38	89	35	83	33
Big Piney	455	90	46	625	63	913	92	1,232	124
Marbleton	811	787	715	1,109	978	1,622	1,430	2,189	1,930
Opal	99	150	17	112	19	122	20	134	23
Superior	239	146	39	242	40	224	37	207	34
Wamsutter	265	100	30	267	30	251	28	239	27
TOTAL	1,965	347	884	2,452	1,167	3,221	1,642	4,084	2,170
GRAND TOTAL	**48,217**		**7,462**	**49,594**	**7,969**	**49,291**	**8,528**	**49,732**	**9,227**

[1]Population is WDA&I or service area estimated population as appropriate

[2]Gallons per capita per day (GPCPD) are from the WWDC 2007 Water System Survey Report.

[3]GPCPD in the Total row is calculated from the total water use divided by the total municipal populations

[4]BV JPB-Bridger Valley Joint Powers Board (Lyman, Mountain View, Fort Bridger, Lower Bench)

[5]GR/RS/SC JPB-Green River, Rock Springs, Sweetwater County Joint Powers Board (White Mountain, Clearview, Ten-Mile, Reliance)

[6]K/D JPB-Kemmerer, Diamondville Joint Powers Board

Table 2 shows the projected municipal use for the moderate growth scenario. Surface water use in 2055 is estimated to be 11,596 acre-feet annually while groundwater use is estimated to be 3,403 acre-feet annually for a total municipal use of 14,998 acre-feet.

Table 2 - Green River Basin Municipal Service Area Use Projections - Moderate Growth

City/Town Service Area	Current Population[1]	Current Use gpcpd[2, 3]	Current Use AF/Yr	2015 Pop	2015 Use AF/Yr	2035 Pop	2035 Use AF/Yr	2055 Pop	2055 Use AF/Yr
Surface Water Users									
Baggs	354	70	28	360	28	339	27	275	22
Bridger Valley JPB[4]	4,500	83	418	4,777	444	4,887	454	4,599	428
Dixon	81	279	25	81	25	76	24	60	19
Granger	146	120	20	166	22	187	25	202	27
GR/RS/SC JPB[5]	35,000	129	5,057	39,413	5,695	44,383	6,413	48,024	6,939
KD JPB[6]	3,950	68	301	5,335	406	7,129	543	9,074	691
LaBarge	421	314	148	532	187	701	246	890	313
Pinedale	1,800	288	581	2,817	909	5,875	1,895	9,788	3,158
TOTAL	46,252	127	6,578	53,481	7,717	63,577	9,628	72,912	11,596
Groundwater Users									
Bairoil	96	350	38	109	43	122	48	130	51
Big Piney	455	90	46	703	71	1,244	125	1,932	195
Marbleton	811	787	715	1,247	1,099	2,210	1,948	3,433	3,026
Opal	99	150	17	126	21	166	28	211	35
Superior	239	146	39	272	44	305	50	325	53
Wamsutter	265	100	30	300	34	342	38	374	42
TOTAL	1,965	347	884	2,757	1,312	4,389	2,238	6,405	3,403
GRAND TOTAL	**48,217**		**7,462**	**56,238**	**9,029**	**67,966**	**11,865**	**79,317**	**14,998**

[1]Population is WDA&I or service area estimated population as appropriate
[2]Gallons per capita per day(GPCPD) are from the WWDC 2007 Water System Survey Report.
[3]GPCPD in the Total row is calculated from the total water use divided by the total municipal populations
[4]BV JPB-Bridger Valley Joint Powers Board (Lyman, Mountain View, Fort Bridger, Lower Bench)
[5]GR/RS/SC JPB-Green River, Rock Springs, Sweetwater County Joint Powers Board (White Mountain, Clearview, Ten-Mile, Reliance)
[6]K/D JPB-Kemmerer, Diamondville Joint Powers Board

Table 3 shows the projected municipal use for the high growth scenario. Surface water use in 2055 is estimated to be 13,965 acre-feet annually while groundwater use is estimated to be 4,382 acre-feet annually for a total municipal use of 18,347 acre-feet.

Table 3 - Green River Basin Municipal Service Area Use Projections - High Growth

City/Town Service Area	Current Population[1]	Current Use gpcpd[2, 3]	Current Use AF/Yr	2015 Pop	2015 Use AF/Yr	2035 Pop	2035 Use AF/Yr	2055 Pop	2055 Use AF/Yr
Surface Water Users									
Baggs	354	70	28	360	28	455	36	354	28
Bridger Valley JPB[4]	4,500	83	418	4,777	444	6,767	629	6,002	558
Dixon	81	279	25	81	25	102	32	78	24
Granger	146	120	20	166	22	251	34	260	35
GR/RS/SC JPB[5]	35,000	129	5,057	39,413	5,695	59,222	8,557	61,354	8,866
K/D JPB[6]	3,950	68	301	5,335	406	9,578	730	11,743	894
LaBarge	421	314	148	532	187	942	331	1,146	402
Pinedale	1,800	288	581	2,817	909	7,848	2,532	9,788	3,158
TOTAL	46,252	127	6,578	53,481	7,717	85,165	12,880	90,725	13,965
Groundwater Users									
Bairoil	96	350	38	109	43	164	64	168	66
Big Piney	455	90	46	703	71	1,672	169	2,488	251
Marbleton	811	787	715	1,247	1,099	2,970	2,618	4,421	3,897
Opal	99	150	17	126	21	223	37	271	46
Superior	239	146	39	272	44	409	67	419	69
Wamsutter	265	100	30	300	34	459	51	482	54
TOTAL	1,965	347	884	2,757	1,312	5,897	3,007	8,249	4,382
GRAND TOTAL	**48,217**		**7,462**	**56,238**	**9,029**	**91,062**	**15,887**	**98,974**	**18,347**

[1]Population is WDA&I or service area estimated population as appropriate

[2]Gallons per capita per day(GPCPD) are from the WWDC 2007 Water System Survey Report.

[3]GPCPD in the Total row is calculated from the total water use divided by the total municipal populations

[4]BV JPB-Bridger Valley Joint Powers Board (Lyman, Mountain View, Fort Bridger, Lower Bench)

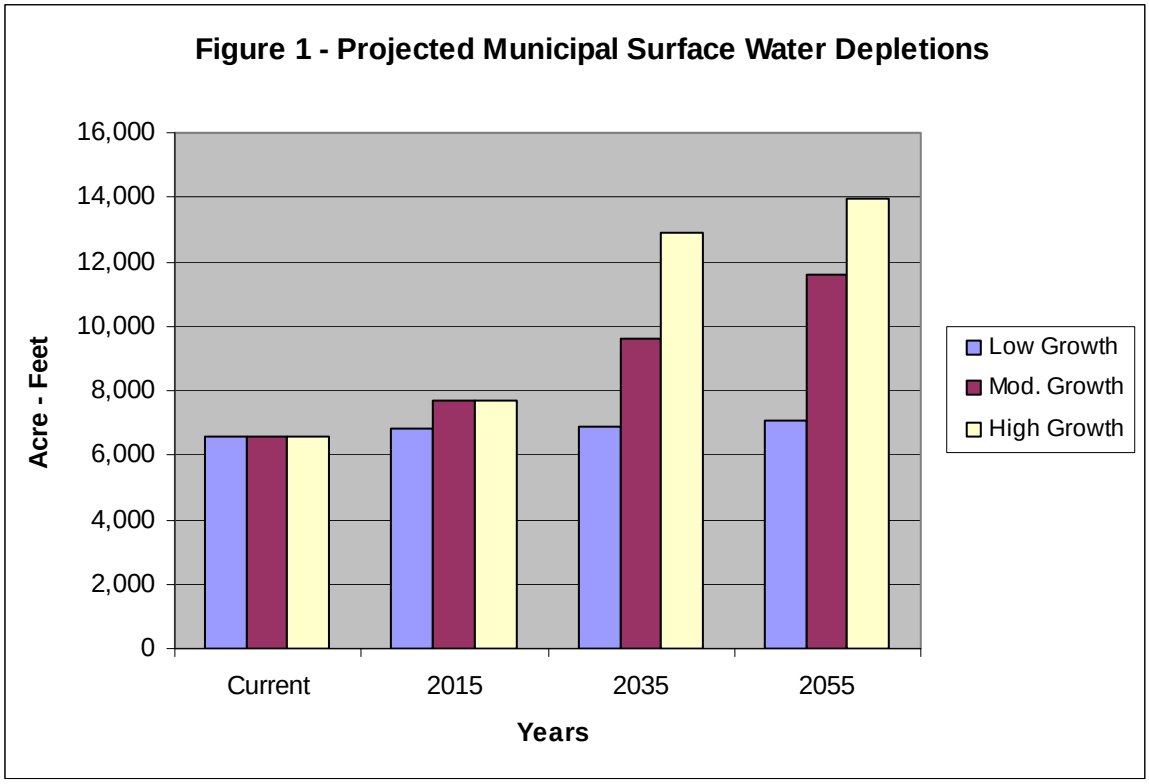
[5]GR/RS/SC JPB-Green River, Rock Springs, Sweetwater County Joint Powers Board (White Mountain, Clearview, Ten-Mile, Reliance)

[6]K/D JPB-Kemmerer, Diamondville Joint Powers Board

The results of the three analyses are summarized in Table 4 and shown graphically in Figure 1 for surface water and Figure 2 for groundwater.

Table 4 Green River Basin Municipal Service Area Use Summary

Use by Source (AF/Yr)	Current	2015	2035	2055
Surface Water				
Low Growth	6,578	6,802	6,886	7,058
Moderate Growth	6,578	7,717	9,628	11,596
High Growth	6,578	7,717	12,880	13,965
Groundwater				
Low Growth	884	1,167	1,642	2,170
Moderate Growth	884	1,312	2,238	3,403
High Growth	884	1,312	3,007	4,382



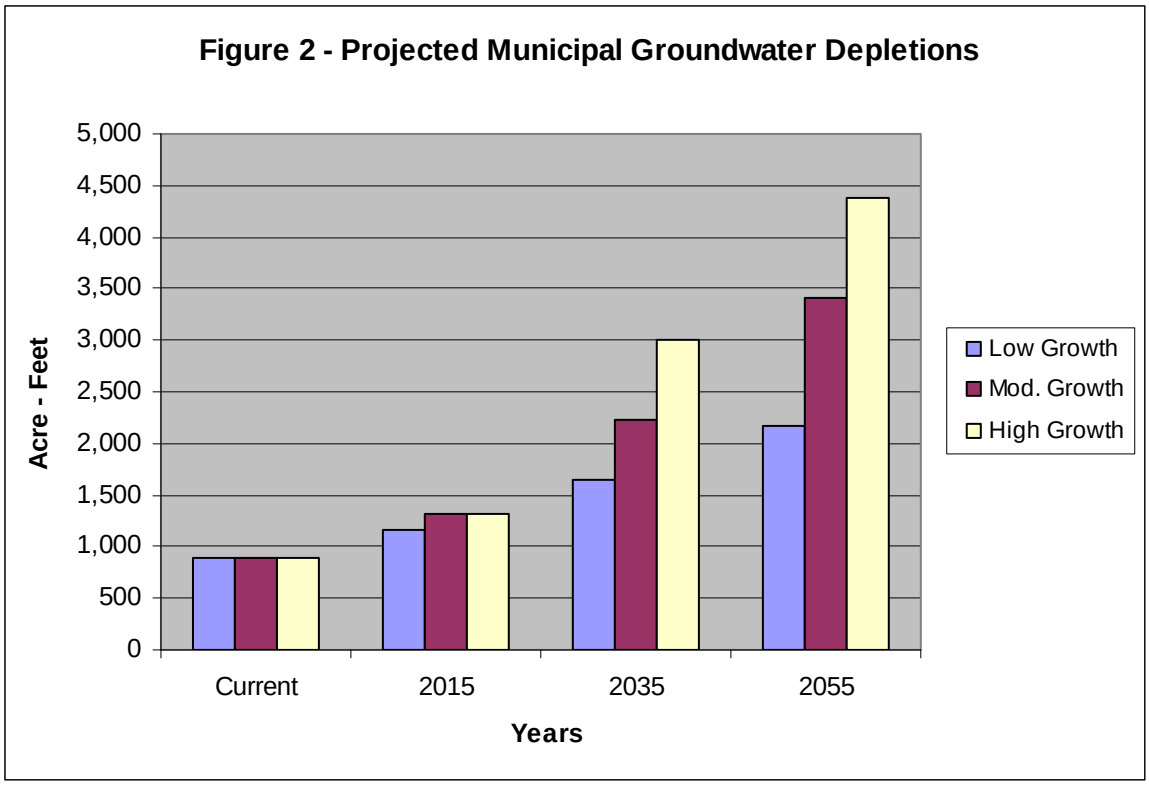


Table 5 displays a comparison of the municipal systems capacity with demand from the current time through the planning horizon of 2055 for the low growth scenario. Table 6 and Table 7 show similar comparisons for the moderate growth and high growth scenarios. In most cases, the existing water right capacity is sufficient to cover the projected demand over the planning period. There are two exceptions to this condition. Under surface water demands, Pinedale's direct flow right will be insufficient to accommodate the moderate growth demands or the high growth demands sometime between 2015 and 2035. However, Pinedale has more than adequate storage water to meet any deficit. Marbleton exhibits similar conditions but does not have storage water to fall back on as it is a groundwater supply system. The opportunity to drill more wells and expand their supply may exist.

Table 5 - Comparison of Existing and Projected Use and System Capacity - Low Growth

Supplier	System Capacity	Water Right Capacity	Current Demand	2015 Demand	2035 Demand	2055 Demand
	AFD = acre-feet per day					
Surface Water						
Baggs	1.33	1.24	0.076	0.069	0.053	0.038
Bridger Valley JPB	12.10	15.10	1.146	1.048	0.869	0.717
Dixon	0.97	0.97	0.069	0.062	0.048	0.033
Granger	3.09	13.01	0.054	0.055	0.050	0.048
GR/RS/SC JPB[1]	97.00	79.30	13.856	13.871	12.988	12.218
K/D JPB[2]	12.83	17.07	0.824	0.955	1.082	1.249
LaBarge	1.77	2.64	0.405	0.455	0.495	0.546
Pinedale	44.20	11.48	1.591	2.121	3.279	4.489
Groundwater						
Bairoil	3.05	0.41	0.10	0.10	0.10	0.09
Big Piney	2.65	3.76	0.13	0.17	0.25	0.34
Marbleton	2.20	4.57	1.96	2.68	3.92	5.29
Opal	0.41	0.46	0.05	0.05	0.06	0.06
Superior	1.60	5.57	0.11	0.11	0.10	0.09
Wamsutter	3.09	1.51	0.08	0.08	0.08	0.07

[1]GR/RS/SC JPB - Green River, Rock Springs, Sweetwater County Joint Powers Board

[2]K/D JPB - Kemmerer Diamondville Joint Powers Board

Table 6 - Comparison of Existing and Projected Use and System Capacity - Mod. Growth

Supplier	System Capacity	Water Right Capacity	Current Demand	2015 Demand	2035 Demand	2055 Demand
	AFD = acre-feet per day					
Surface Water						
Baggs	1.33	1.24	0.076	0.077	0.073	0.059
Bridger Valley JPB	12.10	15.10	1.146	1.217	1.245	1.171
Dixon	0.97	0.97	0.069	0.069	0.065	0.051
Granger	3.09	13.01	0.054	0.061	0.069	0.074
GR/RS/SC JPB[1]	97.00	79.30	13.856	15.603	17.571	19.012
K/D JPB[2]	12.83	17.07	0.824	1.113	1.488	1.894
LaBarge	1.77	2.64	0.405	0.512	0.674	0.856
Pinedale	44.20	11.48	1.591	2.490	5.193	8.651
Groundwater						
Bairoil	3.05	0.41	0.10	0.12	0.13	0.14
Big Piney	2.65	3.76	0.13	0.19	0.34	0.53
Marbleton	2.20	4.57	1.96	3.01	5.34	8.29
Opal	0.41	0.46	0.05	0.06	0.08	0.10
Superior	1.60	5.57	0.11	0.12	0.14	0.15
Wamsutter	3.09	1.51	0.08	0.09	0.10	0.11

[1]GR/RS/SC JPB - Green River, Rock Springs Sweetwater County Joint Powers Board

[2]K/D JPB - Kemmerer Diamondville Joint Powers Board

Table 7 - Comparison of Existing and Projected Use and System Capacity - High Growth

Supplier	System Capacity	Water Right Capacity	Current Demand	2015 Demand	2035 Demand	2055 Demand
	AFD = acre-feet per day					
Surface Water						
Baggs	1.33	1.24	0.076	0.077	0.098	0.076
Bridger Valley JPB	12.10	15.10	1.146	1.217	1.724	1.529
Dixon	0.97	0.97	0.069	0.069	0.087	0.067
Granger	3.09	13.01	0.054	0.061	0.092	0.096
GR/RS/SC JPB[1]	97.00	79.30	13.856	15.603	23.445	24.289
K/D JPB[2]	12.83	17.07	0.824	1.113	1.999	2.451
LaBarge	1.77	2.64	0.405	0.512	0.906	1.103
Pinedale	44.20	11.48	1.591	2.490	6.936	8.651
Groundwater						
Bairoil	3.05	0.41	0.10	0.12	0.18	0.18
Big Piney	2.65	3.76	0.13	0.19	0.46	0.69
Marbleton	2.20	4.57	1.96	3.01	7.17	10.68
Opal	0.41	0.46	0.05	0.06	0.10	0.12
Superior	1.60	5.57	0.11	0.12	0.18	0.19
Wamsutter	3.09	1.51	0.08	0.09	0.14	0.15

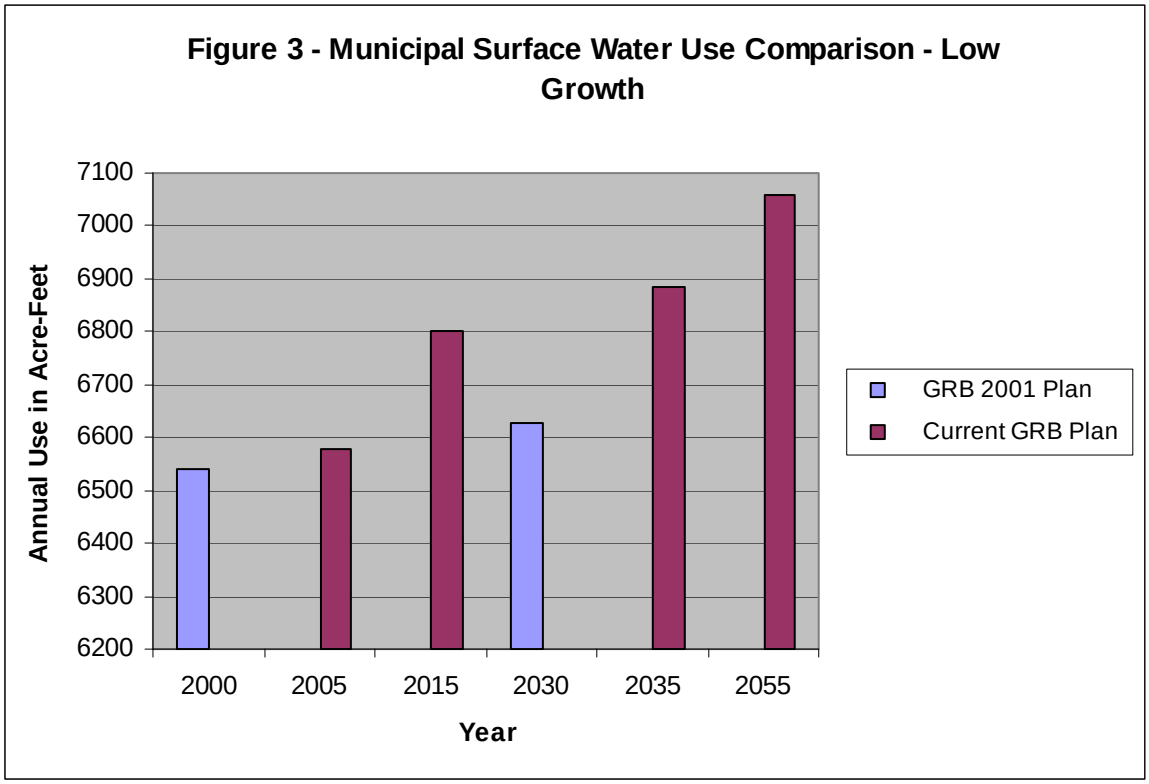
[1]GR/RS/SC JPB - Green River, Rock Springs Sweetwater County Joint Powers Board

[2]K/D JPB - Kemmerer Diamondville Joint Powers Board

Table 8 and Table 9 show the comparative analysis of municipal use shown in the 2001 Green River Basin Plan effort to the results shown in the projections associated with the current plan. Table 8 deals with the municipal surface water use. Table 9 covers the municipal groundwater use in the basin. In these tables municipal use for the various target dates used in the current water planning effort are shown compared to the base line and what the projected future use was in 2001. The results in Table 8 and Table 9 are shown graphically in Figure 3 through Figure 8. Figures 3, 4, and 5 graphically show the municipal surface water use. Figures 6, 7, and 8 graphically show the municipal groundwater use.

Table 8 - Comparison of Municipal Surface Water Use - 2001 Plan to Current Plan

Growth Scenario/ Green River Basin Plan	Year					
	2000	2005	2015	2030	2035	2055
	Use In Acre-Feet Per Year					
LOW GROWTH						
GRB 2001 Plan	6539			6628		
Current GRB Plan		6578	6802		6886	7058
MODERATE GROWTH						
GRB 2001 Plan	6539			8059		
Current GRB Plan		6578	7717		9628	11596
HIGH GROWTH						
GRB 2001 Plan	6539			10068		
Current GRB Plan		6578	7717		12880	13965



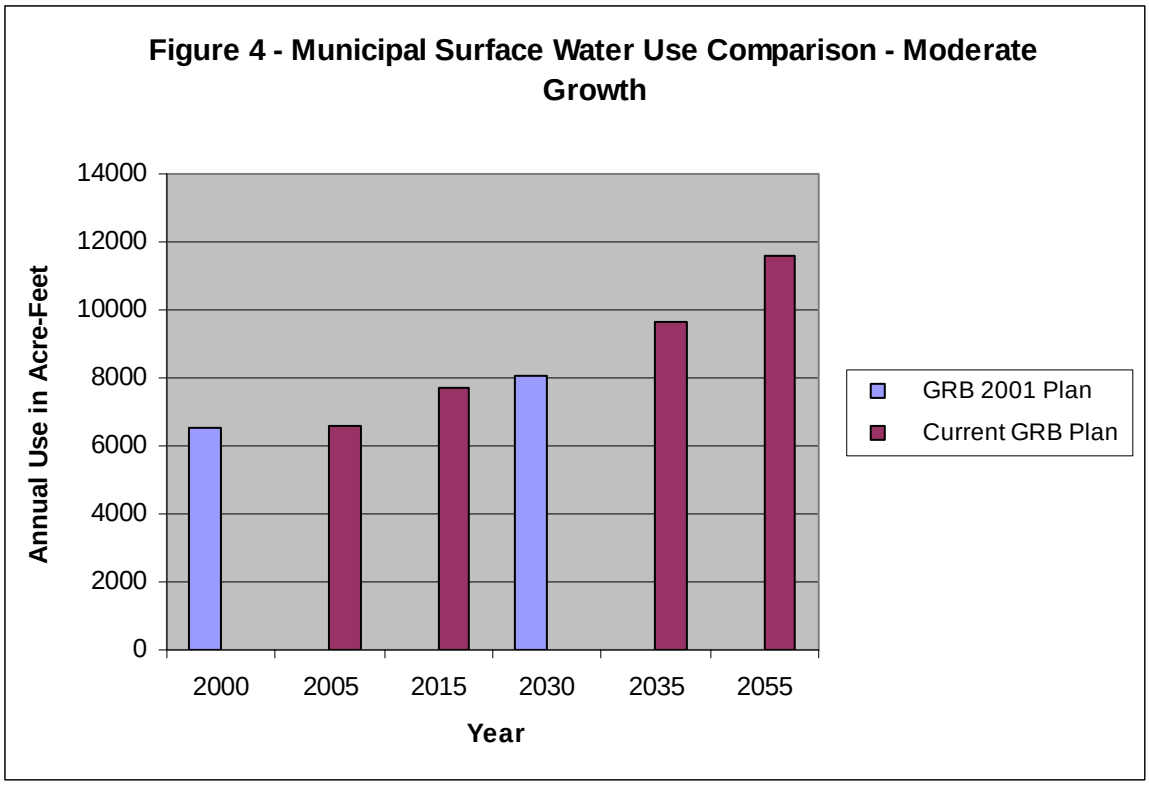


Figure 4 - Municipal Surface Water Use Comparison - Moderate Growth
Annual Use in Acre-Feet
14000
12000
10000
8000
6000
4000
2000
0
2000
2005
2015
2030
2035
2055
Year
GRB 2001 Plan
Current GRB Plan

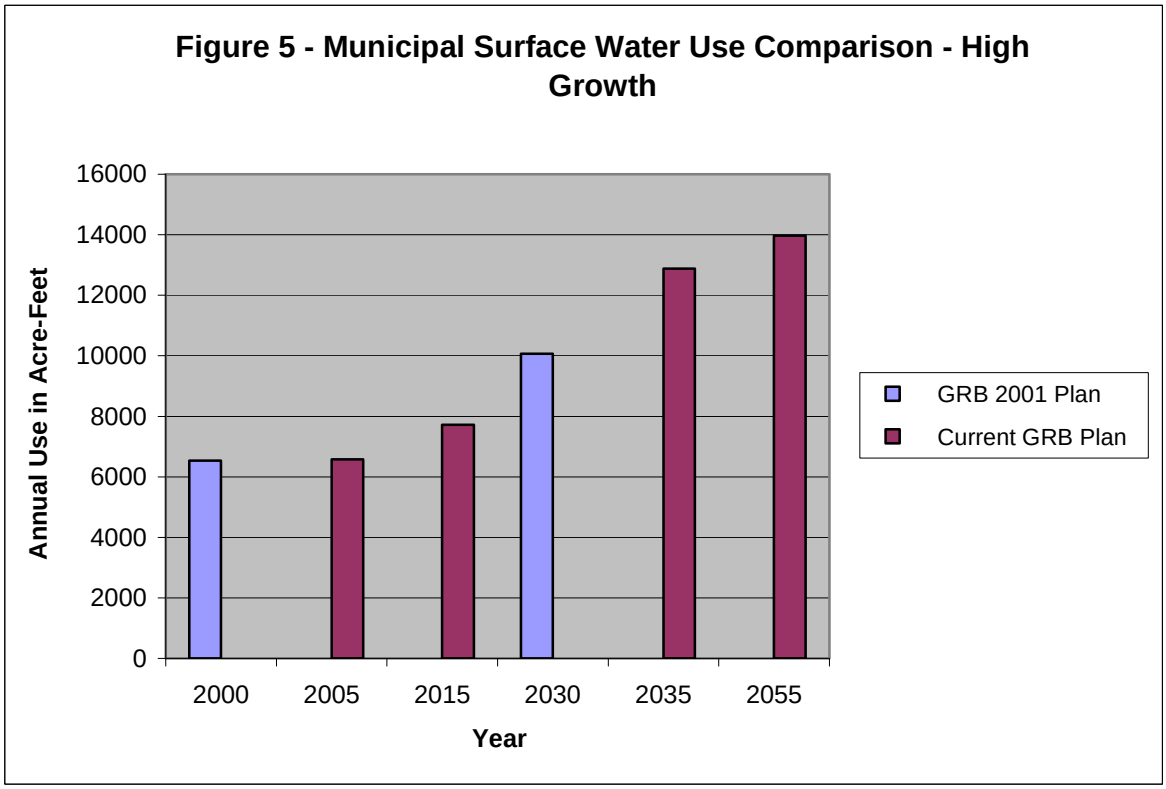
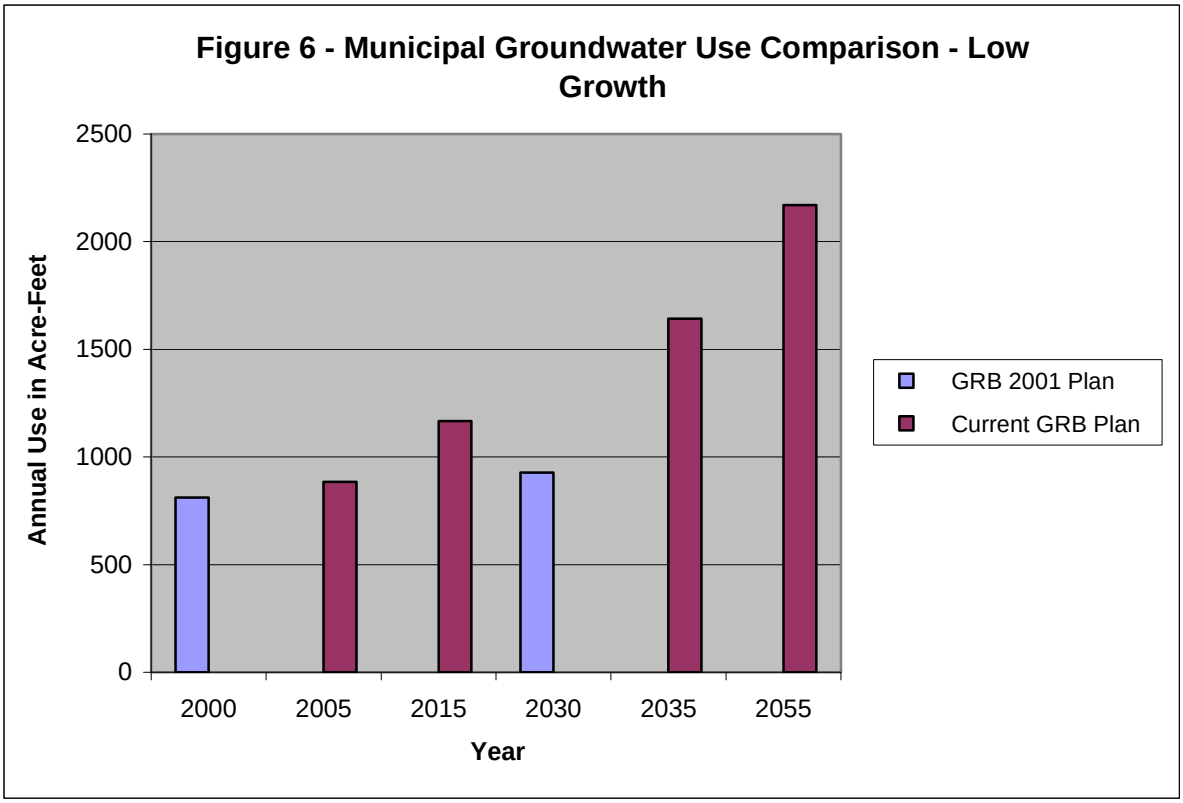


Figure 5 - Municipal Surface Water Use Comparison - High Growth
Annual Use in Acre-Feet
16000
14000
12000
10000
8000
6000
4000
2000
0
2000
2005
2015
2030
2035
2055
Year
GRB 2001 Plan
Current GRB Plan

Table 9 - Comparison of Municipal Groundwater Use - 2001 Plan to Current Plan

Growth Scenario/ Green River Basin Plan	Year					
	2000	2005	2015	2030	2035	2055
	Use In Acre-Feet Per Year					
LOW GROWTH						
GRB 2001 Plan	812			927		
Current GRB Plan		884	1167		1642	2170
MODERATE GROWTH						
GRB 2001 Plan	812			1065		
Current GRB Plan		884	1312		2238	3403
HIGH GROWTH						
GRB 2001 Plan	812			1140		
Current GRB Plan		884	1312		3007	4382



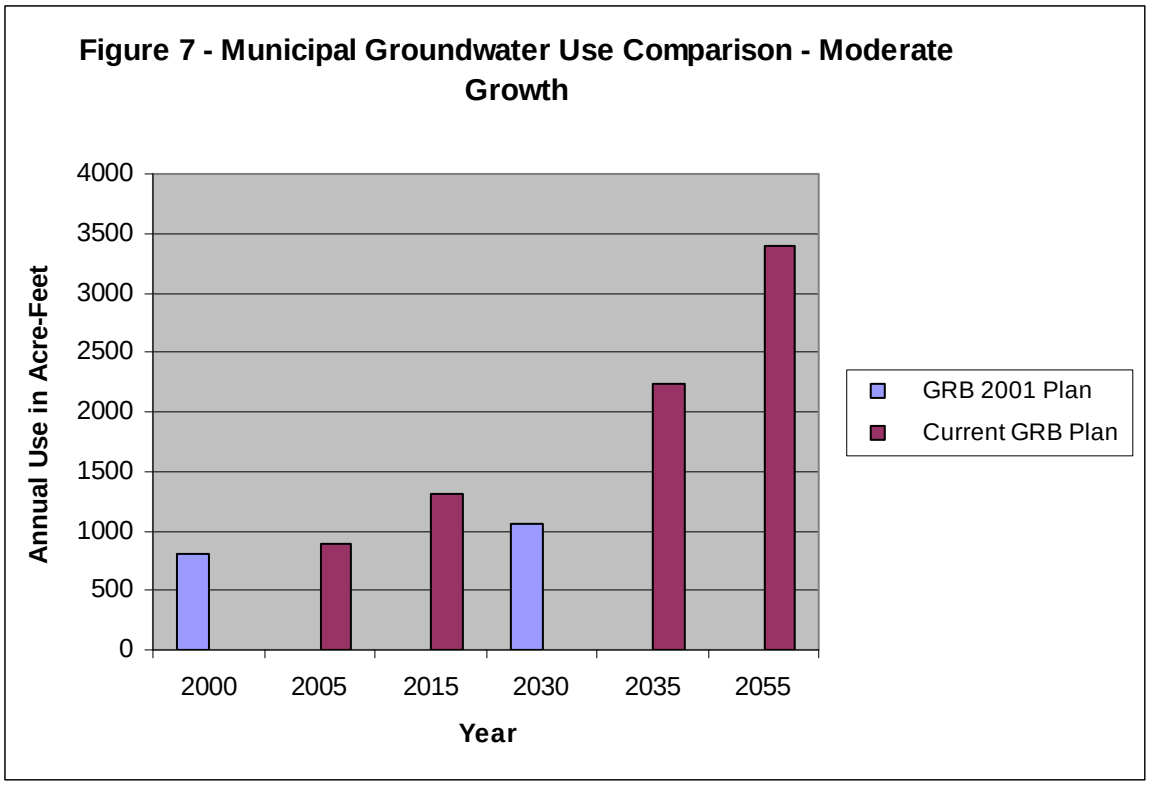


Figure 7 - Municipal Groundwater Use Comparison - Moderate Growth
Annual Use in Acre-Feet
4000
3500
3000
2500
2000
1500
1000
500
0
2000
2005
2015
2030
2035
2055
Year
GRB 2001 Plan
Current GRB Plan

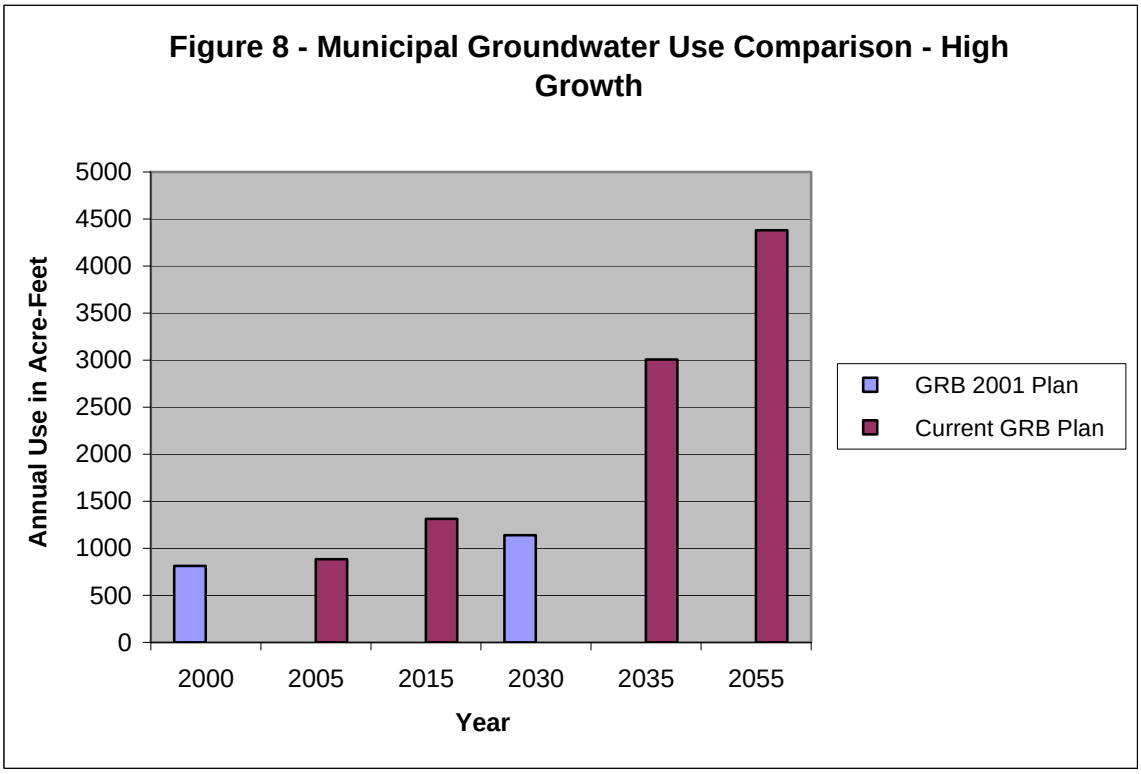


Figure 8 - Municipal Groundwater Use Comparison - High Growth
Annual Use in Acre-Feet
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
2000
2005
2015
2030
2035
2055
Year
GRB 2001 Plan
Current GRB Plan

The City of Cheyenne diverts water from the headwaters of the Little Snake River for municipal use exchange purposes. The system and water rights have a capacity of about 22,700 acre feet and it is expected to be fully utilized during the planning time frame. Table 10 shows the projected diversions, assuming diversions would grow from the present amount uniformly to the maximum allowed, over the 50 year period.

Table 10 - City of Cheyenne Diversions from the Green River Basin

Annual Diversion Acre-feet	Year			
	2005	2015	2035	2055
	15,308	16,560	19,390	22,700

References

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