Chapter 8
Summary and conclusions

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The GGRB is arid, and groundwater sustains human activity throughout most of the basin, as a primary or secondary source. Because geologic and hydrogeologic conditions within the basin are complex and highly variable, the quantity and quality of groundwater is correspondingly variable. In general, most aquifers and some confining units yield small to moderate quantities of water to shallow wells. Most of the water wells in the basin are less than 300 feet deep and yield 25 gallons per minute or less. In most areas of the GGRB, groundwater quality varies from good to poor in wells constructed into aquifers less than 1,000 feet deep. In some areas of the basin, the groundwater quality is poor only 300 feet below the surface.

Construction of shallow and low-yield water wells will probably continue in most rural areas of the basin for domestic and stock use. Except for some localized areas in the Wyoming GGRB with a high density of existing wells, most basin areas offer opportunities to develop additional groundwater resources. No local area has been identified in the GGRB with enough depletion (or "mining") of groundwater resources to warrant the establishment of a groundwater control area. Some observed decline in groundwater levels, ranging from a few feet to tens of feet, occurred across Wyoming and adjacent states during the eight-year regional drought of 1999–2007.

Groundwater quality varies widely in the GGRB, ranging from good to poor. Specific constituents and parameters exceed USEPA drinking water standards in many GGRB aquifers. Groundwater quality constraints in most of the Wyoming GGRB will generally limit new water well construction to depths of 1,000 feet or less into the Tertiary, Mesozoic, and Paleozoic aquifers. This means that groundwater development generally will be limited to aquifer outcrop areas, or near them, depending on structural dip.

Contamination of groundwater is a concern. Many former locations of underground storage tanks for gasoline, diesel fuel, or oil show evidence of subsurface leakage into groundwater from the tanks and associated underground pipelines. Energy development activities that could contaminate local groundwater resources require careful monitoring.

It is difficult to predict the chances of developing a new high-yield well with good-quality water in the Wyoming GGRB. Tertiary-age conglomerate, conglomeratic sandstone, and medium- to coarse-grained sandstone lithologies that are relatively free of fine-grained (clay-silt-mud) material are the best lithologies for construction of high-yield wells. Some members, some tongues, and the main body of the Wasatch Formation, and the Battle Spring Formation in the Great Divide Basin, contain these favorable and highly permeable gravel/sand lithologies. Additionally, Mesozoic and Paleozoic aquifers may be developed in their outcrop areas or within a few miles of outcrop, where the aquifers may be shallow enough and have acceptable water quality for a desired use.

On the basis of many assumptive numbers from disparate sources and sundry times, we have borrowed or generated tentative estimates – many of them average values representing wide ranges – of groundwater recharge, discharge, available storage, and current use in the Wyoming GGRB. Flow regime, a basic parameter for accurate water balance assessment, has not been addressed because we have no data (although adequate flow is implicit in the identity of a "major aquifer").

From estimates given in Chapters 3 and 4 for the modeled Tertiary aquifer system to a depth of 1,000 feet and then for the available groundwater in the GGRB in general:

Available storage (Ch. 4)	75,200,000 acre-ft
Annual recharge (Ch. 4)	130,000 acre-ft/yr
Annual discharge (Ch. 4)	129,000 acre-ft/yr
Annual use (Ch. 3)	8,000–16,000 acre-ft/yr

we can derive:

Annual groundwater deficit
= (annual discharge + annual use) - annual recharge
= 7,000–15,000 acre-ft

With respect to the Tertiary aquifer model as defined in Chapter 4 [a plate 13,000 square miles in surface area by 1,000 feet in thickness, of which 950 feet is saturated], this 7,000 to 15,000 acre-feet per year represents about 0.01 percent to 0.02 percent of the estimated available groundwater stored in the GGRB, and depression of the groundwater surface of about 1 to 2 inches per year. (This rate of groundwater level depression would be masked by a gradual depression caused by drought, such as our regional 1999–2009 drought).

If these conclusions are the best we can generate at present, they are clearly not sufficiently reliable for use in planning because (1) they are averaged over great areas; (2) they are based on data from different times with no way to extrapolate them to present time; (3) the data sets are incomplete; and (4) the effect of drawdown on recharge is not considered. Lack of data on groundwater production seriously affects the unreliability of our conclusions. Therefore, the most valuable contribution to the reliability of future revisions of this memorandum would be accurate annual inventories of groundwater production and use.