Progress Report:

Yellowstone Controlled Groundwater Area
Technical Oversight Committee (TOC)
1994-2000

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Background

The Yellowstone Controlled Groundwater Area (YCGA) was established on January 31, 1994 under the Reserved Water Rights Compact between the U.S. National Park Service and the State of Montana (Montana Water Law: MCA 85-20-401) (Figure 1). The purpose of the YCGA is to monitor and regulate groundwater development adjacent to Yellowstone National Park in an effort to preserve its natural hydrothermal features. Applicants wishing to appropriate water in the YCGA must apply for a Permit for Beneficial Water Use from the Montana Department of Natural Resources and Conservation and have a meter installed to measure total volume of water used. Specific criteria for issuing permits depend on the temperature and amount of the water to be appropriated.

Special Additional Requirements for Permits for Beneficial Water Use in the YCGA

Temperature <60° F

- a permit is required before water from a well pumping <35 gpm or <10 acre-ft/yr can be put to use
- an interim permit is required before a well intended to pump >35 gpm or >10 acre-ft/yr can be drilled
- a provisional permit is required before water from a well intended to pump >35 gpm or >10 acre-ft/yr can be put to use

Temperature >60° F but <85° F (applicant must meat the following criteria to obtain a permit)

- water temperature is the result of the normal thermal gradient of the earth, plus the mean annual air temperature at the site, plus 14° F
- concentration of soluble chloride is less than 10 ppm
- well does not contain a production zone within the Madison Group of formations

Temperature >85° F

- prepare application for permit that contains credible information that the proposed appropriation does not include contribution by hydrothermal discharge water
- application for permit is reviewed and approved by the YCGA Technical Advisory Committee
- a contested-case hearing is held with the application approved by the hearings officer

The compact established a Technical Oversight Committee (TOC) to review scientific evidence related to the YCGA, to advise on administration and monitoring activities, and to recommend modifications to boundaries and restrictions. Members of the TOC are from the U. S. National Park Service, the U.S. Geological Survey, the Montana Department of Natural Resources and Conservation, the Montana Bureau of Mines and Geology, and the Montana University System. The other members select an additional member at large. The purpose of this report is to describe the activities of the TOC since the inception of the YCGA.

The roles of the agencies represented on the TOC follow:

Montana Department of Natural Resources and Conservation (DNRC) - administers the YCGA and regulates groundwater appropriations in the YCGA.

United States National Park Service (NPS) – reviews and evaluates applications for beneficial groundwater use in the YCGA.

Montana University System – advises on inventory and monitoring activities in the YCGA.

Montana Bureau of Mines and Geology (MBMG) – mandated by the water rights compact to inventory all groundwater appropriations within the YCGA having a priority data prior to January 31, 1994.

United States Geological Survey (USGS) – conducts hydrologic and geologic studies in the vicinity of the YCGA, including stream flow and water quality monitoring and geologic mapping.

Well Inventory and Baseline Sampling

MBMG, in a cooperative agreement with the NPS, has completed the well inventory of the CGWA (Metesh and Kougioulis, 2000). Standard operating procedures (SOPs) for the collection of field data and sampling were developed by the MBMG. Laboratory analyses were conducted under the U.S. Environmental Protection Agency (EPA) Statement of Work 846.

Information collected from each well that was inventoried included the following:

Location (cadastral and latitude/longitude)
Current well owner/user
Water Temperature
pH
Specific Conductance
Chloride concentration (field determination)
Well flow rate or pump capacity
Pumping and static water level

In addition to the inventory, samples were collected from a representative number of wells based on well depth, aquifer type, water temperature, chloride concentration, and geographic distribution. Laboratory analyses conducted by the MBMG Analytical Division included major cations, major anions, trace elements, and ^{222}Rn. Isotopes, including ^{18}O, ^{3}H, ^{2}H, and ^{3}He, were analyzed by other laboratories. All of the information gathered during this inventory and baseline sampling, including well logs, are available through the MBMG Ground-Water Information Center (GWIC) as hard copy or via the Internet at: http://mbmggwic.mtech.edu.

Water Permitting Activities

Permits for the use of groundwater issued in the YCGA through the Bozeman DNRC Office from January 31, 1994, the effective date of the compact, through December 31, 2000 are

summarized by year and drainage basin in tables 1 and 2. No permits have been issued in the YCGA for water warmer than 60°F, however several permits have been issued in the Corwin Springs area for water warmer than 55°F; temperatures in these wells will be monitored periodically to detect changes.

There has been a notable drop-off in permit activity since 1998, although there is no indication that development in this part of the state is actually slowing. DNRC is currently comparing the numbers of permits to the numbers of well logs received by the Montana Bureau of Mines and Geology to investigate the reason for the drop-off in permitting activity. In addition, DNRC has developed a Geographic Information System Project to assist in tracking well and spring information (see information box below).

Table 1. Applications Received By Year:

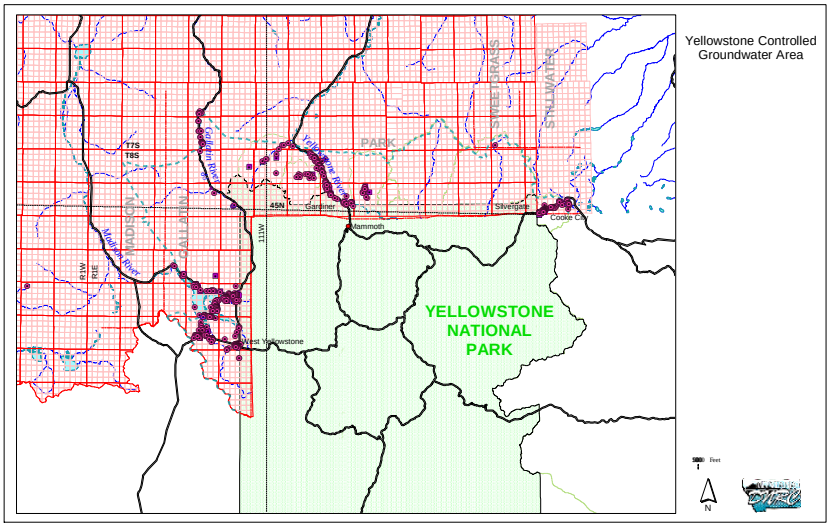
1994 - 35
1995 - 23
1996 - 26
1997 - 29
1998 - 20
1999 - 16
2000 - 7

Table 2. Applications Received By Basin:

Madison/Gallatin (West Yellowstone) – 86
Gardiner (YNP to Tom Miner Basin) – 45
Silver Gate/Cooke City – 25

YCGA GIS Project

The YCGA GIS Project was created for the Bozeman, Montana office of DNRC to assist in tracking well and spring information within the YCGA. The project has two main components: 1) an Access 97 database of well/spring information, and 2) a customized ArcView GIS project. Basic database functions include the ability to enter data, query data and create reports. The GIS is linked to the database so that any new or updated information is automatically displayed within the GIS. The basic GIS functions include the ability to query a specific DNRC Water Right number from the associated database, zoom the display to the selected Right, label the Right, toggle between scanned USGS 7.5 minute topographic maps and scanned Digital Orthophoto Quads, and print a well/spring report containing site information and a map showing the location of the site. The project also has all the traditional tools and functionality available in ArcView.



Proposed Long-Term Monitoring Program

Section H.2.a of Article IV of the Water Rights Compact between the State of Montana and the National Park Service (Compact) provides for a ground-water monitoring program to be implemted by the Montana Bureau of Mines and Geology (MBMG) in consultation with the TOC. This section further states that the Working Group Report (Custer and others, 1993) will be used as a guide for selection of sampling sites and frequency until superseded by the TOC. In addition, Section H.2.b states that the MBMG shall maintain a database on the YCGA.

Pursuant to the requirements of the Compact, the TOC has identified minimum monitoring needed to meet the objectives of the Compact. The TOC makes the following recommendations based on: a) the YGWA Compact, b) the Working Group Report, and c) information collected in the recent well and spring inventories:

MBMG proposes to monitor all wells with water temperatures greater than $15^{O}C$ ($59^{O}F$). Data to be collected at each site shall include:

1) water levels by continuous recorders
2) field specific conductance
3) field pH
4) water temperature
5) field alkalinity
6) chloride
7) field oxidation-reduction potential

Field parameters (items 2 through 7) shall be collected three times per year since winter access is too difficult and costly to allow quarterly measurements. The measurements will coincide with the required maintenance of the continuous recorders. Initially, samples for both field- and lab-chloride determination will be collected from all wells. When sufficient data is collected, the TOC and the MBMG will select a preferred method of analysis. The TOC requested MBMG to select 5 additional wells with water temperatures less than $15^{O}C$ ($59^{O}F$) for the same monitoring. The "cold water" sites will provide base-line responses to climatic and anthropogenic changes. At present there are 10 wells with water temperatures greater than $15^{O}C$ ($59^{O}F$). Thus, a total of 15 wells will be monitored.

All springs with water temperatures greater than $15^{O}C$ ($59^{O}F$) shall be monitored. Data to be collected at each site shall include:

1) discharge by flow metering devices
2) field specific conductance
3) field pH
4) water temperature
5) field alkalinity
6) chloride
7) field oxidation-reduction potential

Flow monitoring will require the installation of a flume, weir, or similar device and a continuous recorder at each site. Procedures proposed for monitoring of springs are similar to those for wells. Field parameters (items 2 through 7) shall be collected three times per year coinciding with the required maintenance of the continuous recorders. Initially, samples for

both field- and lab- chloride determination will be collected from all springs. When sufficient data is collected, the TOC and the MBMG will select a preferred method of analysis. The TOC requested the MBMG to select five additional springs with water temperatures less than $15^{O}C$ ($59^{O}F$) for the same monitoring. The "cold water" sites will provide base-line responses to climatic and anthropogenic changes. At present, there are 15 springs with water temperatures greater than $15^{O}C$ ($59^{O}F$). Thus, a total of 20 springs will be monitored.

Purchase and installation of monitoring equipment will require a significant capital investment. The TOC recommends that the program be phased in over a five-year period in order to reduce annual costs. Each year, data will be collected three times-per-year from the 35 sites and about seven sites would be instrumented. The annual monitoring costs would increase each year as sites are added. Thus the annual cost will shift from installation to monitoring over the five-year period. At the end of the five-year period, the annual cost of monitoring, repair/replacement of equipment, and the increase or decrease of the number of sites can be evaluated.

As required in the Compact, the MBMG shall maintain a database containing information gathered during the inventories and subsequent monitoring. In addition, the MBMG shall continue to request flow-meter readings from new (priority dates after January 31, 1994) well owners with the assistance of the Montana Department of Natural Resources and Conservation and maintain a database of the annual meter readings received from the well owners.

Recommendations

The Yellowstone Reserved Water Rights Compact was established to protect the geothermal resources of Yellowstone National Park. Long-term monitoring of wells and springs, both within the YCGA and the Park, is necessary to assess impacts of future development on the Park's ground-water and surface-water resources. In addition, monitoring flow and water chemistry of rivers flowing from the Park into the YCGA would provide valuable insight into the natural variability of geothermal activity and any changes attributable to future development. Rivers that should be monitored include the Gardiner and it's two upstream tributaries near the high bridge, the Madison River at the west boundary and the Gibbon and Fire hole rivers above their confluence.

Dr. Steven Custer, Chairman

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