Proposed

Ground Water Investigation Program

(LC5007)

Design Summary

John Metesh
Montana Bureau of Mines and Geology

Design elements of GWIP (compiled):

- project **duration** (1 to 3 years),
- level of **effort** (budgeting),
- project **area** (identification of sub-basin),
- topical areas of interest within each investigation might include:
  - changes in land use - agriculture
    (reduction, flood to sprinkler, subdivisions)
  - existing and planned/proposed subdivisions
  - managed underground storage and recovery
    (ASR, AR, return flow, etc.)
  - special water quality concerns associated with local land use,

- **cumulative** effects of ground-water and surface-water development,
- ground-water flow, transport, and/or geochemical **modeling** as appropriate.

****** stream depletion and offset ******

Ground Water Investigation Model

Statement of Work:
- description of sub-basin area,
- objectives of investigation
  - (stream depletion, but there are others),
- products (data, models, reports)

Data Quality Objectives:
- enforcement quality …. screening quality

Work Plan:
- Report of Investigation based on:
  - sampling and analysis plan – what and when
    - field work – physical (wells, p-tests, flow, etc)
    - field work – chemistry (basic, isotopes, pharm etc)
    - modeling (analytical/numeric, flow/chemistry/transport)
    - analyses/interpretations and report(s)
- feasibility* study – what if
  - potential responses under the range of conditions for a range of stresses

*feasibility is **not** a decision

The steering committee (2-15-1523) will prioritize investigation areas based on:

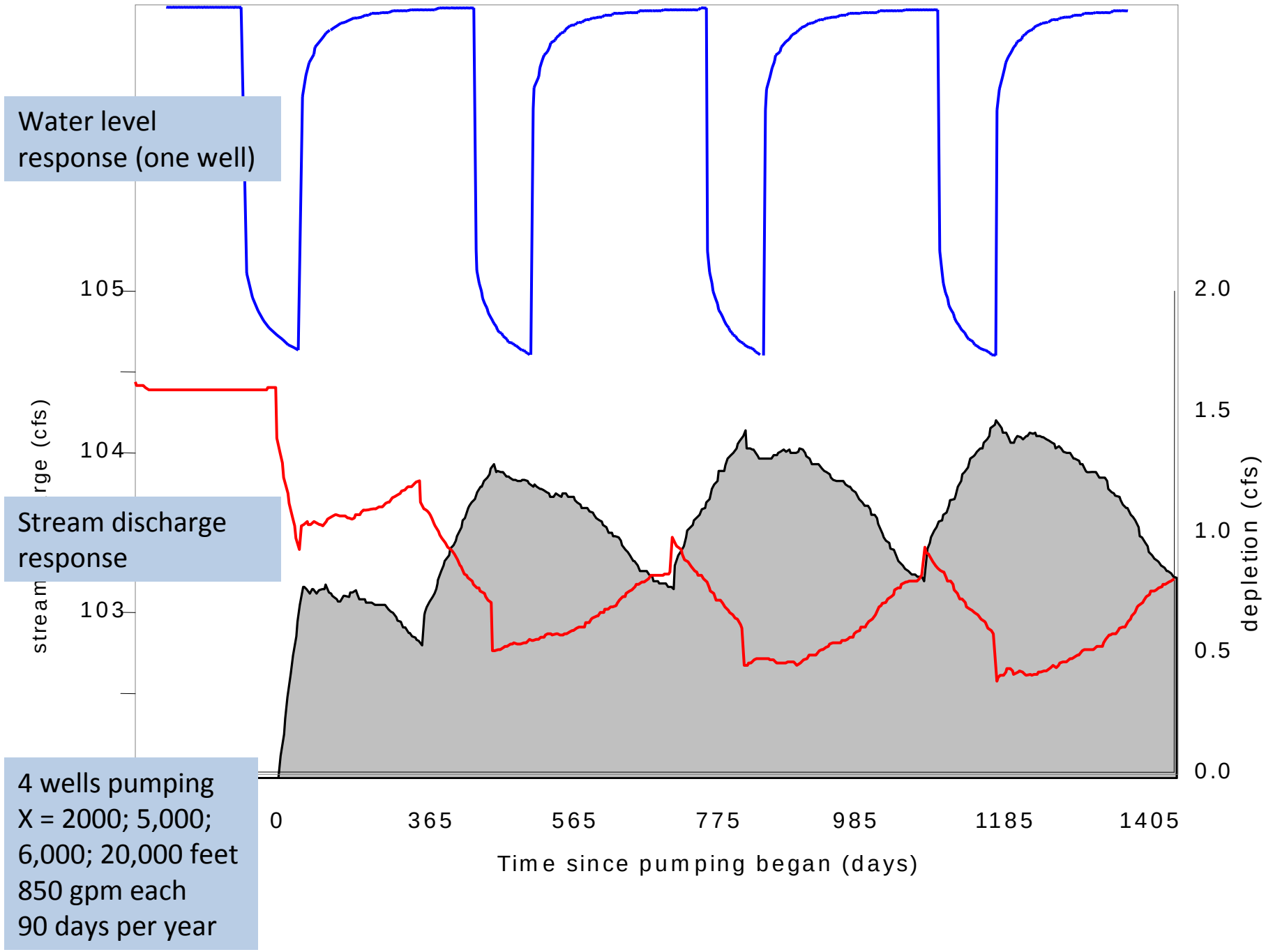
- current and anticipated growth of agriculture, housing, and/or municipal/commercial activities

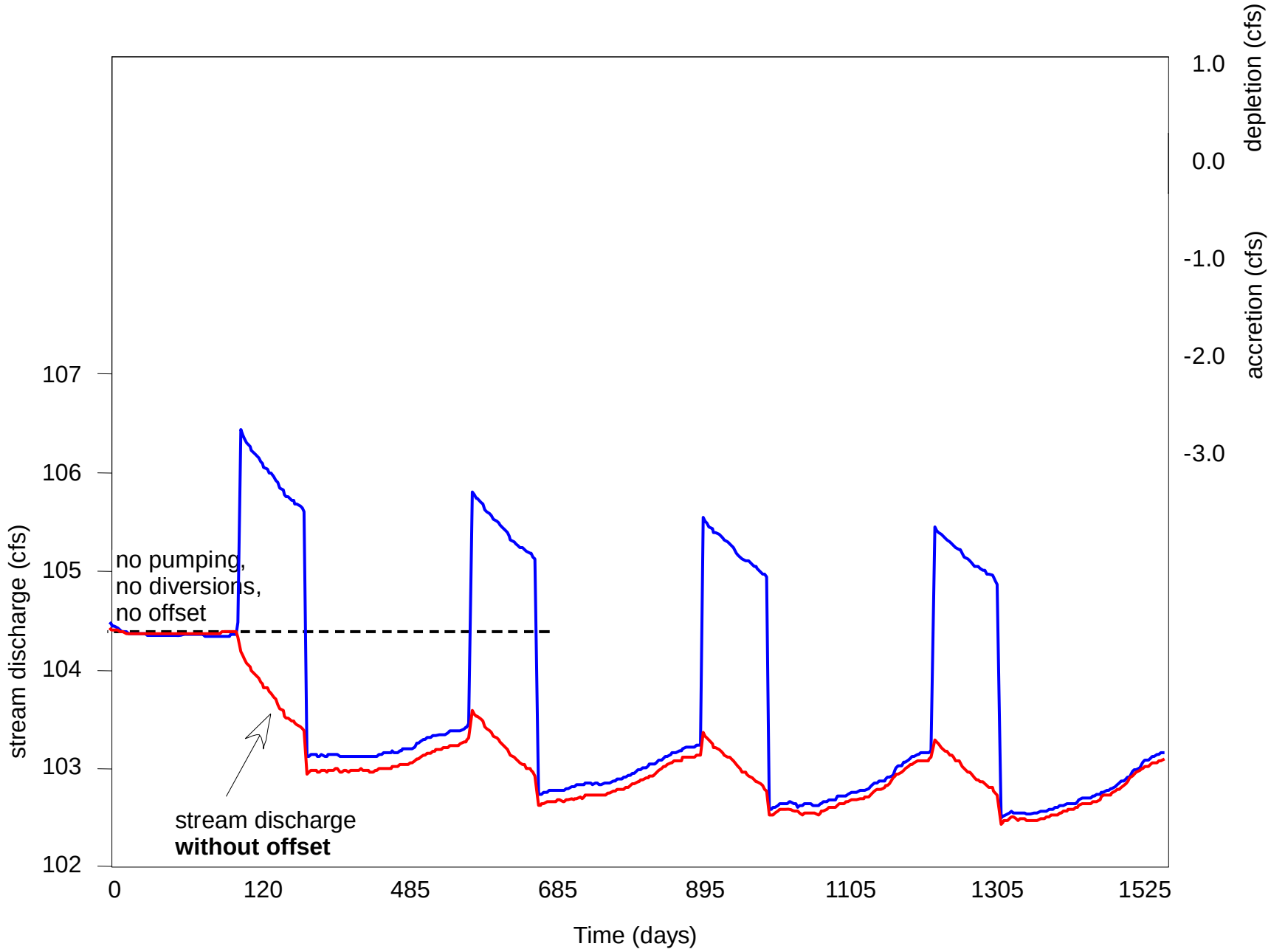
- applications for (but not limited to)
  - •subdivisions,
  - •non-exempt wells,
  - •water treatment systems,
  - •aquifer storage recovery,
  - •controlled ground water areas

- potential ground water quantity and/or quality issues

  (not already addressed by other programs)

for example?


Water level response (one well)
Stream discharge response
4 wells pumping
X = 2000; 5,000; 6,000; 20,000 feet
850 gpm each
90 days per year
105
104
103
rge (cfs)
stream
2.0
1.5
1.0
0.5
0.0
depletion (cfs)
0
365
565
775
985
1185
1405
Time since pumping began (days)


stream discharge (cfs)
107
106
105
104
103
102
depletion (cfs)
accretion (cfs)
1.0
0.0
-1.0
-2.0
-3.0
no pumping,
no diversions,
no offset
stream discharge
without offset
0
120
485
685
895
1105
1305
1525
Time (days)

Beaverhead River example

RI draft completed

Feasibility Study in progress

Feasibility Study: mitigation / aquifer recharge strategies

- flood to pivot combined with
- use of canals (but not flooding) for offset
  optimum timing and location of recharge

- change in pumping rates / timing

- kill the @$#%& willows

Products (for each investigation)

Detailed report / publication
- SOW
- DQOs
- WP
- RI/FS

Data (GWIC)
- logs
- water quality
- water levels
- aquifer tests

Model files (with “metadata”)
- Analytical
- MODFLOW, GSFLOW, TRAFRAP
- PHREEQE/MINTEQ/WATEQ

ROCKET SURGERY?

If not now…when

Infrastructure

The proposed ground water investigation program will be very much dependent on existing programs in the MBMG. The Ground Water Assessment Program (comprised of the Ground Water Information Center [GWIC] database, Ground Water Characterization Program, and Ground Water Assessment Monitoring), the state wide geologic mapping program, individual long-term monitoring programs, and independent investigations comprise a robust infrastructure that has been in place for many years.

Ground Water Information Center (GWIC) database

The GWIC online database is one of the most comprehensive sources of information related to ground water in Montana. Water well location, lithology, and construction are available from this searchable online database. For over 30 years, MBMG projects related to ground water have contributed water quality and water level data to the database that contained data for over 200,000 water wells including more than 35,000 water-quality analyses at about 15,000 sites in Montana.

Ground Water Characterization Program

The need for investigations of large areas encompassing one or more watersheds is met through the existing program. Water balance, well inventory and baseline sampling, water-level and water-quality monitoring at selected sites throughout the area are compiled by the GWCP.

MBMG Long-term monitoring programs

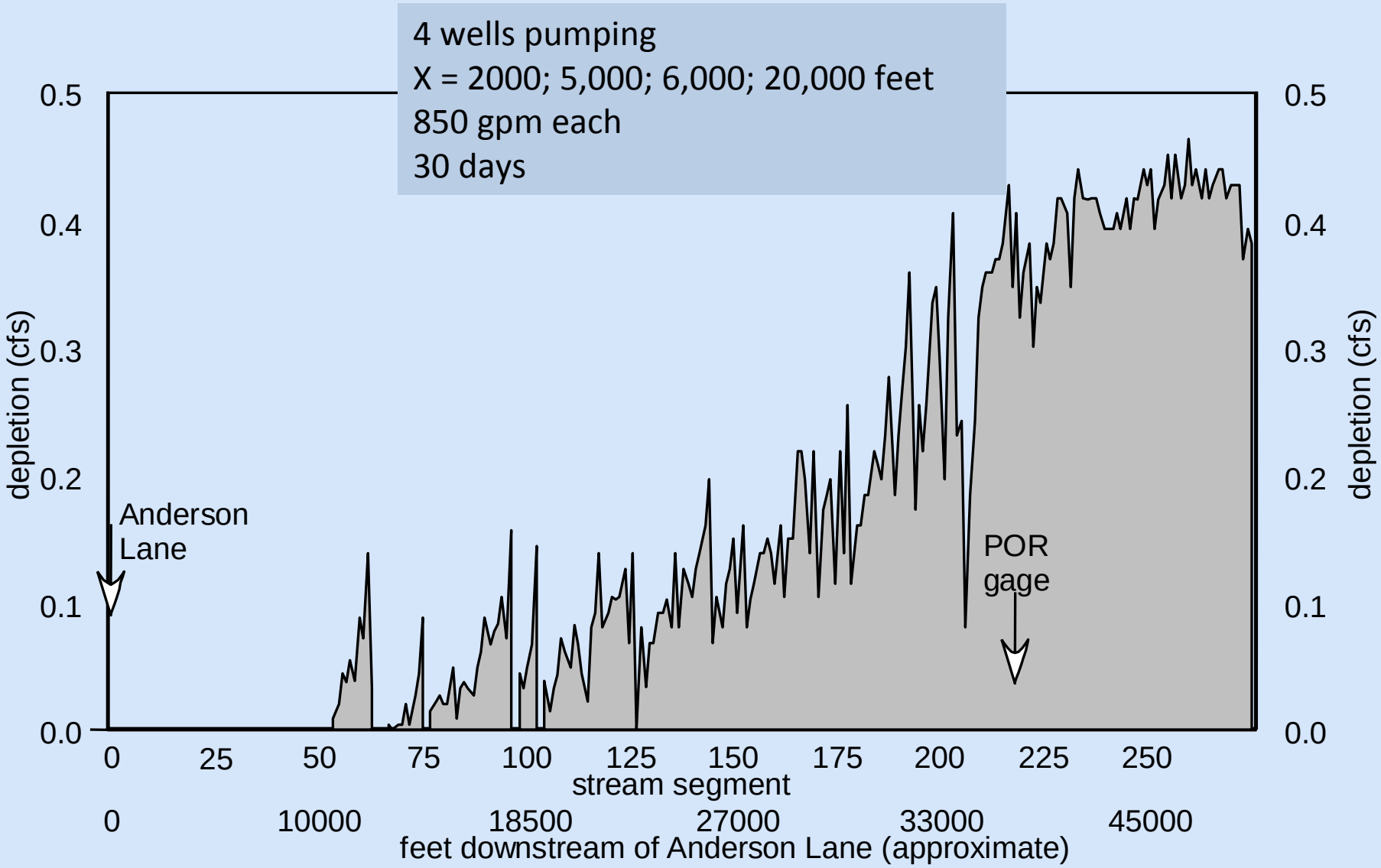
The MBMG has several long-term monitoring programs that include the Ground Water Assessment state-wide monitoring of wells, the Yellowstone Controlled Ground-Water Area monitoring of wells and springs, the Powder River Basin mining and coalbed methane monitoring of wells and springs, and the upper Clark Fork Superfund monitoring of mines, wells, and surface water. The new program will take advantage of these and other monitoring programs conducted other State and Federal agencies, it will contribute short-term monitoring data for each area of investigation, and will provide a monitoring design for each area.

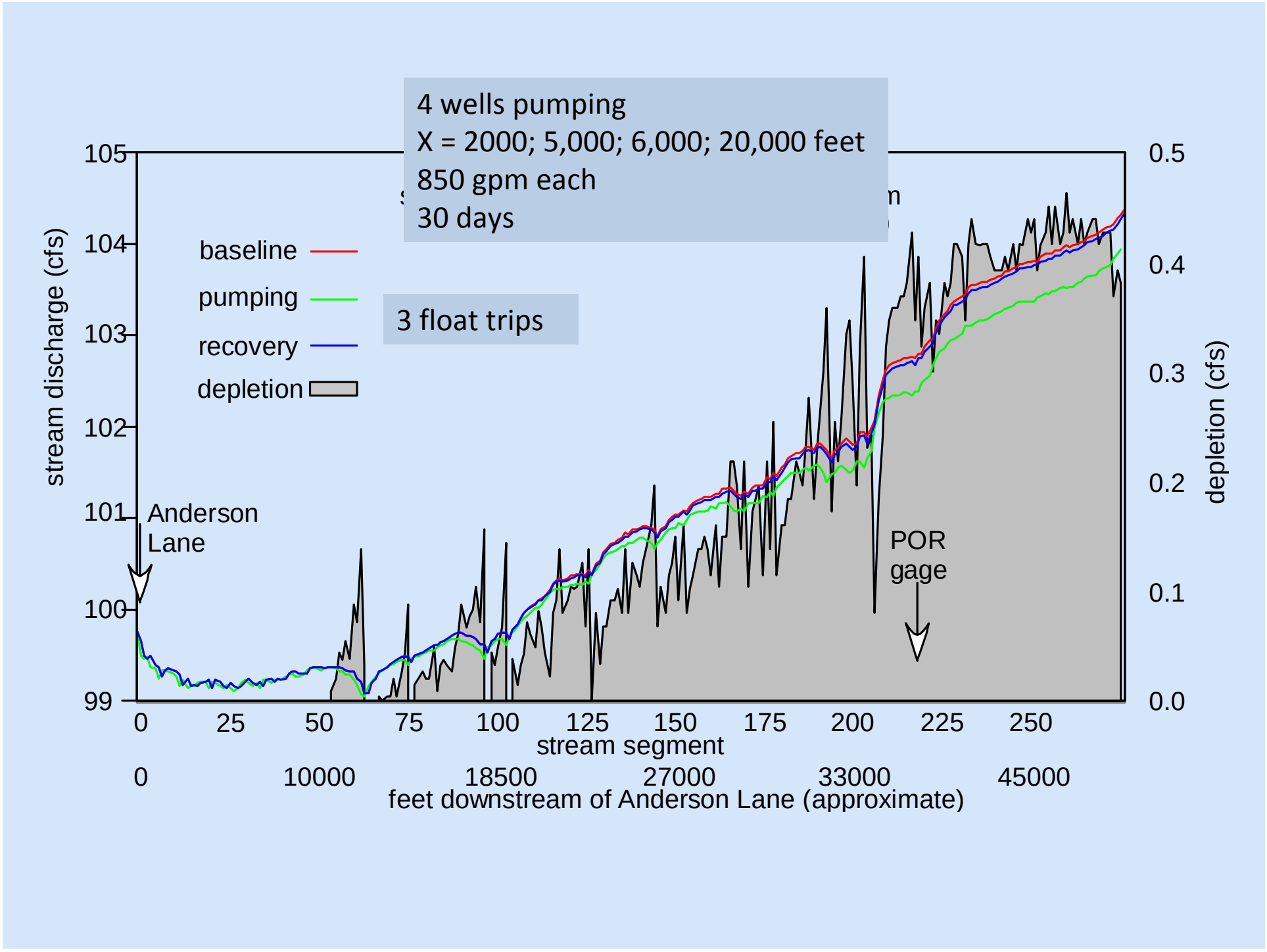
Individual investigations

The MBMG is funded by State (DNRC, DEQ, NRDP) and Federal Agencies (USGS, USFS, BLM, NPS, NRCS) to conduct geologic and hydrgeologic investigations throughout the state. These investigations are often limited in scope and area, but contribute a great deal of information.

STATEMAP geologic mapping program

The MBMG has successfully applied for annual support from the USGS for geologic mapping at various scales throughout Montana. Although the need for very specific mapping of small areas may be needed, the geologic setting of the Montana's watersheds are well documented in geologic maps available through the MBMG - most as digital products.


4 wells pumping
X = 2000; 5,000; 6,000; 20,000 feet
850 gpm each
30 days
depletion (cfs)
0.5
0.4
0.3
0.2
0.1
0.0
Anderson Lane
POR gage
0
25
50
75
100
125
150
175
200
225
250
stream segment
0
10000
18500
27000
33000
45000
feet downstream of Anderson Lane (approximate)


4 wells pumping
X = 2000; 5,000; 6,000; 20,000 feet
850 gpm each
30 days
3 float trips
baseline
pumping
recovery
depletion
Anderson Lane
POR gage
stream discharge (cfs)
depletion (cfs)
105
104
103
102
101
100
99
0.5
0.4
0.3
0.2
0.1
0.0
0
25
50
75
100
125
150
175
200
225
250
stream segment
0
10000
18500
27000
33000
45000
feet downstream of Anderson Lane (approximate)