Ground-Water Investigation Program
June 21, 2011 Update

Presented by
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http://www.mbmg.mtech.edu/gwip/gwip.asp
Water Policy Interim Committee
June 21, 2011

Subjects for Today:

- Review of GWIP
- Status of 2010-2011 projects
- Projects for 2012-2013
- A few of the lessons we have learned so far

Review of GWIP

The Problem Statement

Why was it formed?

Specific issues have been identified that need a unified Statewide approach

Impacts to aquifers from expanding demand (more wells)

Protection of senior water rights

Stream depletion - Groundwater management

Water quality impacts

Implementation of **aquifer storage and recovery** (ASR) in Montana

Others

The Solution

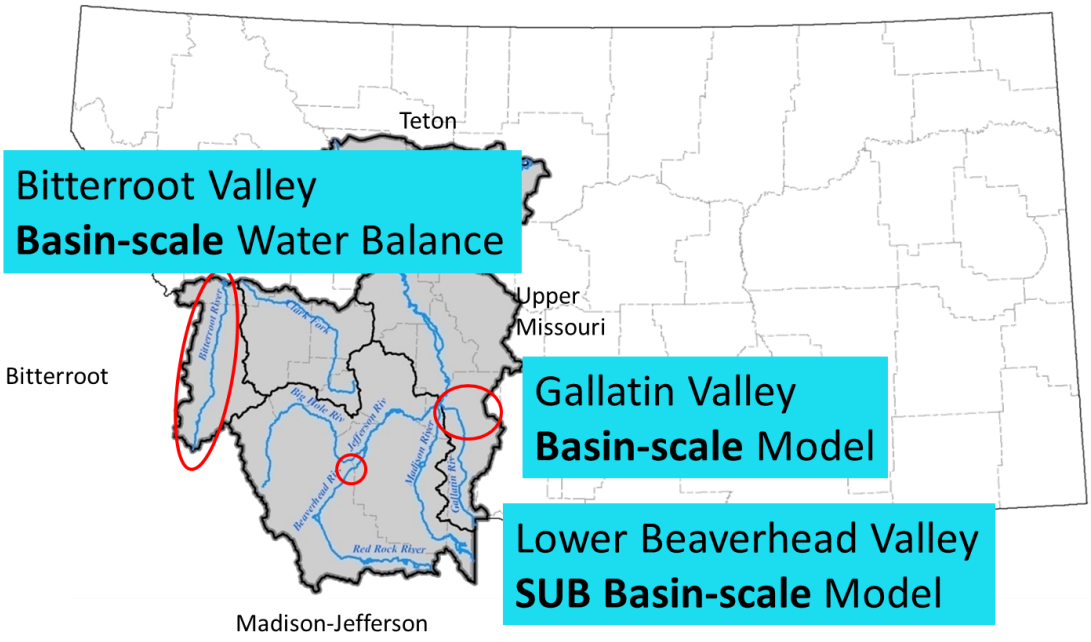
Step One:

House Bill 831 (60th Legislature)

Funded three case studies

One – Time – Only

Provided updates to newly formed WPIC



The approach used in HB 831 studies worked

Results continue to be used

Demonstrated that a long-term program would be beneficial

But now there was a list of 39 projects

Step 2:

Montana 61st Legislature

House Bill 52

Formed the Ground-Water Investigation Program (G W I P)

Proposed and supported by WPIC

Recognized need for small and intense studies in a structured program

Statewide and ongoing

Funded to complete 7 studies in first Biennium

Local,
sub-basin,
very intensive,
very focused
Investigate specific groundwater questions

Ground-Water investigation Program

How it works:

Problem identified locally

Nominated to Ground Water Steering Committee

Projects ranked each biennium

Top 10 authorized to MBMG GWIP

Assign teams and design work plans in coordination with local groups

Update WPIC quarterly during Interims

At end of project, publish results

Steering Committee: Assigns GWIP Projects

Voting members:
DNRC
DEQ
Dept of Agriculture
State Library

Ex officio members from:
(a) the legislative services division;
(b) the board of oil and gas conservation;
(c) the bureau of mines and geology;
(d) a unit of the university system,
(e) a county government,
(f) a city, town, or city-county government,
(g) principal federal agencies

Governor appointees:
(i) agricultural water users;
(ii) industrial water users;
(iii) a conservation or ecological protection organization;
(iv) the development community

Ground-Water investigation Program

Project Approach:

Refine Problem Statement
Design Work Plan
Data Collection
Interpretation
Report publication
GWIC
All results and data are immediately public

Results:

<u>Science for decision making input for resource optimization</u>

A far better and detailed understanding of the hydrogeologic system

Computer Model files passed on to other users

Hydrogeologic data available through the MBMG

Ground-Water Information Center (GWIC)

All results and data are immediately public

Peer reviewed, published reports

Project reports

Project dependent:

Interpretive report; modeling report; plus data/technical report

Or together as a single volume

All will be released as MBMG publications

released first as OFR

some will then be replaced as formal publication

Electronic versions, GWIC data

Report reviews: all will be reviewed
internal GWIP, MBMG, editorial

A brief chronology of GWIP during the first biennium:

2010-2011 Biennium - A review

Budget - $4,200,000 per biennium
7 projects assigned in September, 2009
Started 5 then, and 2 more through January, 2010
OTO threat
500K budget cut
New Budget - $3,700,000 per biennium ($1,850,000 per year)
Met with Steering committee
Chose to continue all 7 anyway
OTO concern continues

2011 Legislature –

OTO concern is removed
Base budget is now set at $1,358,259 per year ($2,716,518 per biennium)
Two annual fixed budgets – not a lump, 2-year budget
Reduced flexibility that we would like to fix next session

Projects: July 2009 – June, 2011

Ground Water Investigation Program
Projects
Biennium 2009 - 2010

25-Sep-09																						
GWIP Prioritization Matrix																						
Name	**RANKING**	**Subdivision**	**New wells**	**Closed Basin**	**Sprinkler**	**Water quality**	**Industrial**	**Agricultural**	**Population**	**Water class**	**Information**	**Complexity**	**Growth plan**	**Contentious**	**Ecological**	**Mitigation**	**Aquifer systems**	**Efficiency**	**Diversity**	**Controlled area**	**Match**	**SCORE**
		rank 1-5	rank 1-5	5=Yes 1=No	rank 1-5	5=Yes 1=No	rank 1-5	rank 1-5	rank 1-5	rank 1-5	rank 1-3	rank 1-3	5=Yes 1=No	5=Yes 1=No	5=Yes 1=No	1=Yes 3=No	basin=1 bedrock =2 both=3	no = 0 parrelel = 3	Complex=3 simple=1	5=Yes 1=No	Attract match= 3, no=0	
North Hills	1	4	4	5	2	5	1	2	5	3	3	3	1	5	1	3	3	3	3	5	3	64
Four Corners	2	4	4	5	5	5	1	3	5	3	2	2	1	5	1	3	1	3	3	1	3	60
Belgrade	3	4	4	5	5	5	1	3	5	3	1	2	1	5	1	3	1	3	3	1	3	59
Lower BH River West	4	1	2	5	5	1	1	5	1	3	3	3	1	5	5	3	3	3	3	1	3	57
Scratch Gravel Hills	5	4	4	5	2	5	1	1	5	3	1	3	1	5	1	3	3	3	3	1	3	57
Florence	6	4	4	5	5	1	1	4	3	3	2	2	1	5	5	3	3	3	2	1	0	57
Flathead Valley	7	4	4	1	3	1	1	4	5	3	3	3	1	5	5	3	3	3	2	1	0	55

Projects: July 2009 – June, 2011

1. North Hills – Technical work and computer model completed, **report is in review**

2. Four Corners – Finishing computer modeling and preparing report for review

3. Belgrade – Finishing computer modeling and preparing report for review

4. Lower Beaverhead River West – Finishing computer modeling, the next report for reviewers

5. Scratchgravel – Technical work and computer model completed, **report is in review**

6. Florence – Delayed startup, transient computer modeling is nearing completion; report writing will be in late summer.

7. Flathead Valley deep aquifer – Delayed startup, final field work is finishing now, report writing and review in late summer and early fall.

Projects: July 2011 – June, 2013 Top ten - 4 or 5 will be undertaken

Ground Water Investigation Program
Projects
Biennium 2011 - 2012

9-Sep-10																				
GWIP Prioritization Matrix																				
Name	County	RANKING	Subdivision 2010	New wells 2010	Closed Basin 2010	Water quality 2010	Industrial 2010	Agricultural 2010	Population 2010	Water class 2010	Information 2010	Complexity 2010	Ecological	Aquifer systems 2010	Efficiency 2010	Diversity 2010	Controlled area 2010	Match Funds committed 2010	Matching funds requested 2010	TOTAL SCORE 2010
			rank 1-5	rank 1-5	5=Yes 1=No	5=Yes 0=No	rank 1-5	5=Yes 0=No	rank 1-5	rank 1-5	rank 1-3	rank 1-3	rank 1- 4	basin=1 bedrock =2 both=3	No score (+ or - for tie break)	Comple x=3 simple= 1	5=Yes 0=No	match= 5 no=0	2=Yes 0=No	
Stevensville Bitterroot River	Ravalli	1	3	5	5	5	2	5	2	4	3	2	1	1		3	0	0	0	41
Boulder River Valley	Jefferson	2	1	2	5	5	1	5	1	4	2	2	3	1		2	0	5	2	41
Hamilton	Ravali	3	3	5	5	5	2	5	2	4	3	1	3	1		1	0	0	0	40
Manhattan	Gallatin	4	4	5	5	0	3	5	4	4	1	2	1	3		3	0	0	0	40
Coalbed Methane	Horn/Rosebud/P owder River	5	1	1	0	5	5	5	1	3.5	3	3	2.5	2		2	5	0	0	39
Madison Valley Ennis to Three Forks	Gallatin/ Madison	6	3	3.5	5	5	1	5	2.5	4	2	1	2	1		3	0	0	0	38
North Fork Flathead River	Flathead	7	5	5	0	0	2	0	4	5	1	2	4	2		2	0	5	0	37
West Billings	Yellowstone	8	3	4	0	5	1	0	5	4	3	2	1	1		2	0	5	0	36
Townsend, Toston	Lewis&Clark/ Broadwater	9	3	3.5	5	5	1	5	2	4	1	2	2.5	1		1	0	0	0	36
Big Sky	Gallatin/ Madison	10	4	3.5	5	5	1	0	2.5	4	1	3	2.5	2		2	0	0	0	35.5

2012 – 2013 Biennium

2011 Legislature – Base budget is now set at $1,358,259 per year
($2,716,518 per biennium)
Two annual fixed budgets – not a lump, 2-year budget
Reduced flexibility that we would like to fix next session

Projects:

Staggered start up, due in part to 2010 budget cuts and delayed starts.
Allow more efficient processing and report reviewing.
Not all projects are equal duration.

Starting Now –
Stevensville – Evaluations to prepare for replacing surface water withdrawals with groundwater.

Boulder – Groundwater / Surface-water interaction, and possible ASR

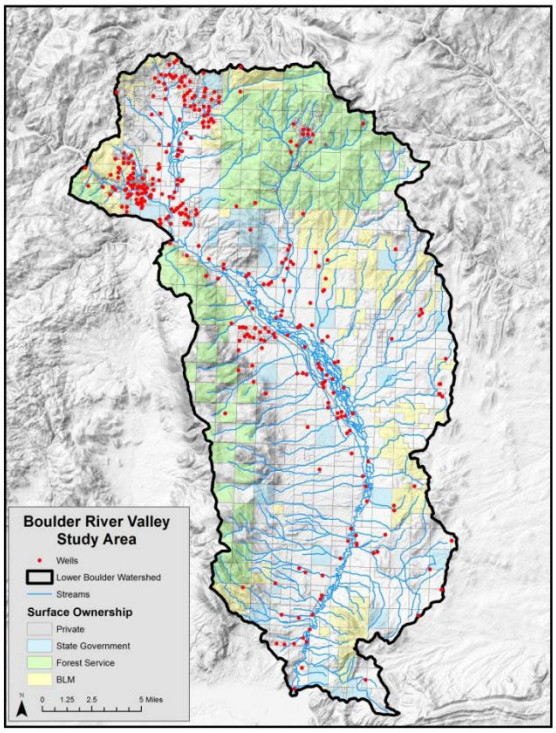
Manhattan / Church Hill – Groundwater / surface-water interaction, land use changes, irrigation wells

Start October, 2011 –
Hamilton – Land use changes, decrease in irrigation recharge, groundwater availability

Start July, 2012 –
Coalbed Methane – Develop modeling for potential aquifer drawdown for CBM development scenarios

Boulder River Valley Groundwater Investigation:

The Montana Bureau of Mines and Geology (MBMG) Groundwater Investigations Program (GWIP) has been asked to conduct a groundwater study of the Boulder River Valley. The purpose of GWIP is to investigate specific local groundwater issues. More information on GWIP is available at http://www.mbmg.mtech.edu/gwip/gwip.asp.



It is believed that the alluvial aquifer of the Boulder River provides baseflow to the Boulder River. In its current state, the Boulder River often runs dry in the late summer, eliminating the ability to irrigate, even for senior water rights holders. As such, there are concerns that continued approval of exempt wells in the watershed will adversely impact senior water rights holders. The DEQ is also currently developing a TMDL for metals, sediment and temperature in the Boulder River. This GWIP study will examine the flux of water between the alluvium and the river, the magnitude of impacts that would be expected from existing and potential housing developments in the watershed, and the potential for increasing water availability throughout the year. Water quality samples will also be collected from groundwater and surface waters in the study area.

This will be a two year study, running from July 1, 2011 to June 30, 2013. The area of study will be the Lower Boulder River Watershed from Boulder to Cardwell (USGS Watershed 1002000605), with the focus being on the alluvial aquifer along the Boulder River.

For the initial phase of the project, wells will be inventoried, and surface water sites (including on irrigation ditches) will be established. Additional wells may be installed where data is needed. These sites will be used to establish a monitoring network. If you know of a site to include, please let us know.

Contact:
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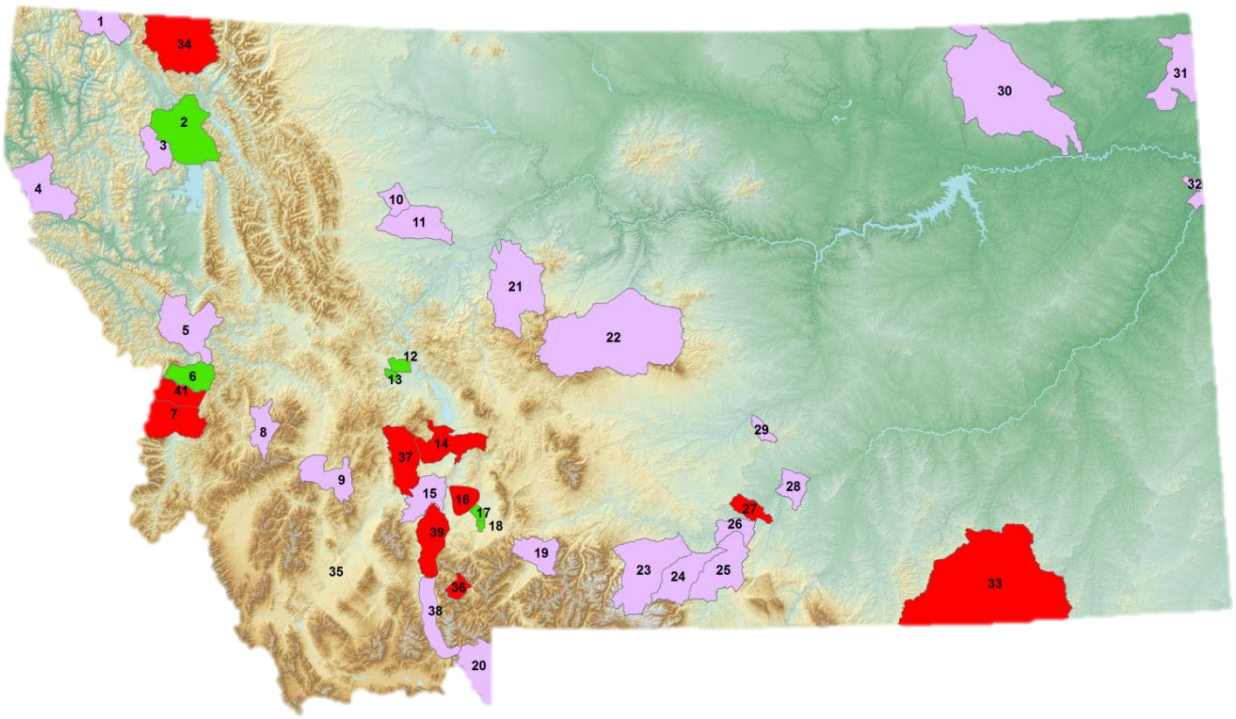
6/17/11

Nominated GWIP Project areas, approximate locations



Map numbers for nominated projects. Green = 2010-2011; Red = 2012-2013; Recent additions are not shown on map.

2 Flathead Valley
6 Florence
12 North Hills
13 Scratchgravel Hills
17 Belgrade
18 Four Corners
35 Lower Beaverhead W.
7 Hamilton
14 Townsend, Toston
16 Manhattan
27 West Billings
33 Coalbed methane
34 NF Flathead
36 Big Sky
37 Boulder River
39 Madison Valley Ennis to Three Forks
41 Stevensville Bitterroot
1 Eureka
3 Smith Valley
4 Noxon
5 Missoula Valley
8 Georgetown Lake, Philipsburg
9 Summit Valley
10 Priest Butte Lk
11 Greenfi eld Bench
15 Three Forks
19 Pine Creek
20 W. Yellowstone
21 Belt, Monarch
22 Little Belt Mts
23 Stillwater Valley
24 Rock Creek
25 Pryor Mts
26 Park City
28 East Billings
29 Roundup
30 Flaxville Gravels
31 Clear Lake
32 Sidney
38 Madison Valley Quake Lake to Ennis
40 Jefferson Valley
41 Yellowstone Park/ Madison Limestone
42 Fox Hills aquifer/Bakken
43 Wise River
44 Shields Valley

Ground Water Investigation Program - Update June 21, 2011

A Few of the Lessons Learned so far

Information from 4 projects:

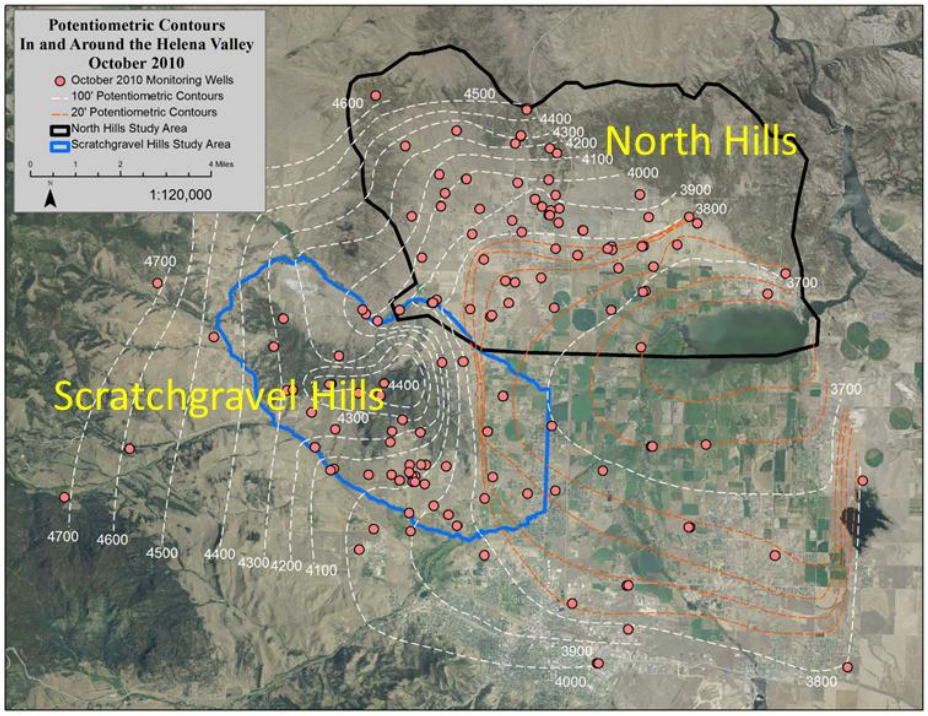
North Hills

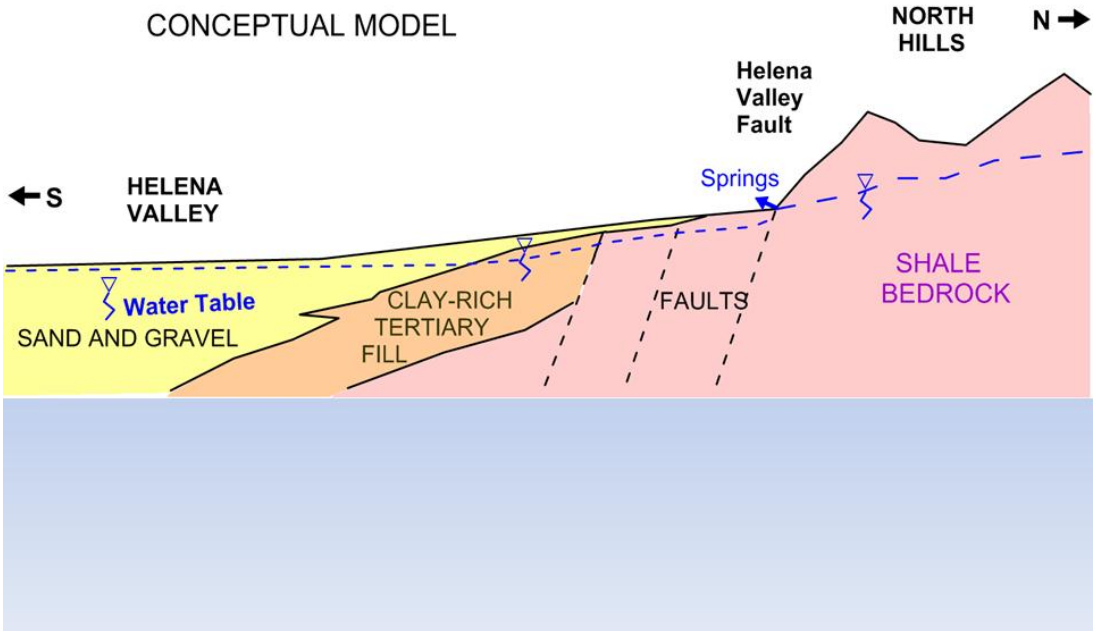
Scratchgravel Hills

Bozeman (Belgrade and Four Corners)

Dillon

Ground Water Investigation - Helena area projects



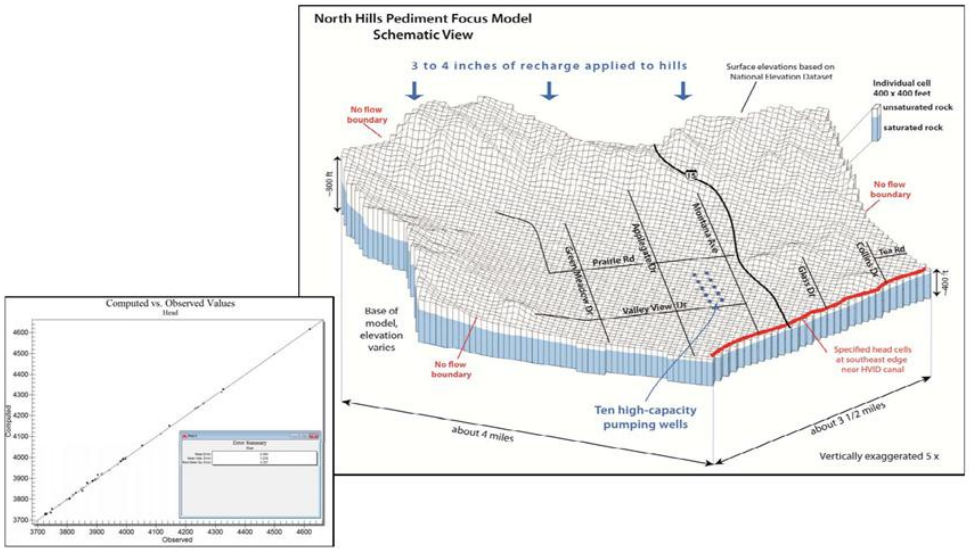


North Hills Groundwater Investigation

- Groundwater flow is from the surrounding Hills to Lake Helena
- Much of the Study Area shows no water level declines
- An area above the Helena Valley Ditch, and immediately west of the Interstate is showing sustained drawdown
- The bedrock aquifers are less productive than Tertiary materials or Quaternary alluvium
- Bedrock faults can form barriers to flow and/or subsurface fractured rock reservoirs
- Groundwater Quality is typically suitable for household use (1 sample exceeded MCL for Nitrate)

North Hills Groundwater Investigation

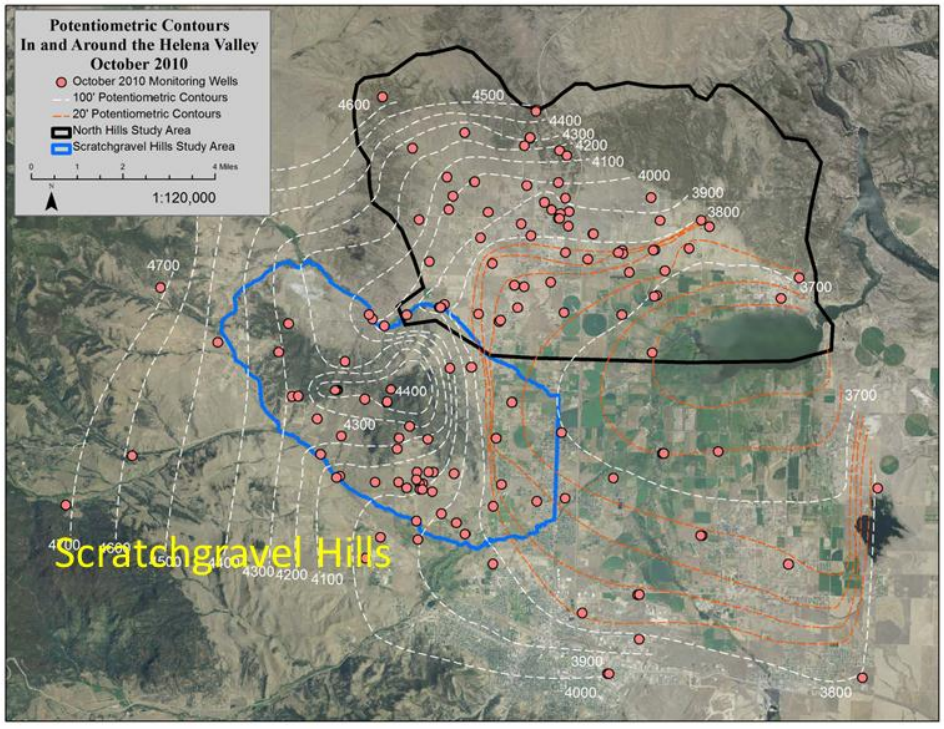
- Groundwater models have been developed for the North Hills



North Hills Groundwater Investigation

- The Groundwater Models Can be Used to:
  - Evaluate the long term effects of existing and proposed development
    - Water availability
    - Size and Magnitude of drawdown cone
    - Impacts to surface water flows (Lake Helena)
    - Contaminate transport
  - Evaluate the potential effects to Groundwater from:
    - Drought
    - Wet periods
    - Changes in Land Use
      - Methods of Irrigation
      - Ditch Management
      - Fields to Houses

Ground Water Investigation - Helena area projects

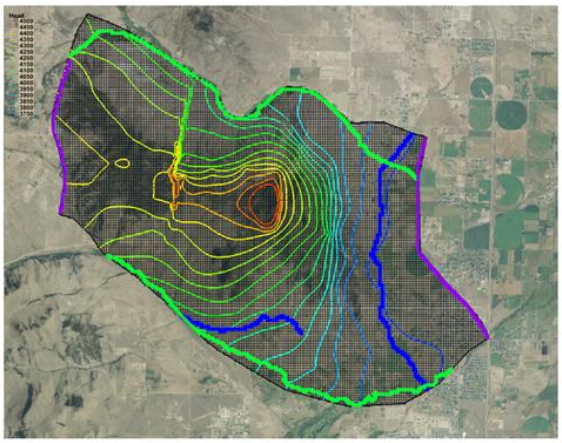


Scratchgravel Hills Groundwater Investigation

- Groundwater recharge for the CGWA is local
- There are not currently areas of water level declines
- Some individual wells have declined; however this appears to be due to poor aquifer conditions and over pumping at each site rather than area wide water level decline.
- The bedrock aquifers are less productive than the Quaternary alluvium. The Helena Formation and the Granite are particularly poor.
- Bedrock faults form barriers to flow
- Groundwater Quality is typically suitable for household use.
  - MCLs exceeded for:
    - Nitrate – Septic (3 sites)
    - Uranium – Alteration near igneous bodies (1 site)
    - Arsenic – Alteration along Bald Butte Fault Zone (1 site)

Scratchgravel Hills Groundwater Investigation

- Groundwater models have been developed for the Scratchgravel Hills
- They show that a high density development in the area of Cornerstone Estates obtaining its water from the bedrock would result in substantial drawdown
- Similar to North Hills, the models will allow for future scenarios to be evaluated.



Belgrade and Four Corners

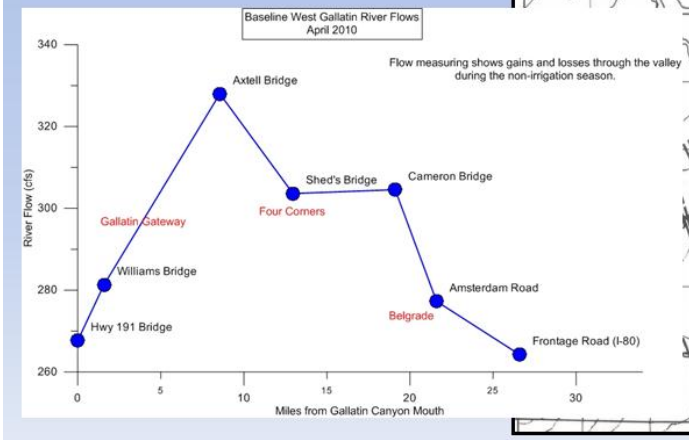
Gallatin Valley Hydrology

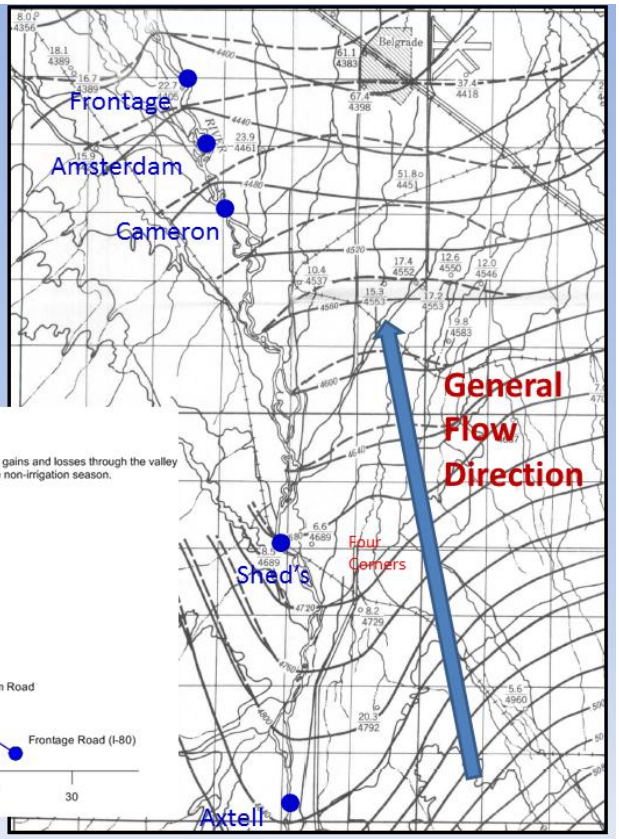
Forty five surface water diversions on the West Gallatin River

More than **2,000 miles** of canals and ditches were present in the Gallatin Valley during the 1950's

Irrigated land has decreased by **20%** from 2002 -2007, from 101,823 - 81,651 acres.

Ground water development from 2002-2007 increased in the Gallatin Valley by **23%**, from 12,064 – 14,865 wells.

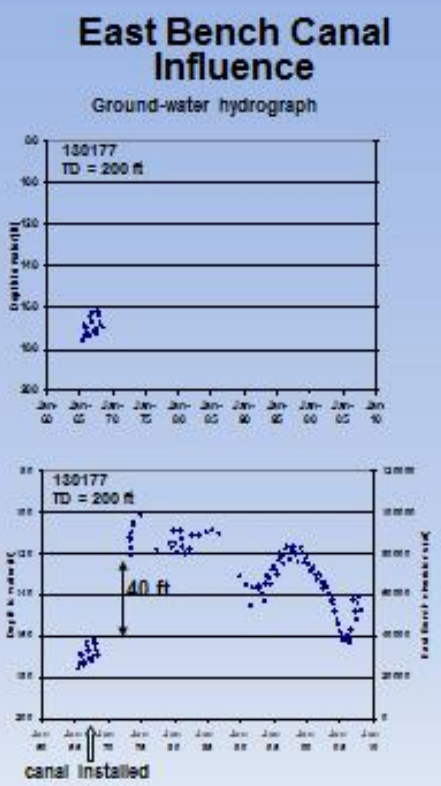


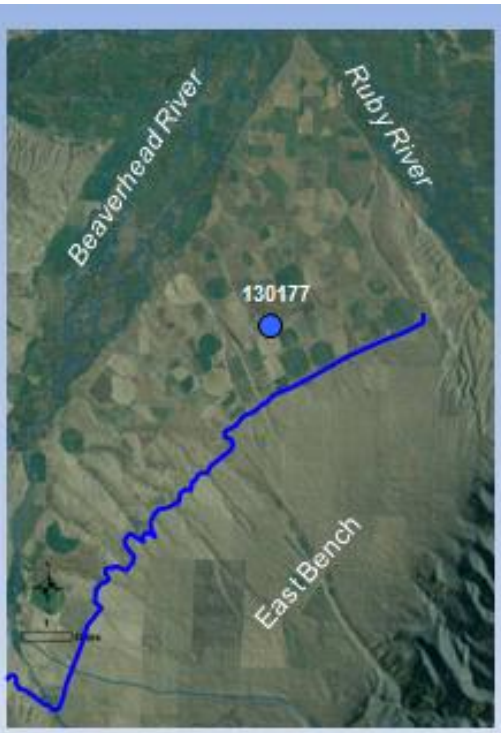


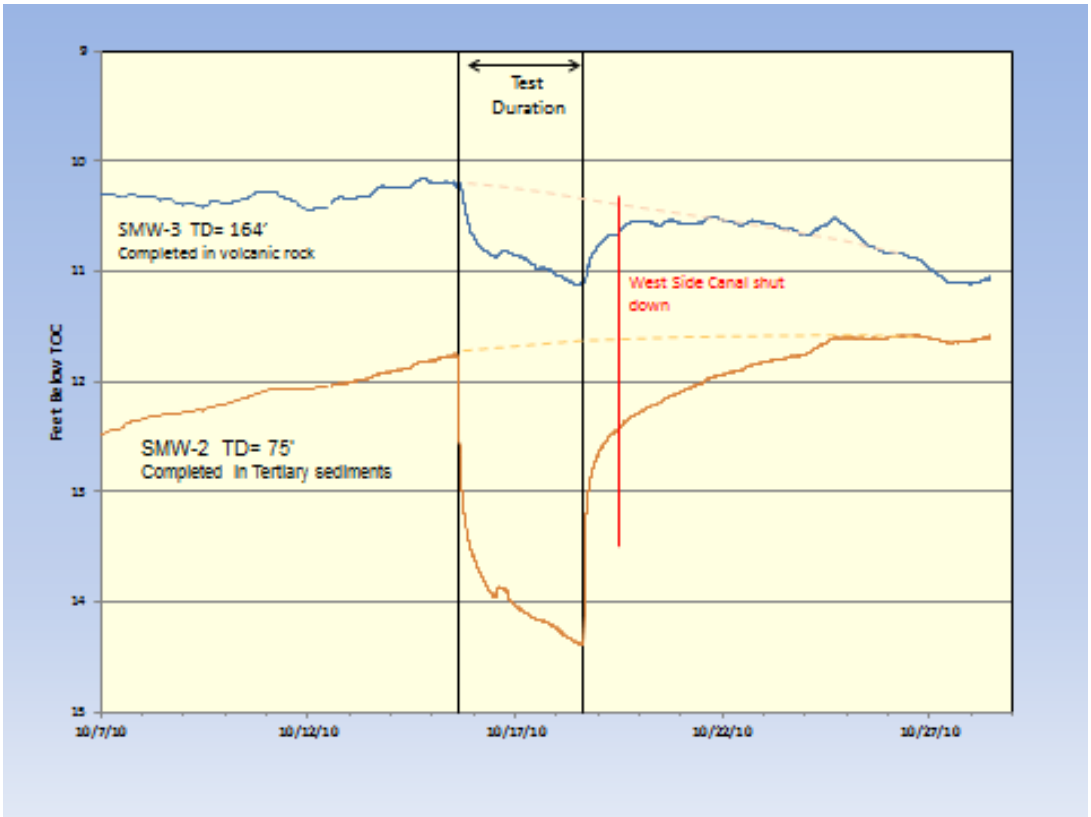
Beaverhead River

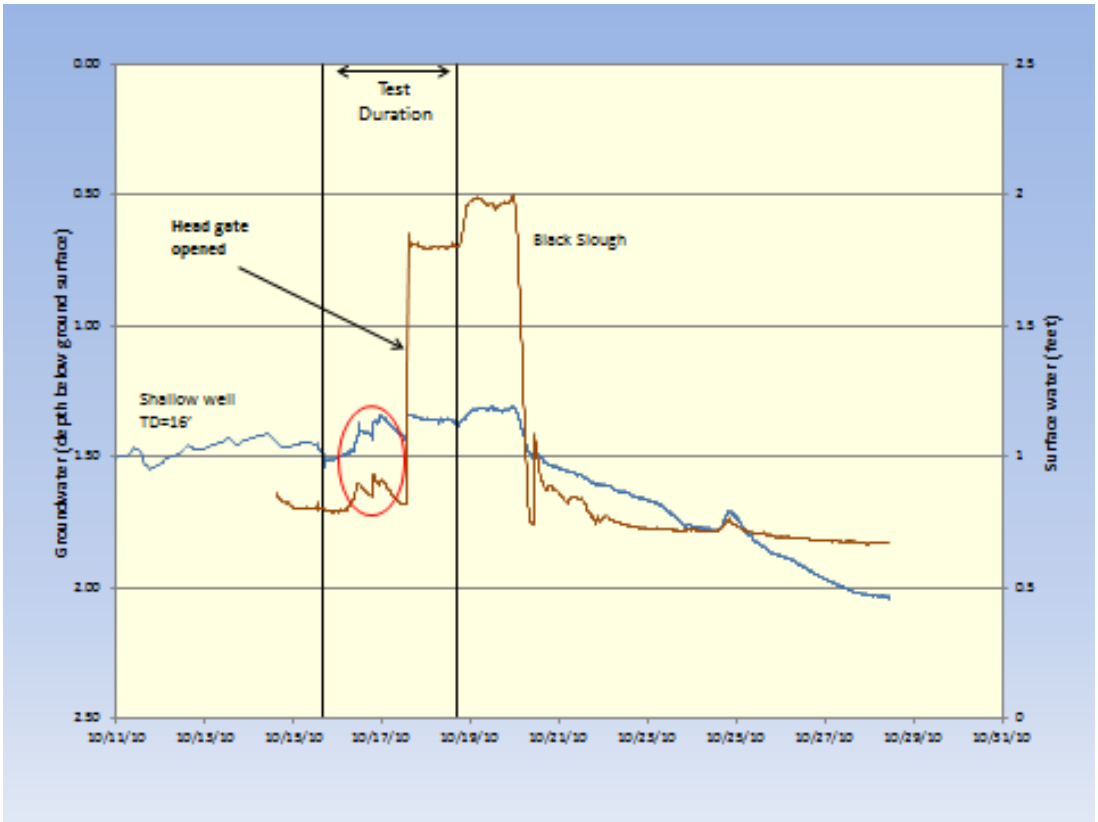
Dillon to Beaverhead Rock

- Observations of chemistry and water elevation data at two sites along the East Bench and West Side Canals show a connection between groundwater and canal water.
- Volcanic rock on the West Bench is a high yield aquifer. Previous water rights investigations indicate a confined aquifer. However, an aquifer test showed that this aquifer is not confined and it is directly connected to the overlying sediments.
- This aquifer test, performed by pumping a high capacity irrigation well, also showed a connection to surface water down gradient from the pumped well.
- Water isotopes results indicate groundwater upwelling in the Dillon and Beaverhead Rock areas. These are natural ‘pinch’ points in the topography.






Test
Duration
SMW-3 TD= 164'
Completed in volcanic rock
West Side Canal shut
down
SMW-2 TD= 75'
Completed In Tertiary sediments
Feet Below TOC
9
10
11
12
13
14
15
10/7/10
10/12/10
10/17/10
10/22/10
10/27/10


Test
Duration
Head gate
opened
Black Slough
Shallow well
TD=16'
Groundwater (depth below ground surface)
Surface water (feet)
0.00
0.50
1.00
1.50
2.00
2.50
2.5
2
1.5
1
0.5
0
10/11/10
10/13/10
10/15/10
10/17/10
10/19/10
10/21/10
10/23/10
10/25/10
10/27/10
10/29/10
10/31/10