

Prioritization criteria and nominating form for GWIP project areas

The following list is used to rank nominated project areas under the Ground Water Investigation program. The criteria name is highlighted to show which column heading is used in the ranking matrix. Please address all points. Possible sources of information are suggested, but other sources are likely available for most criteria. Each criterion is assigned a ranking value by the Ground-Water Steering Committee.

Project title: Lower Yellowstone Buried Channel Aquifer Development Potential: Availability of groundwater resources for agriculture and industrial development.

Watershed: Yellowstone River

Nominating Group or individual: Richland County Conservation District

Contact name: Julie Goss, Administrator RCCD

Address: Richland County Conservation District

Phone: (406) 433-2103 x101

Email: Julie.goss@mt.nacdn.net

County: Richland

Problem Description:

Demand for water resources have increased significantly in the Sidney area over the past several years because of the demand related to the development of oil and gas resources out of the Bakken, Three Forks, and other Formations in the region of Montana and North Dakota surrounding Sidney. In addition, the town of Sidney is growing rapidly and is considering expanding its well field to meet the increasing demand for municipal supplies. The proposed project will determine the potential physical availability of groundwater from this aquifer. The project will use existing and new data to develop a conceptual model of the physical hydrogeology of the aquifer. The new conceptual model will be expanded and used to construct and calibrate a digital ground-water model of the Lower Yellowstone Buried Channel (LYBC) aquifer. This model will provide a predictive tool for forming wise growth strategies and managing critical ground-water resources. The model will be calibrated to measured ground-water and surface-water data and will test ground-water level responses over time to various water-development scenarios. The model, its results, and a summary report will be available free to the public.

Overview of the magnitude of the problem:

- ☐ The LYBC aquifer has previously been mapped on the basis of incomplete and scattered drill logs from the MT/ND boundary near Fairview for about 40 miles southwest to Burns Creek on the Richland /Dawson County line. The aquifer has a proven high yield capability with production wells ranging from 500 gpm to 1500 gpm. The northern part of the aquifer extends from near Fairview to Fox Creek; is referred to as the Sidney aquifer; and underlies land recharged by deep percolation of irrigation water and leakage from irrigation canals. The southern part of the aquifer extends from Fox Creek to Burns Creek ; is referred to as the West Crane aquifer; and underlies land at higher elevations than irrigation development and is recharged by direct precipitation and runoff. Much of the land overlying the West Crane aquifer has been developed as upland pastures and dry land crops.
- ☐ Recharge-discharge relationships in the West Crane and Sidney aquifers have not been adequately defined and are important to clearly understanding the development potential of these aquifers. Preliminary analyses of water levels in the 7 high-yield wells in the Sidney well field completed within a 2000 foot radius indicate little or no well interference. New wells

completed in the Crane Creek Aquifer indicate high potential for irrigation. One irrigation well has operated successfully for part of 2 years. Monitoring in the vicinity of the irrigation well indicates full recovery following irrigation. Two additional irrigation wells have been proposed in the Crane Creek aquifer.

- ☐ Changes in aquifer recharge resulting from land–use changes including reduced recharge in areas converted from flood irrigation to sprinkler irrigation and reduced recharge caused by replacing lateral canals with pipelines will require additional information that would be derived from this project.
- ☐ The high demand for water from agriculture, domestic, municipal, and industrial use will result in increased discharges from the Lower Yellowstone Buried Channel aquifer. The results of this project along with sustained monitoring will allow for
 1. **Subdivision** growth rate
 - a. Actual number of new lots permitted during the previous 5 years. About 850 new lots have been permitted or are in the permit process. Most of these are from the past year.
 - b. Data source: Richland County Conservation District
 2. **New Wells**
 - a. Actual numbers of wells recorded in GWIC during the previous 5 1/2 years (446)_.
 - b. Data source: MBMG-GWIC

Note: A recent GWIC download indicates 446 new wells were constructed in the previous 5 1/2 years. This total is about 20 % of the total number of wells drilled in this area. About 80% of the new wells were domestic or other use wells.
 3. Designated **Closed Basin**
 - a. Is the project area within a Closed Surface Water Basin or a Controlled Ground Water Area Yes____, No X_.
 - b. Data source: MBMG

Note: Although the Basin is not closed; during dry years there is a shortage of water. The 1978 FWP instream flow water right is not met during dry years. The DNRC has required assessing groundwater impacts of new development as if the Yellowstone River basin in the Sidney area as a closed basin. In a recent water permit application FWP objected requiring mitigation for any new water use permitting other than exempt wells. The objection was eventually withdrawn.
 4. Flood to **Sprinkler** conversion
 - a. Number of acres changed in the previous 5 years (3500-4000 acres)
 - b. Data source: Dept of Ag or NRCS, LYIP, Agri Industries, Monkota

Note: In the previous 5-10 years 5000 acres were converted and there is a potential for another 4500 acres in the next 4 years under the AWEF program through NRCS and Lower Yellowstone Irrigation project. These changes could significantly alter the current hydrogeological conditions especially the recharge /discharge relationships.
 5. Impaired **Water Quality**
 - a. Is the surface-water body on the State TMDL, 303(d) list Yes X, No ____.
 - b. Data source: DEQ website

Note: the Yellowstone River is on the 303(d) list in the Sidney area.
 6. Expansion of **Industrial** water use

- a. New industrial and municipal wells during the previous 5 1/2 years 26.
 - b. Data source: MBMG-GWIC, DNRC water rights or local input
Note: Little increase based on latest GWIC data. Several individuals are interested in developing industrial/water marketing permits to meet the needs of high-pressure fracing required to develop oil wells drilled into the Bakken or Three Forks Formations. In the past many unpermitted wells and other supplies provided water for oil development.
7. Expansion of **Agricultural** water use
 - a. Number of new Ag WELLS (Stock and Irrigation) wells during the previous 5 ½ years 126.
 - b. Data Source: Dept of Ag, DNRC Water Rights wells and surface withdrawal permits, MBMG-GWIC wells
8. **Population** density
 - a. Total number of people impacted in Richland county 9313. Recent estimates are about 14,000 people in Richland County due to Bakken development.
 - b. Data source: US Bureau of Census, County Planning office.
9. **Water Class** or usability
 - a. Water-quality classification or description. Good quality water for all common purposes.
 - b. Data source DEQ and MBMG
Note: No change from original matrix.
10. **Information** already known
 - a. **MBMG, USGS, City of Sidney**
 - b. See attachment at the end of the form
11. System **Complexity**
 - a. Is the hydrogeologic system simple and straightforward or is the project scientifically complex? Provide information if possible. The Steering Committee will address this criterion.
 - b. DEQ, DNRC, **MBMG**
Note: The hydrogeology of the Crane Creek and the Sidney aquifers are poorly understood. The importance of flood irrigation, and irrigation canal leakage to the Sidney Aquifer recharge has not been defined. Likewise there is little known about the extent and location of the recharge area for the Crane Creek Aquifer. Both aquifers have surface discharge to the Yellowstone River through natural streams and agricultural drains, but little is known about the amount of groundwater discharge to marshy areas.
12. County **Growth Plan** in place
 - a. Does the County have a formal growth plan and is this a high density area Yes X, No ____.
 - b. Data source: **Richland County Planner- Available online at www.richland.org/planning**
13. **Contentious/** litigious
 - a. Is the issue locally sensitive, potentially headed for court? Yes X, No ____
There have been several recent instances where groundwater development for irrigation has been delayed due to objections by Montana Fish Wildlife and Parks. The proposed work will help resolve these issues.
 - b. Local input, The city of Sidney and Richland County Conservation District have

been long term supporters of evaluating and developing groundwater resources while addressing potential impacts.

14. Highly valued **Ecological** water system

- a. Is the surface water body a commissioned stream? Are Murphy rights involved? Provide information if possible. The Steering Committee will address this criteria.
- b. DNRC, MT FWP

Note: The entire Yellowstone River is considered a highly valued ecological water system by MT FWP. Water shortages during dry years cause the flow to be less than FWP's 1978 instream-flow water right.

15. Basin fill or bedrock **Aquifer Systems** or both

- a. Similar to the complexity issue, but allows more direct inclusion of geologic controls. Provide information if possible. The Steering Committee will address this criteria.
- b. MBMG, DNRC

Note: The extent of the aquifers in both the Sidney and Crane Creek areas is not defined. There is virtually no surface expression of the buried channel, yet the gravels of aquifer materials from well cuttings match gravels found in outcrops and gravel pits throughout the area. This aquifer material has a high capacity for water storage and rapid recharge.

16. **Efficiency** of effort

- a. Adjacent project areas can allow for more efficient investigations. Provide information if possible. The Steering Committee will address these criteria.
- b. Data source Map, DEQ, DNRC, MBMG

Note: Coordination with the various MBMG programs Richland County Conservation District, consultants and local residents has resulted in project efficiency. We are using monitoring points established by the USGS in the 1950's and 1960's, the GWAAMON program in the mid-1990's, and the MBMG Billings office in the late 1990's and mid-2000's. We have compiled data from city of Sidney and consulting firms regarding water use and aquifer tests in the Sidney area. The MBMG is currently working on an RRG project evaluating the LYBC aquifer system. We have recently been requested to provide the city Sidney Hydraulic conductivity information in the area of proposed sewage lagoon expansion. There are no GWIP projects in this area but we have a lot of information ready to be used by a new project.

17. **Diversity** of hydrogeology and issues

- a. Similar to complexity criteria but emphasizes the need to investigate a wide range of issues. Provide information if possible. The Steering Committee will address this criterion.
- b. Data source DEQ, DNRC, MBMG

Note: The Sidney area has a strong economic base in agriculture, and energy development and both are increasing the demand for water resources. Some areas need to drain off excess water and other areas are water short. The Sidney and Crane Creek aquifers will be used to meet this demand. More information about the connection of the aquifers to the Yellowstone River system is needed to manage this resource.

18. **Controlled** groundwater Area

- a. Is the project area within a Controlled Ground Water Area? Yes ____, No X__
- b. Data source DNRC

19. Availability of **Matching Funds**

- a. Priority for other funding sources
 - i. Are matching funds available Yes X , No
 - ii. Have matching funds been requested but not committed? Such as a grant application that has not been approved.. Yes X , No .
Indicate the source and amount requested. DNRC RRG program, city of Sidney.

- b. Data source: City/County Planning Division, MBMG

Note: Possible match through RRG. City and county have helped with match in past proposals. Both cash and in-kind funds are possibilities.

20. Information already known

a. Existing hydrogeologic data and reports:

A review of the available literature identified several publications discussing the geologic setting and ground-water resources of the lower Yellowstone River basin which includes Sidney. A study by Howard (1960) interprets the Cenozoic history of the region focusing primarily on the Pleistocene. Prichard and Landis (1975) developed a concise summary of Cenozoic history and landscape development as part of an investigation of coal resources in the Girard Field. Water resources in upper Cretaceous to Holocene age sediments were assessed in a publication by Torrey and Kohout (1956). This report documents the ground-water resources within the Yellowstone River valley between Glendive and Sidney, Montana and concentrated on the alluvial aquifers. Anecdotal information and notes on file with the city of Sidney Water Department indicate that the buried channel aquifer was initially noticed by seismograph drillers who identified the deep sand and gravel aquifer during geophysical surveys. The city has records of well logs and water use from each well. The water use records will be very useful information for modeling efforts. The MBMG has worked on several projects in the Sidney area. The area was part of the first Ground Water Characterization Project in the mid-1990s. The GWCP program published several maps and reports as the result of this work. The city of Sidney's well field was one of the case studies as part of a DEQ Source Water Protection project. The case study is part of MBMG OF378. A drilling project expanded on the extent of the buried channel aquifer under a DNRC RRG project. The final report was submitted to DNRC in 2008. Test drilling funded by the DNRC irrigation development officer and the results were submitted in a report dated_2007.

References:

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Miller, K.J., Meek, J., Norbeck, P., Reiten, J.C., 1998, Montana Source Water Protection: Technical Guidance Manual, Parts 1 and 2, Montana Bureau of Mines and Geology: Open-File Report 378, 281 p.

Prichard, George E. and Landis, Edwin R., 1975, Coal resources and Cenozoic geology of the Girard Coal field, Richland County, Montana, U.S. Geological Survey Bulletin 1310, 89 p.

Reiten, Jon C. 2007, West Crane test drilling: Potential for developing irrigation supplies from ground water near the West Crane Irrigation project. Project summary report submitted to the MT DNRC Irrigation development Officer, Billings, MT.

Reiten, Jon C., 2008, Irrigation potential of ground water underlying the Lower Yellowstone River Valley in Richland County MT. Final Report: RRG-06-1280 submitted to the DNRC RRG program in 2008.

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Waren, Kirk, 1993, Gartside Reservoir impacts at the Wyman property, unpublished MT DNRC report dated October 26, 1993 12 p.

Smith, L.N., LaFave, J.I., Patton, T.W., Rose, J.C., McKenna, D.P., 1999, Ground-water resources of the Lower Yellowstone River Area: Dawson, Fallon, Prairie, Richland, and Wibaux Counties, Montana. Part A- Descriptive overview and basic data, Montana Bureau of Mines and Geology: Ground-Water Assessment Atlas 1A, 43 p.

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21. Availability of **Matching Funds**

The city of Sidney has applied for funding to assist developing a groundwater model to help them efficiently manage water resource from their well field. There is a potential to develop a Rural Water system in the Sidney area (Dry Redwater Project) and because of the water treatment capabilities and potential for expansion the city is interested in managing their water supplies under higher demands. Other management issues include the potential development of water marketing wells providing water for the oil industry. An RRG project was funded for about \$100,000 to collect additional data from the Lower Yellowstone Buried Channel aquifer system.

In the past the City of Sidney, Richland County, and the town of Fairview have provided a match equal to what the DNRC has provided. The Lower Yellowstone GWIP project has a good potential for additional funds from these sources. In addition the city typically provides match of labor assisting with well completions, land access, and other project activities.