

Subject: **Northeast Wyoming River Basins Plan
Future Water Use Opportunities
Task 5**

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INTRODUCTION

The purpose of this task is to identify future water use opportunities that can be implemented to satisfy present and projected water demands in the Little Missouri River, Belle Fourche River, Cheyenne River, and Niobrara River Basins in Wyoming. The list of opportunities compiled under this task is intended to be used by individuals and organizations that need to develop a water supply to satisfy their specific needs.

To further assist the users of this list to identify potential opportunities to satisfy their demands, a methodology is presented that can be employed to evaluate a specific opportunity on the list relative to similar and related opportunities. The suggested methodology evaluates opportunities according to the likelihood they are desirable, functional, and capable of receiving the support required for development. By using the list of future water use opportunities and employing the evaluation methodology, individuals and organizations will have “a place to start” in their investigation to develop a water supply to satisfy their specific needs.

The procedure used to complete this task consists of the following four steps:

1. Develop screening criteria to evaluate future water use opportunities;
2. Develop a long-list of future water use opportunities;
3. Develop a short-list of opportunities; and,
4. Evaluate the opportunities on the short-list.

These steps and the results of this task are described in the remainder of this technical memorandum.

SCREENING CRITERIA

A significant task of the river basin planning process is the development of screening criteria and methods for evaluating future water use opportunities identified and listed for the study basins. For the Northeast Wyoming River Basins, the screening criteria and evaluation method developed for the Green River Basin Plan were presented to the Basin Advisory Group (BAG) for consideration, modification, and adoption at a BAG meeting held October 11, 2001. The criteria adopted by the BAG, and a description of each criterion, is presented below:

Criterion 1: Water Availability

This criterion reflects the general ability of a project to function, given likely bypasses for environmental uses and prior rights. It is not a reflection of the relative size of the project.

Criterion 2: Financial Feasibility

This criterion reflects the effects of the combination of technical feasibility (high or low construction cost) and economic use to which the water would be put (e.g. irrigation of

native meadow vs. cultivation of alfalfa or row crops). The intent of this criterion is to indicate the likely ability to afford the project or meet Wyoming Water Development Commission (or other) funding source criteria. A low number represents a project with suspect ability to be repaid, whereas a high number represents a project that should more easily meet funding and repayment requirements.

Criterion 3: Public Acceptance

This criterion reflects the extent to which a project will encounter or create public controversy (low number) versus a project that would likely engender broad public support (high number). For example, on-stream storage in environmentally sensitive areas would be very controversial, while off-channel storage in less sensitive areas would more likely be supported.

Criterion 4: Number of sponsors/beneficiaries/participants

This criterion reflects the desirability, all other things being equal, that a project serving a larger segment of the population should be evaluated higher (higher number) than one serving only a few (lower number).

Criterion 5: Legal/Institutional concerns

This criterion reflects the perceived relative ease (high number) or difficulty (low number) with which a project could be authorized and permitted under existing state and federal law.

Criterion 6: Environmental/Recreation benefits

This criterion reflects the net effect of positive environmental and recreational aspects of a project as offset, to the extent it can be determined, by potential negative impacts on these attributes.

LONG-LIST OF FUTURE WATER USE OPPORTUNITIES

Compiling the long-list of future water use opportunities began with a review of published reports available for the study basins. The level of information and data available for the projects varied from very sketchy to completed conceptual designs.

Specific groundwater development projects were not identified and included on the long-list. However, groundwater development is included as a generic future water use opportunity for each of the sub-basins and was considered along with the surface water opportunities. Similarly, groundwater produced in the development of coalbed methane was not included on the long-list. Although this resource has the potential to supply small, localized demands over the short-term, the feasibility of developing a significant water supply from this activity is considered to be limited because of the wide geographic dispersion of the wells and the projected short time of operation.

Another future water use opportunity in the Northeast Wyoming River Basins is the establishment of instream flow water rights. These water rights are developed through a specified procedure that begins when the Wyoming Game and Fish Department proposes a stream segment for an instream flow water right. The segment is then studied by the Water Development Commission, and the water right is granted or rejected by the State Engineer. This opportunity is not, however, included on the long-list since the segments that have been proposed are either under investigation, have been granted, or have been rejected. As new segments are nominated they will be advanced through the process.

The initial long-list was presented to the BAG at a meeting held October 11, 2001. BAG members were asked to review the list and identify potential opportunities not included on the initial draft of the long-list.

Comments and suggestions received from BAG members and additional research led to the development of the final long-list. This list is presented in Appendix A, and the future water use opportunities included on the long-list are shown on Figure 1.

SHORT-LIST OF FUTURE WATER USE OPPORTUNITIES

Projects and opportunities on the long-list were reviewed to determine if they should be included on the short-list or if they should be eliminated from consideration during the 30-year planning period. Reasons considered to eliminate projects include: 1) the project has already been constructed; 2) the location of project facilities, i.e. within a National Forest or wilderness area, presents major legal, institutional, and permitting constraints; and, 3) the original demand for the project no longer exists and is not expected to appear within the planning period.

When the initial long-list was presented to the BAG on October 11th the recommendation was made to include all of the long-list opportunities on the short-list. This recommendation was accepted by the BAG members. Subsequent to the BAG meeting, the final short-list was prepared based on the comments and suggestions received from BAG members and additional research.

SHORT-LIST EVALUATION METHODOLOGY

The methodology described in this section is intended to assist the user of the short-list of future water use opportunities. The process described can be employed to establish “a place to start” in the quest to match specific water demands to future water use opportunities.

The process begins after the short-list of future water use opportunities has been prepared. The result of the process is an evaluation of opportunities according to their relative likelihood they are desirable, functional, and capable of receiving enough public support to be implemented. In general, the results present an overall picture of the favorability of a future water use opportunity or project.

The first step in the process is to categorize the future water use opportunities into one of the four types described below:

Type 1: Rehabilitation projects that preserve existing uses.

Type 2: Projects that rectify existing shortages consistent with the hierarchy of preferred uses established by the Wyoming statutes.

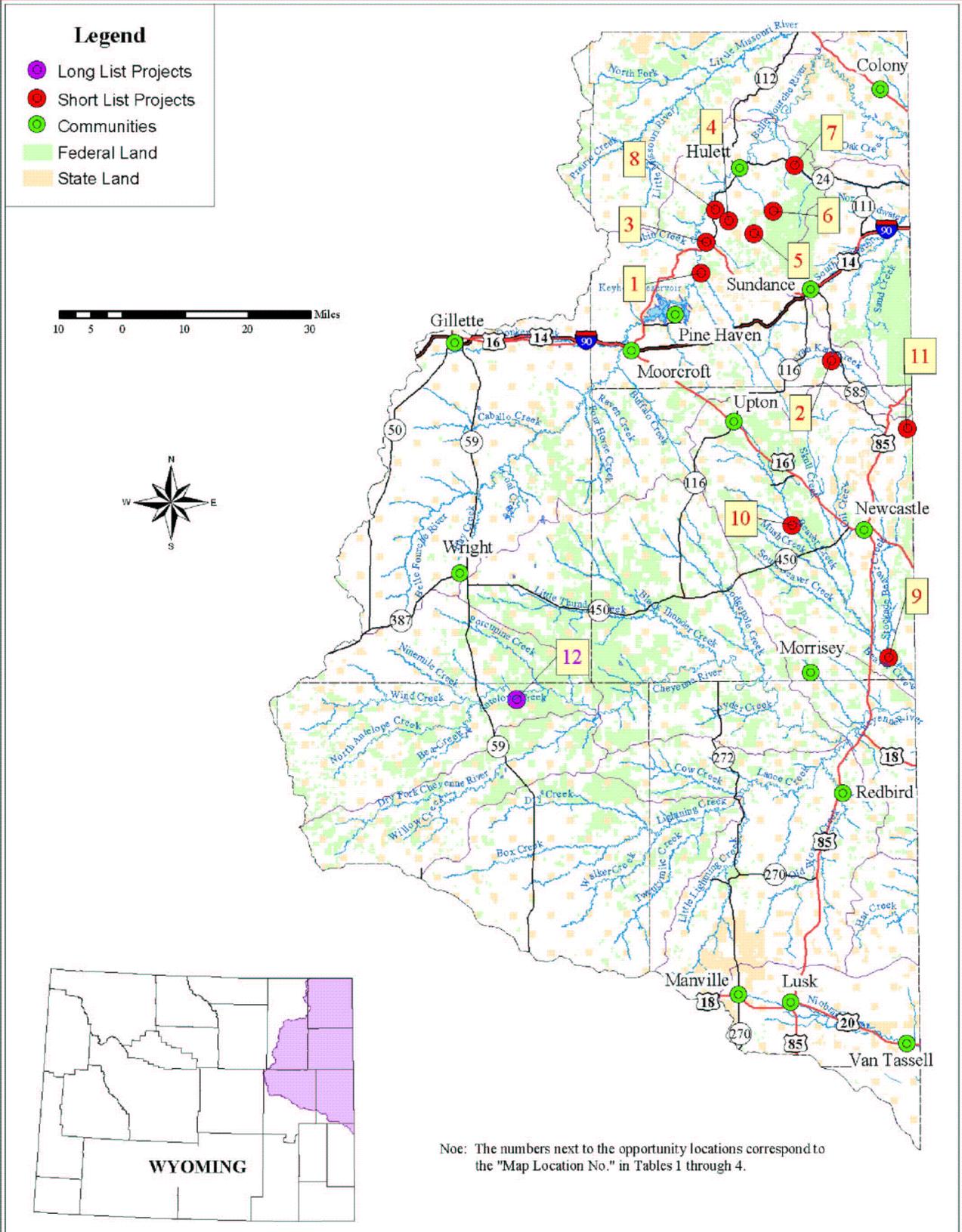
Type 3: Projects that meet projected future demands consistent with the hierarchy of preferred uses established by the Wyoming statutes.

Type 4: Projects that enhance uses in other Wyoming basins through trans-basin diversions.

By categorizing the short-list projects into one of these four types, projects are evaluated only relative to similar type projects. Furthermore, the projects are grouped by sub-basin to allow planning evaluations by geographic locale.

After the short-list projects have been assigned to a type category, the six evaluation criteria were used to evaluate the projects under each of the types.

The evaluation process entails assigning a weight value to each of the criteria. These values range from a weight of 10 for criteria judged to be very important, to a weight of 1 if the criterion is not considered significant. Different criterion weight values are assigned for each of the four type categories. For



Future Water Use Opportunity Locations



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Figure 1

example, Criterion 1: Water Availability is not significant for Type 1 projects, since these projects already have an established water supply, and will be assigned a low weight value. Conversely, this criterion is very important for projects categorized under Types 2, 3, and 4, and will be assigned higher weight values.

Each project is then assigned an evaluation score for each of the six criteria. These scores range from a high of 10 if the project is very favorable for that criterion, to a low score of 0 if the project is very unfavorable. Scoring a project under each criterion is accomplished relative to the other projects in the same type category. For example, consider Project X and Project Y that are categorized as Type 2 projects and the evaluation of these two projects concludes Project X will result in more environmental and recreational benefits (Criterion 6). Therefore, Project X will receive a higher score than Project Y under Criterion 6 with the difference in scores reflecting the degree to which Project X provides more environmental and recreational benefits than Project Y.

The total evaluation score for a project is then computed as the sum of the products of the weight value and the evaluation score. Projects achieving a higher total score are considered to be more desirable, more functional, and have a higher capability of receiving enough public support to be implemented, relative to the other projects in the same type category.

As previously stated, the level of information and data available for the projects on the list of future water use opportunities varies significantly from very sketchy to completed conceptual designs. Therefore, the exercise of assigning weights to criterion and evaluation scores to projects is totally subjective and the results of the evaluation process can only be interpreted to reflect the knowledge and judgement of the individual assigning the weights and scores. In order to make the process more objective and less subjective, detailed engineering, legal, and environmental investigations would need to be completed to advance all projects to the same level of information and data.

The suggested evaluation process described above was applied to the short-lists of future water use opportunities to provide an example of the thought process followed in its application. The results of the application of the process are presented in Tables 1, 2, 3, and 4 for each of the four basins of the planning area.

It must be emphasized the four evaluated short-list tables reflect the knowledge and judgement of the individual that performed the exercise. When another individual having different opinions and a different level of knowledge of the projects being evaluated completes the exercise, different total scores will likely result. Variable results will be achieved because different weights will be assigned to the evaluation criteria and different scores will be assigned to the projects.

Given this intrinsic characteristic of the evaluation methodology, it is difficult if not impossible to use the resulting evaluated short-lists for anything other than to establish “a place to start” the required investigations leading to the selection of a future water use opportunity compatible with the specific water demands of the reviewer. The evaluated short-lists simply aren’t appropriate to be used by the Wyoming Water Development Commission or any other funding entity to prioritize funding awards.

Table 1
Evaluated Short-List: Little Missouri River Basin

Project Type (see below) Project Title	Map Loc. No.	Est. Yield(y), Cap(c) or Depl(d) (AF)	Project Evaluation Criteria						Total Score
			Water Availability	Financial Feasibility	Public Acceptance	No. of Sponsors/ Beneficiaries	Legal/ Institutional Constraints	Environmental/ Recreation Benefits	
Type 1 (None)									
Type 2 (None)									
Type 3 Groundwater Development		unk	Not ranked, only one project of this type						
Type 4 (None)									

Notes:

1. Each criteria has a different weighting for each type of project; 10 is most important, 1 is least important
2. Under each project, the criteria are individually scored; 10 means largely favorable, 0 is unfavorable
3. Total scores are the additive result of multiplying each project criteria weighting by the associated project type criteria score

Type 1: Rehabilitation projects that preserve existing uses

Type 2: Projects that rectify existing shortages consistent with the hierarchy of preferred uses established by the Wyoming statutes

Type 3: Projects that meet projected future demands consistent with the hierarchy of preferred uses established by the Wyoming statutes

Type 4: Projects that enhance uses in other Wyoming basins through trans-basin diversions

Table 2
Evaluated Short-List: Belle Fourche River Basin

Project Type (see below) Project Title	Map Loc. No.	Est. Yield(y), Cap(c) or Depl(d) (AF)	Project Evaluation Criteria						Total Score
			Water Availability	Financial Feasibility	Public Acceptance	No. of Sponsors/ Beneficiaries	Legal/ Institutional Constraints	Environmental/ Recreation Benefits	
Type 1 (None)									
Type 2			6	7	4	5	7	6	
Inyan Kara Creek Reservoir	1	1,000 c	7	6	8	5	8	5	227
Enl. Driskill No. 1 Reservoir	8	2,800 c	7	8	6	5	5	7	224
Miller Creek Reservoir	3	1,000 c	6	6	8	5	8	5	221
Lytle Creek Reservoir	4, 5	1,000 c	6	6	8	5	8	5	221
Blacktail Creek Reservoir	6	1,000 c	6	6	8	5	8	5	221
Beaver Creek Reservoir	7	1,000 c	6	6	8	5	8	5	221
Livingston Creek Reservoir	2	955 c	5	6	8	5	8	5	215
Type 3			6	8	4	5	5	6	
CBM Aquifer Storage and Retrieval		unk	7	6	7	7	4	7	215
Groundwater Development		unk	6	5	8	4	7	5	193
Transbasin diversions to Gillette		unk	8	4	7	6	3	5	183
Type 4 (None)									

Notes:

1. Each criteria has a different weighting for each type of project; 10 is most important, 1 is least important
2. Under each project, the criteria are individually scored; 10 means largely favorable, 0 is unfavorable
3. Total scores are the additive result of multiplying each project criteria weighting by the associated project type criteria score

Type 1: Rehabilitation projects that preserve existing uses

Type 2: Projects that rectify existing shortages consistent with the hierarchy of preferred uses established by the Wyoming statutes

Type 3: Projects that meet projected future demands consistent with the hierarchy of preferred uses established by the Wyoming statutes

Type 4: Projects that enhance uses in other Wyoming basins through trans-basin diversions

Table 3
Evaluated Short-List: Cheyenne River Basin

Project Type (see below) Project Title	Map Loc. No.	Est. Yield(y), Cap(c) or Depl(d) (AF)	Project Evaluation Criteria						Total Score
			Water Availability	Financial Feasibility	Public Acceptance	No. of Sponsors/ Beneficiaries	Legal/ Institutional Constraints	Environmental/ Recreation Benefits	
Type 1 (None)									
Type 2			7	8	5	6	4	5	
Beaver Creek Reservoir (north)	10	7,775 c	7	4	7	5	7	7	209
Stockade Beaver Creek Reservoir	11	6,100 c	7	3	5	5	5	5	173
Type 3			7	8	7	7	5	6	
Beaver Creek Reservoir (south)	9	15,000 y	6	5	6	5	6	8	237
Groundwater Development		unk	5	6	5	5	7	5	218
Type 4 (None)									

Notes:

1. Each criteria has a different weighting for each type of project; 10 is most important, 1 is least important
2. Under each project, the criteria are individually scored; 10 means largely favorable, 0 is unfavorable
3. Total scores are the additive result of multiplying each project criteria weighting by the associated project type criteria score

Type 1: Rehabilitation projects that preserve existing uses

Type 2: Projects that rectify existing shortages consistent with the hierarchy of preferred uses established by the Wyoming statutes

Type 3: Projects that meet projected future demands consistent with the hierarchy of preferred uses established by the Wyoming statutes

Type 4: Projects that enhance uses in other Wyoming basins through trans-basin diversions

Table 4
Evaluated Short-List: Niobrara River Basin

Project Type (see below) Project Title	Map Loc. No.	Est. Yield(y), Cap(c) or Depl(d) (AF)	Project Evaluation Criteria						Total Score
			Water Availability	Financial Feasibility	Public Acceptance	No. of Sponsors/ Beneficiaries	Legal/ Institutional Constraints	Environmental/ Recreation Benefits	
Type 1 (None)									
Type 2 (None)									
Type 3 Groundwater Development		unk	Not ranked, only one project of this type						
Type 4 (None)									

Notes:

1. Each criteria has a different weighting for each type of project; 10 is most important, 1 is least important
2. Under each project, the criteria are individually scored; 10 means largely favorable, 0 is unfavorable
3. Total scores are the additive result of multiplying each project criteria weighting by the associated project type criteria score

Type 1: Rehabilitation projects that preserve existing uses

Type 2: Projects that rectify existing shortages consistent with the hierarchy of preferred uses established by the Wyoming statutes

Type 3: Projects that meet projected future demands consistent with the hierarchy of preferred uses established by the Wyoming statutes

Type 4: Projects that enhance uses in other Wyoming basins through trans-basin diversions

REFERENCES

Wyoming Water Development Commission, Northeast Wyoming Level I Comprehensive Water Development Plan, September 1985

Wyoming State Engineer's Office, Wyoming Water Planning Program, Report 10, Water & Related Land Resources of Northeast Wyoming, April 1972.

Bearlodge Ltd., Inc., Beaver Creek Dam and Reservoir Project Final Report, August 1991, Wyoming Water Development Commission

Bearlodge Ltd., Inc., Stockade Beaver Creek Reservoir Level I, November 1986, Wyoming Water Development Commission

ESA Consultants, Inc., Crook County Reservoir Project Level I, July, 1999, Wyoming Water Development Commission

Phillips Petroleum Company, Fact Sheet – Antelope Creek Water System – NPDES Surface Water Discharge Permit, September 12, 2001

APPENDIX A

Appendix A – Long-list and Short-list of Future Water Use Opportunities

The following is a long-list of future water use opportunities for the Little Missouri, Belle Fourche, Cheyenne, and Niobrara River Basins of Wyoming. The long-list was compiled from a review of published reports and input from the Basin Advisory Group. A brief description of each project is provided. Numbers in parentheses following the project title, i.e. (MLN 6), are map location numbers indicating the location of the projects on Figure 1. Projects without map location numbers either have no specific location, i.e. groundwater development, or the project features are outside of the study area. Projects marked with an “ * ” were eliminated from the short-list. Reasons for elimination are provided.

Little Missouri River Basin

No opportunities identified.

Belle Fourche River Basin

1. Inyan Kara Creek Reservoir (MLN 1): 1,000 acre-foot reservoir to provide supplemental irrigation water to 2,800 acres along the Belle Fourche River
2. Livingston Creek Reservoir (MLN 2): 955 acre-foot reservoir to provide supplemental irrigation water to 2,800 acres along the Belle Fourche River
3. Miller Creek Reservoir (MLN 3): 1,000 acre-foot reservoir to provide supplemental irrigation water to 2,800 acres along the Belle Fourche River
4. Lytle Creek Reservoir (MLN 4,5): 1,000 acre-foot reservoir to provide supplemental irrigation water to 2,800 acres along the Belle Fourche River
5. Blacktail Creek Reservoir (MLN 6): 1,000 acre-foot reservoir to provide supplemental irrigation water to 2,800 acres along the Belle Fourche River
6. Beaver Creek Reservoir (MLN 7): 1,000 acre-foot reservoir to provide supplemental irrigation water to 2,800 acres along the Belle Fourche River
7. Enl. Driskill No. 1 Reservoir (MLN 8): 2,800 acre-foot reservoir to provide supplemental irrigation water to Crook County Irrigation District
8. Transbasin Diversions to Gillette: potential diversion schemes to deliver approximately 175,000 acre-feet per year to Gillette from: 1) Yellowstone River at Miles City; 2) Bighorn River at Harden; 3) Wind River (Boysen Reservoir); Nowood River, and, 4) Green River
9. CBM Aquifer Storage and Retrieval Project: groundwater pumped for CBM production is injected into an aquifer for later retrieval and use

Cheyenne River Basin

1. Beaver Creek Reservoir (south) (MLN 9): 55,000 acre-foot reservoir; annual yield 15,000 acre-feet
2. Beaver Creek Reservoir (north) (MLN 10): 7,775 acre-foot reservoir; 580 acres; recreation purpose
3. Stockade Beaver Creek Reservoir (MLN 11): three reservoir sites investigated for recreation: #1 208 acre-feet, 15.8 acres; #2 520 acre-feet, 24.5 acres; #1 6,100 acre-feet, 87 acres
4. Antelope Creek Water System* (MLN 12): water produced by CBM development in the Powder River drainage is collected and conveyed to Antelope Creek in the Cheyenne River drainage; water stored and treated in Bell 2 Reservoir, 9.2 acre-feet, and Bell 1 Reservoir, 762.5 acre-feet; discharged into Antelope Creek for potential irrigation use
Reasons for elimination: the purpose of the project is the disposal of water produced through coalbed methane development and is not considered to be a water supply project

Niobrara River Basin

No opportunities identified.