

## 9 Program Strategies

As discussed in Chapter 8, program strategies were developed to address issues identified by the BAG. This chapter describes the process for developing strategies and the final list of opportunities. More information on program strategies is contained in Technical Memorandum 6.

### 9.1 Development of Program Strategies

The process for identifying project strategies for the Basin Plan Update generally followed the procedures developed in Technical Memorandum 7 - Approach to Developing Opportunities and Strategies. The following steps were conducted.

1. A list of issues and proposed strategies for addressing these issues was developed in conjunction with the BAG during meetings held on March 3, 2009 (BAG 2009a) and September 17, 2009 (BAG 2009c). Summaries of these meetings are discussed in Technical Memorandum 3G - Basin Advisory Group Issues and Strategies
2. The Framework Water Plan was reviewed for lists of issues, strategies and recommendations both within the Wind-Bighorn Basin and the basin planning process as a whole, and strategies were developed to address these issues and recommendations.
3. The lists of strategies from items (1) and (2) above were merged and strategies were combined where there was overlap.
4. A preliminary final list of strategies that includes all strategies from item (3) above, and defines the strategy itself, ownership of the strategy, and a timeline for implementing the strategy was developed and is included in this technical memorandum.
5. The list of strategies was reviewed with the BAG during the final BAG meeting (BAG 2010).
6. Based on information from the final presentation, a final list of Program Strategies that includes the information prepared in item (4) above with modifications based on BAG input was included in the final report. Rather than organizing these strategies by sub-basin and water use category, they were organized by activity and ownership, as most strategies apply to all sub-basins and water uses.

Two lists of issues, recommendations and strategies have been identified for the Wind-Bighorn Basin. The first list is a list of issues that were identified by the BAG, and strategies to address those issues developed by the BAG, WWDC staff and the consulting team. The second list of issues and recommendations is a result of information developed in the Framework Water Plan for the Wind-Bighorn Basin and the basin planning process in general. Each of these lists is discussed in the following sections. A final consolidated list of strategies is presented in the final section of this chapter.

## 9.2 Recommended Program Strategies

This section describes the final list of strategies that was created following the merging and refinement of the two lists of strategies identified above. It should be noted that none of the strategies identified above were deleted or removed from the list. Rather, they were incorporated into other strategies. Furthermore, a portion of the strategies are already under development as part of the current basin planning process.

In addition to merging and refining strategies, in order to move strategies from their current conceptual phase to implementation, further information was developed for each strategy. This included the ownership of the strategy, a time frame for implementing the strategy, and key strategy development activities. A summary of the strategies is presented in Table 64. A description of each strategy is presented below.

### Administrative

#### *Outreach plans should be continued and improved*

Basin plans should address how best to provide information to the public and how to involve the public in the planning process. The outreach plans should review the BAG process. The review should strive to adopt new ideas for maintaining the BAG's diversity, viability and effectiveness.

#### *Describe and continue maintenance of existing irrigation and municipal water supply infrastructure*

This strategy is a combination of the strategy identified by the BAG to continue maintenance of existing facilities, and recommendations by the Framework Water Plan that basin plan updates should describe system improvement and maintenance needs of agriculture and municipalities within the Basin.

#### *Establish and use master plans to assess growth potential and establish water and infrastructure needs for municipalities*

The need for municipal master plans for future water supply and infrastructure needs was identified by the BAG to address several issues within the Basin. This strategy encourages the involvement of municipalities, county land-use departments, and state agencies such as WWDC, in planning for future growth to ensure adequate future water supplies.

Master plans are commonly used tools used by municipalities to plan for all utilities and services that are provided. Many master plans within the Basin already consider water resources requirements of growth activities. For actively growing communities that do not have a master plan or have a master plan that does not consider water resources, the plans should be developed or expanded to do so. Ultimately, it is the decision of each municipality on whether a master plan is needed to address future growth.

Table 64. Wind-Bighorn Basin Program Strategies

Category	Strategy	Ownership	Time Frame	Key Implementation Activities
Admin-istrative	Continue to hold BAG meetings and adopt new ideas for maintaining the BAG's diversity, viability and effectiveness	WWDC/BAG	On-Going	- Hold BAG meetings at quarterly intervals during basin plan updates - Hold BAG meetings annually during other periods
	Describe and continue maintenance of existing irrigation and municipal water supply infrastructure	Water Providers	On-Going	- Develop rehabilitation plans for irrigation systems - Develop sustainable local funding source for rehabilitation projects
	Establish and use master plans to assess growth potential and establish water and infrastructure needs for municipalities	Water Providers	On-Going	- Identify key municipalities requiring master plans
	Work to maintain and protect water rights within the Basin	WWDC/WSEO	On-Going	- Continue adequate funding for WSEO offices and staff. Continue adequate funding for river basin planning.
	Promote better understanding of and address issues regarding federal project issues	WSEO/WWDC/ Others	Long-Term	- A general description of the Pick-Sloan Program was added to the basin plan information
	Improve communication and understanding of issues at local, Tribal and state level	All	On-Going	- Attendance at BAG meetings by Tribal representatives is desirable
Basin Planning	Evaluate and consider environmental, recreation, aesthetic and other non-consumptive and aesthetic water uses and needs in planning	WWDC - Basin Planning	On-Going	- A more substantial description and evaluation of environmental and recreational needs was included in the Basin Plan Update - The socioeconomic forecasting methods used in the Basin Plan Update were improved to account for non-consumptive water needs
	Project future agricultural and municipal water system needs and compare to current and future water availability	WWDC - Basin Planning	On-Going	- Continue Basin Plan Update technical activities
	Incorporate basin plan products into existing WRDS data storage system, including the development of GIS layers where necessary	WWDC - Basin Planning	On-Going	- Involve WRDS staff in production of basin plan products
Technical Analysis	Plan for potential future industrial water use within the Basin	WWDC - Basin Planning	On-Going	- Coordinate with industrial water users, including participation in the BAG process
	Perform a comprehensive groundwater study within the Basin and determine safe yields from aquifers	WWDC/WSGS	On-Going	- Expand groundwater technical analysis performed as part of basin plans (currently being performed by Wyoming Geological Survey for WWDC as part of Basin Plan Update)
	Evaluate potential for aquifer storage and retrieval throughout the basin	WWDC/Project Sponsor	Short-Term	- Expand groundwater technical analysis performed as part of basin plans (currently being performed by Wyoming Geological Survey for WWDC as part of Basin Plan Update.

Category	Strategy	Ownership	Time Frame	Key Implementation Activities
	Implement new modeling tool	WWDC - Basin Planning	Long-Term	- Perform feasibility study on potential model platforms
	Extend water supply study period in new model platform using historical and stochastic hydrology	WWDC - Basin Planning	Long-Term	- Implement new modeling tool - Develop stochastic data sets using historical and paleohydrology
	Analyze hydrologic effects of 2000's drought	WWDC - Basin Planning	Short-Term	- Update spreadsheet models (performed as part of Basin Plan Update)
	Analyze effects of Tribal Futures Projects	WWDC - Basin Planning	Short-Term	- The current spreadsheet models analyze the effects of Tribal Futures Projects
WWDC Projects	Encourage water resource development to meet the current and future needs and demands in the Basin	All	On-Going	- Identify opportunities and sponsors
	Conduct watershed studies to assess water resources and opportunities.	WWDC/Project Sponsor	On-Going	- Identify potential watershed studies and sponsors
	Evaluate potential for and effects of additional municipal and agricultural conservation	WWDC/Project Sponsor	Short-Term	

*Work to maintain and protect water rights within the Basin*

This is a direct implementation of the strategy proposed by the BAG. In general, this strategy was proposed by the BAG to support historical and continuing work by the WSEO to administer water rights within the Basin, including continuing to protect Wyoming water rights holders during negotiations and administration of interstate compacts, and to continue to review and permit new water rights development for unappropriated water within the Basin.

*Promote better understanding of and address issues regarding federal projects*

The BAG identified the administration, restrictions and effects of federal projects as an issue within the Basin. Two more specific strategies prescribing additional description of the Pick-Sloan Program and development of federal legislation to address these issues were proposed. Very general information on the Pick-Sloan Program was included in the Basin Plan Update documentation. However, proposing federal legislation is a strategy that would require higher level support in the state. For purposes of the basin planning process, this strategy was generalized to include education of the public on these issues and working with others, including federal and state agencies and legislatures, in and outside of the Basin on these issues.

*Improve communication and understanding of issues at local, Tribal and state level*

The BAG had identified issues of communications with the Tribes as a key issue within the Basin. For the final list of strategies, this BAG strategy was expanded to include improved communication and understanding of issues at local, Tribal and state levels. As described in several other Framework strategies, improved communication is a key goal of basin planning. Increased participation in basin planning efforts would be one opportunity to improve this communication.

Basin Planning

*Evaluate and consider environmental, recreation, aesthetic and other non-consumptive and aesthetic water issues and needs in planning*

Information regarding environmental and recreational uses within the Basin has been greatly expanded from the previous Basin Plan, including providing information showing the location of wetlands, instream flows, and key fishing locations, key rafting and whitewater rafting locations within the Basin. This information is contained in Technical Memorandum 3D – Recreation and Environmental Water Use.

*Project future agricultural and municipal water system needs and compare to current and future water availability*

This strategy is a direct implementation of strategies identified to address BAG concerns. The strategy was included in both the Water and Economic Development category and the Current and Future Water Uses category. The purpose of the strategy is to provide technical information regarding the location of where water is needed under existing and future conditions and where water could be available for development under existing and future

conditions. This strategy is one of the main focuses of technical activities in Tasks 3, 4 and 5 of the Basin Plan Update. This type of information should continue to be supplied and refined in future basin plan updates.

### *Incorporate Basin Plan products into existing WRDS data storage system, including the development of GIS layers where necessary*

This strategy is a direct implementation of the strategy identified in the Framework Water Plan. The WRDS data storage system is an integral part of the basin planning process. It provides a common repository for basin plan information, makes this available to the public through the internet, makes information available in a GIS format, and maintains consistency between the various basin plans. Information should continue to be developed and delivered in a manner that is consistent with this process.

### *Plan for potential future industrial water use within the Basin*

This strategy is a direct implementation of a strategy identified to address BAG issues. Industrial uses, especially those related to oil and gas development and CBNG development, should be included in future planning activities. Industrial uses include the diversion/pumping of water for consumptive or non-consumptive uses, and the return of water that is produced as a by-product of other activities like oil and gas and CBNG. Produced water has the potential to increase the overall water supply within the Basin. Coordination with the entities involved in these industrial activities and other water users in the Basin should be expanded, including participation in the BAG process by the industrial users.

## Technical Analysis

### *Perform a comprehensive groundwater study within the Basin and determine safe yields from aquifers*

The groundwater portion of the Basin Plan Update was expanded to more directly describe and analyze aquifers within the Basin. This information is being developed by the Wyoming State Geological Survey and will be submitted to WWDC under separate cover.

### *Evaluate potential for aquifer storage and retrieval throughout the Basin*

Aquifer storage and retrieval was identified by the BAG as a key strategy. Aquifer storage and retrieval (or recovery; ASR) involves the injection of water available at the ground surface (typically surface water, but can include return flows from other groundwater supplies) into empty pore spaces within alluvial or bedrock aquifers. This water can then be recovered at a later time when needed using wells. Typically, this type of system can serve as a replacement for storage in municipal water systems. There can be technical hurdles to overcome, including location of suitable aquifers and treating injection water to appropriate water quality levels, but can be economic and efficient for many municipal applications. Agricultural users could benefit using a similar strategy of recharging alluvial aquifers using surface water infiltration ponds to provide late season streamflow increases through delayed alluvial aquifer return flows. These strategies would involve identification of potential users

that have suitable aquifers near the point of withdrawal and appropriate studies to determine their feasibility and effectiveness.

*Implement new water rights based modeling tool*

The Framework Water Plan recommended transitioning to more advanced models. WWDC staff and the consulting team concur with this recommendation for the Wind-Bighorn Basin. The existing spreadsheet models are adequate to make planning level decisions on a basin-wide level regarding locations of water availability and potential shortages. However, they are limited in the analysis of carryover storage, long-term drought conditions, water rights, operational scenarios and future projects. New models would allow a much more comprehensive analysis of potential future projects and their ability to alleviate shortages. The models would include time-series analyses that can use historical hydrology or stochastic (artificial) hydrologic data sets.

The following activities are recommended by staff and the consulting team to make this transition.

- Investigate an acceptable modeling platform for the Basin - Selection of an appropriate modeling platform for the advanced models is critical for successful implementation of the tool. Selection of a model should be made based upon the ultimate needs and uses for the model, data availability, model flexibility, model support, cost and several other critical issues. A feasibility study is currently being performed by WWDC in the Green River Basin to investigate the different types of models available for this use, and determine which may best be suited in that basin. This study could be used to investigate expanded modeling opportunities in the Wind-Bighorn Basin.
- Implement common data storage tools – A basic necessity for any water-rights based modeling platform will be data storage. A hydrologic database (the WindBighorn\_Hydro database) was created as part of the Basin Plan Update to store, allow easy access to, and allow easy updates to hydrologic, diversion and demand calculations. This database also performs most of the pre-processing calculations required for the spreadsheet models, and was designed to allow easy transition to supplying data for more sophisticated time-series hydrologic models. The database is described in Technical Memorandum 4B – Database and Model Operations. Depending upon the tool ultimately selected, this tool may require refinement or porting into a new database platform as part of the update.
- Implement new modeling tool - Current basin modeling activities could be expanded to include the effects of carryover storage. Carryover storage can be analyzed using a time-series analysis rather than individual dry, average and wet years. Time-series analyses can use historical hydrology or stochastic (artificial) hydrologic data sets. This type of analysis could be further expanded to include water rights, which would be helpful in analyzing effects of future water development activities in the Basin.

*Extend water supply study period in new model platform using historical and stochastic hydrology; analyze hydrologic effects of 2000's drought*

This strategy is a combination of two separate strategies developed from Framework Water Plan recommendations. As part of new modeling efforts in the Basin, it is recommended that

the hydrology study period be extended to include drought conditions in the 1950's, and if adequate data exists, drought conditions in the 1930's. In addition to extending the historical study period of the models, consideration should be given for development and use of stochastic hydrologic data. Stochastic data sets can be used to analyze hydrologic conditions that are outside of historical conditions. Stochastic data sets can also be used to analyze paleohydrology and/or climate variability.

*Analyze effects of tribal futures projects*

The BAG identified Tribal Futures projects and the technical analysis shows that implementation of Tribal Futures projects could have a significant effect on existing water users in the Basin. The spreadsheet models were developed to simulate Tribal Futures projects. However, these models are limited by their construction, and may not fully reflect expected impacts of the projects on other water users in the Basin. An expanded model as described in previous strategies could provide more detailed estimates of how development of Futures Projects would affect the Basin in general and particular water users and water rights, and guide the development of opportunities to mitigate these effects.

WWDC Projects

*Encourage water resource development to meet the current and future needs and demands in the Basin*

This strategy uses similar descriptions as strategies identified in the BAG process, but is essentially a combination of strategies identified by the BAG and strategies identified in the Framework Water Plan. This strategy promotes the development and use of water resources within the Basin to meet current and future water uses. Key components of this strategy would be moving recommendations made as part of this plan to Level I and Level II studies by WWDC. The strategy should also consider promoting funding and organizational opportunities within the Basin, which can often prevent projects from being considered beyond initial planning phases.

*Conduct watershed studies to assess water resources and opportunities*

This strategy is a direct implementation of the strategies identified by the BAG. This strategy was recommended for three different categories of issues, including Current and Future Water Uses, Agriculture, and Environmental. Watershed planning activities typically involve the evaluation of all water resources uses and water availability, land use and its effect on hydrology, and non-consumptive uses. Because watershed plans are conducted on a smaller scale than the larger basin planning activities, more focus and detail can be provided on the technical analysis. Furthermore, because the activities are on a localized basis, it provides a much easier means for local residents and stakeholders to become involved in the process.

*Evaluate potential for and effects of additional municipal and agricultural conservation*

Several strategies identified by both the BAG and in the Framework Water Plan deal with the potential for municipal and agricultural conservation and the limitations and effects of conservation. This strategy is intended to address all of these strategies.

Municipal conservation can be initiated to either reduce the amount of water that is diverted or pumped and treated by the municipality, or to reduce consumptive use. All typical forms of municipal conservation, such as low-flow fixtures, reduced lawn watering and other practices will reduce municipal diversion/pumping. Past studies have found that simply complying with new plumbing codes results in about 5 percent reduction in overall water use over time as old fixtures and appliances are replaced with new water-efficient models. However, reduction in consumptive use can be more difficult. Typically, lawn watering is the highest consumptive use within municipal systems. Therefore, reduction in the amount of lawn watered (i.e. removal of lawns) is the most effective means for municipal conservation. Other conservation measures can also result in lower consumptive use, but the incremental effects are smaller.

Typically, agricultural irrigation conservation is implemented to address either delivery systems or on-farm systems. Conservation in delivery systems typically involves the replacement of open-channel ditches with concrete or fabric lined ditches or pipe. On-farm conservation typically involves increased use of sprinkler and/or drip irrigation systems. Due to the economics of conversion to these systems, it is likely that some type of public funding would be required, such as low interest loans or grants.

Large scale conservation efforts can have an effect on downstream water users. Conservation efforts that reduce the amount of water but do not reduce consumptive use will have an effect on the timing of return flows to streams and rivers. These return flows are often counted on by downstream users to provide water supplies later in the season. For instance, if early season diversions are reduced, absent storage facilities or with full storage facilities, this would flow downstream and not be available for downstream users. These effects would vary based upon basin and proposed practices. These conservation efforts should be evaluated before large-scale efforts are undertaken.