Subject: **Powder/Tongue River Basin Plan**
Future Recreational and Environmental Water Requirements
Task 4

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INTRODUCTION

This memorandum presents projections of the future water needs associated with recreational and environmental water uses in the Powder/Tongue River Basin. Where practical, projections were developed for three planning scenarios:

1. Low Growth
2. Moderate Growth
3. High Growth

Unlike other water uses, recreational water uses are generally non-consumptive, while environmental water uses can be either consumptive or non-consumptive, depending upon circumstances. In both cases, quantification of the amount of water needed to meet future needs is difficult, and often must be addressed qualitatively. There is also considerable overlap between the two categories. For example, instream flows are considered an environmental water use for purposes of this water planning process because they are a form of natural resource stewardship undertaken by the State. One important purpose of such flows, however, is to maintain the habitat supporting recreational fisheries. As a result, there is some overlap in the discussion of future water needs for recreational and environmental uses presented in this technical memorandum.

FUTURE RECREATIONAL WATER REQUIREMENTS

Background and Approach

One of the more difficult problems in water resource planning is estimating the demand or "need" for water-based recreational opportunities in an area such as Wyoming's Powder/Tongue River Basin. There are several reasons for this difficulty, including the fact that many recreational resources are publicly owned and are utilized without the accounting activity that normally accompanies resource utilization in the private sector. It thus can be difficult to accurately estimate how much water-based recreational activity is currently taking place in a river basin. As a result, estimates of current and historical demands are best viewed as indicators rather than absolute quantities.

There are also problems associated with estimating the supply of water-based recreational resources (Harrington, 1987). Commonly used measures such as miles of stream and acres of standing water do not address issues such as resource quality or ease of access, which are also elements influencing supply. Nevertheless, such measures do provide indicators of resource supply that can be used for planning purposes.

In some instances, estimates of current recreational activity are available from survey data. For example, based upon Wyoming Game and Fish Department (WGFD) estimates, resident and non-resident anglers currently spend about 132,000 days annually fishing on standing waters in the Powder/Tongue River Basin. This estimate can be construed as a measure of the current demand for stillwater fishing given the current supply of opportunities for such fishing. What it does not tell us, however, is what the demand

would be if the supply of stillwater fisheries increases. For example, if a new reservoir fishery were developed, we would expect the demand for fishing to increase, but the amount of that increase is difficult to estimate without detailed site-specific studies.

Site-specific studies of water-based recreation demands are beyond the scope of this and other basin-wide planning studies. Instead, such studies usually adopt the convention of assuming that current activity rates will change in the future in proportion to changes in population, tourism, and angler preferences. Projected recreational activity rates are then compared to resource availability to determine if overcrowding or other unfavorable effects are likely to occur. That convention was followed in developing the recreational demand estimates described in this technical memorandum.

Current Recreation Activity

The most popular water-based recreational activity in the Powder/Tongue River Basin is fishing. Figure 1 shows that about 53 percent of Basin residents participated in fishing activities in 1989, the most recent year for which detailed survey information is available (University of Wyoming, 1990). The second most popular water-based recreational activity among residents is waterfowl hunting, with 16 percent of residents participating, followed by power boating (8 percent participation), rafting and canoeing (5 percent participation), and sailing (4 percent participation). Other popular outdoor recreational activities among area residents include camping, picnicking, and big game hunting. These latter activities are not directly tied to water resources, however, and thus are not included in Figure 1.

Less information is available concerning the participation of tourists in water-based recreation in the planning area. According to surveys commissioned by the Wyoming Business Council (WBC), over 4.2 million tourists visited Wyoming in 1998, and approximately 10 percent of those visitors fished at least once while in the state (Morey & Associates, 1998). No estimates are available concerning the proportion of those tourists that fished or pursued other water-based recreational activities in the Powder/Tongue River Basin.

The WGFD provided estimates of the number of annual activity days of angling and waterfowl hunting in the Powder/Tongue River Basin.[1] These estimates are given in Table 1. The results show that stillwater fishing on lakes and reservoirs in the Basin accounts for 132,000 activity days annually. About one-third of this activity occurs on Lake DeSmet. Much of the remaining stillwater fishing activity occurs on alpine lakes and reservoirs, which are concentrated on national forest lands.

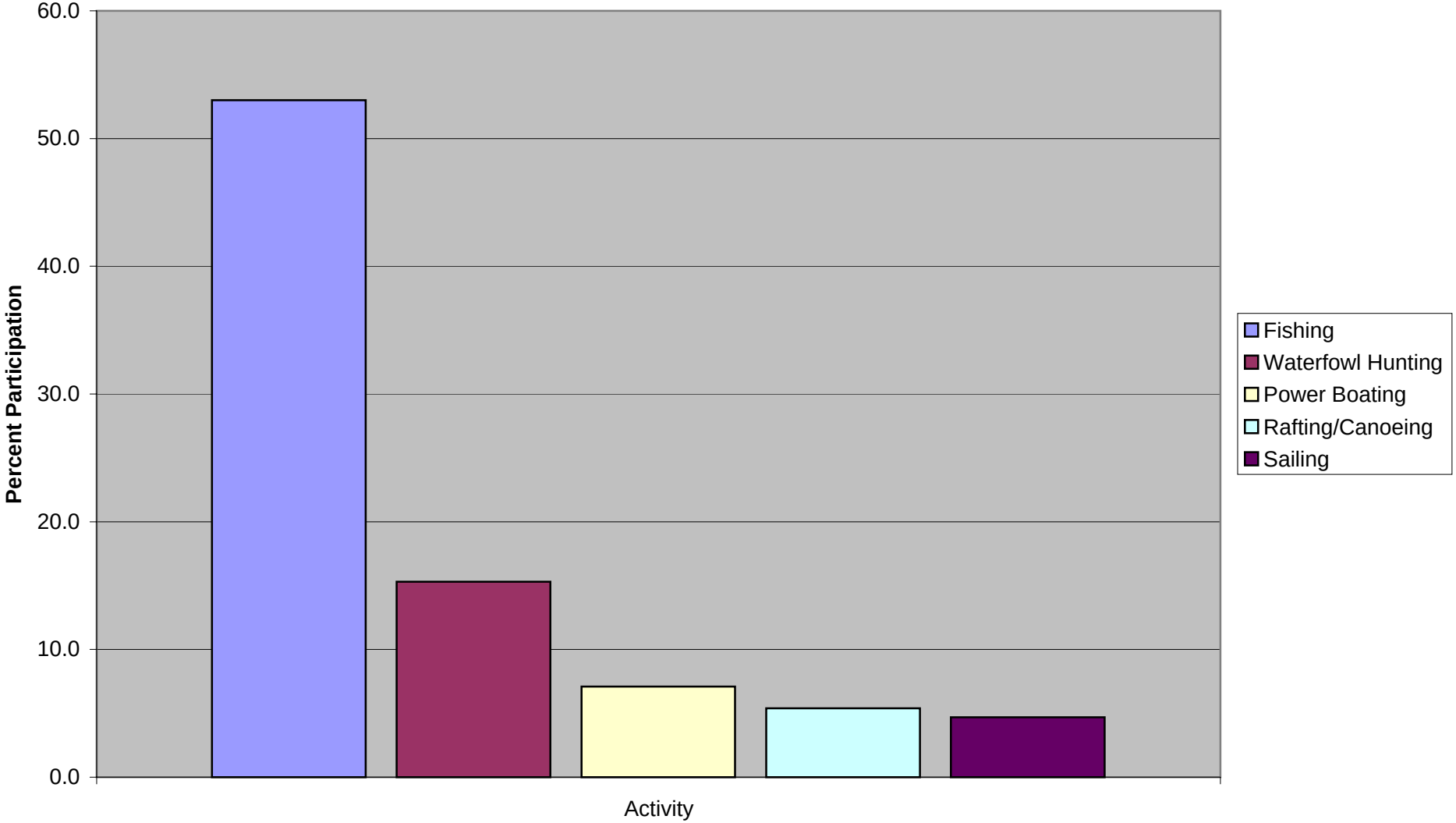
Table 1
Water-based Recreational Activity Days – Powder/Tongue River Basin

Activity	Activity Days
Stillwater fishing	132,000[1]
Stream fishing	140,000[1]
Boating/waterskiing	n/a[2]
Waterfowl hunting	2,000
Rafting/kayaking/canoeing	n/a[2]
Sailing/wind surfing	n/a[2]
Total	274,000

[1] Estimate by Watts & Associates based upon WGFD data.
[2] Data not available.

[1] Activity days are defined as days during which at least some part of the day is spent angling or waterfowl hunting. The number of hours per day spent in these activities varies. The sources of the activity day estimates are listed in a technical memorandum by HKM Engineering (2002a).

Figure 1
Resident Participation in Water-based Recreational Activities
Powder/Tongue River Basin



Stream fishing in the Basin accounts for about 140,000 activity days annually. The upper reaches of many of the streams in the Basin provide very good trout fishing opportunities. The most popular areas for stream fishing in the Basin include the Tongue River, Clear Creek, the Powder River, and Crazy Women Creek.

Waterfowl hunters spend about 2,000 days annually in the pursuit of ducks and geese that inhabit or pass through the Basin. Activity day estimates are not available for other water-based recreational pursuits, including boating, water skiing, rafting, canoeing, sailing, and wind surfing.

Recreation Demand Projections

Future demands for recreational water resources depend upon numerous factors, including population growth, tourism growth, and participation rates in various water-based recreational activities. Future participation rates depend upon changes in preferences over time as well as the availability of water resources and the amount of congestion encountered at recreational sites. Changes in future recreational preferences are hard to predict, so the projections described in this section are based upon the assumption that participation rates remain constant over the planning horizon. This assumption means that projected recreational demands are proportional to growth in population and tourism. The potential effects of congestion on future recreational water uses are discussed in the following section.

Projections of population growth in the planning area are described in a technical memorandum by that title (Watts, 2002). Those projections are summarized in Table 2 in terms of average annual growth rates for the low, moderate, and high growth planning scenarios. These annual average growth rates range from 0.53 percent for the low growth scenario to 1.04 percent for the high growth scenario. Table 2 also gives projections of tourism growth over the planning horizon for low, moderate, and high growth scenarios. The range for these growth rates is from 1.00 to 3.00 percent.

Table 2
Projected Annual Growth Rates In Powder/Tongue River Basin
Population and Tourism — (2000-2030)

	Average Annual Growth Rate	
Scenario	Basin Population	Tourism
Low growth	0.53%	1.00%
Moderate growth	0.82	2.00
High growth	1.04	3.00

Source: See text.

The tourism growth rate projections are based upon data from a variety of sources that provide indications of tourism growth rates in the Powder/Tongue River Basin and Wyoming. For example, the Wyoming Department of State Parks and Cultural Resources (WDSPCR) estimates that visitation at Wyoming's state parks increased at an average annual rate of 0.50 percent annually during the period from 1995 through 1999. During the same period, visitation at Wyoming's historical sites (perhaps a better gauge of tourism than state parks) increased at an annual rate of 1.90 percent (WDSPCR, 2000).

A study of tourism in Wyoming by Morey and Associates and the University of Wyoming found that Wyoming tourism increased at an average annual rate of 3.6 percent during the three- year period from 1996 through 1999, although that growth rate is based upon a very short time period (Morey and Associates, various years). BBC Research and Consulting prepared projections of tourism for the Bear River Basin. Those projections are for tourism to increase at an average annual rate of between 1.6 and 2.9 percent between 2000 and 2030 (Harvey and Jeavons, 2000). Based upon the above data, a range of one to three percent for average annual tourism growth in the Powder/Tongue River Basin was used to project future demands for water-based recreational activities.

The other information needed to project future recreation demand is a breakdown of recreational activity between residents and nonresidents. No precise estimates exist, but based upon what information is available and the judgment of professionals in the WGFD, it was assumed that 80 percent of future hunting and fishing activity would be by Wyoming residents and 20 percent by non-residents.

This information, in conjunction with the data in Tables 1 and 2, was used to project future recreational activity days over the 30-year planning horizon from 2000 to 2030. Those projections are given in Table 3. The demand for stillwater fishing in the planning area is projected to expand significantly over the next three decades. From a current level of 132,000 activity days annually, demand would grow to 159,000 days in 2030 under the low growth scenario, an increase of 20 percent. For the moderate growth scenario, demand would grow to 183,000 activity days, a 39 percent increase. For the high growth scenario, stillwater fishing demand would rise to 208,000 activity days by 2030, an increase of 58 percent over current levels.

Similar increases are projected for stream fishing demands in the planning area. The projections in Table 3 show that demand would increase from a current level of 140,000 activity days to between 169,000 and 221,000 activity days by 2030, depending upon the growth scenario chosen. The high growth scenario projects a 67 percent increase in stream fishing demand over the next 30 years.

The demand for waterfowl hunting is also expected to increase over the planning horizon, but at a lesser growth rate than for fishing. Total annual activity day demand is projected to increase from a current level of about 2,000 activity days to between 2,300 and 2,700 activity days by 2030, depending upon the planning scenario.

Adequacy of Existing Resources to Meet Projected Demands

The issue of the adequacy of water resources to meet projected demands on a basin-wide basis is difficult to assess because it involves subjective judgments. There are no absolute standards for determining the number of miles of stream fisheries or acres of reservoir fisheries that are needed to accommodate a given number of anglers. Similarly, there are no absolute standards for the water resources needed to meet demands for boating or waterfowl hunting.

Table 3
Current and Projected Water-based Recreational Activity Days
Powder/Tongue River Basin — 2000-2030

	Activity Days			
Activity	Current	Low growth	Moderate growth	High growth
Stillwater fishing	132,000	159,000	183,000	208,000
Stream fishing	300,000	169,000	194,000	221,000
Water fowl hunting	2,000	2,300	2,500	2,700
Totals	274,000	330,300	379,500	431,700

Source: See text.

The WGFD in the past has estimated the supply of water resources available to meet the demands of fishermen in various regions of the state (WGFD, 1989). These supply estimates were expressed in terms of fishermen days, and reflect the amount of pressure that the Department believed at that time (1988) that publicly accessible fisheries could withstand without significant deterioration. Although these estimates have not been updated in the past decade, they serve as one benchmark for judging the capacity of fisheries to meet projected future demands. Unfortunately, the WGFD did not estimate fishery supplies separately for the Powder/Tongue River Basin, but for an area including the Powder/Tongue, Little Missouri, Belle Fourche, Cheyenne, and Niobrara River Basins. Nevertheless, it is useful to review these supply estimates as background for assessing resource adequacy.

According to the WGFD, the Northeast Wyoming River Basins and Powder/Tongue River Basin combined provide an annual supply of 405,000 activity days of fishing opportunities. With the exception of Keyhole Reservoir, almost all of this supply is located in the Powder/Tongue River Basin. When this figure is contrasted with a current utilization rate of 272,000 activity days in the Powder/Tongue River Basin, it is apparent that there is no current overall shortage of angling opportunities. Individual water may experience overcrowding at times, however, because they are easily accessible.

The projections of future demands for fishing opportunities described above range from 328,000 to 429,000 activity days annually by the year 2030, depending upon the growth scenario used. These demand scenarios indicate that fishing pressure demands may approach the supply of resources available in the Powder/Tongue River Basin over the next thirty years. The implications of this conclusion are limited by the fact that there is a relatively fixed supply of streams that are suitable for maintaining recreational fisheries. One inference that can be drawn is that future activities that would denigrate existing recreational stream fisheries could have significant negative recreational effects, while activities that enhance fisheries habitat could have significant positive effects.

Another inference that can be drawn from these projections is that private landowners who control access to good quality stream fisheries in the planning area own a valuable asset and may be able to derive income in the coming decades by allowing access to those fisheries, either through private leases, leases to public agencies such as the WGFD, or through daily access fees.

The other water-based recreational pursuit for which demand projections were developed is waterfowl hunting. Those projections indicate that demand is expected to ride from a current level of 2,000 activity days to between 2,300 and 2,700 activity days by the year 2030 (Table 3). The WGFD has not estimated the supply of waterfowl hunting opportunities, partially because populations are migratory and hunting seasons and bag limits are established in accordance with guidelines established by the U.S. Fish and Wildlife Service (USFWS). These guidelines are intended to maintain sustainable populations of migratory birds that are subject to hunting in several states along their migratory routes (USFWS, 1996).

FUTURE ENVIRONMENTAL WATER REQUIREMENTS

Background and Approach

Current environmental uses of water in the Powder/Tongue River Basin are described in a separate technical memorandum (HKM, 2002a). Those uses include:

- instream flows and reservoir bypasses;
- minimum reservoir pools;
- maintenance of wetlands, riparian habitat, and other wildlife habitat; and
- direct wildlife consumption.

Unlike recreational water requirements, environmental water requirements are not necessarily related to changes in population or tourism. Instead, environmental water requirements are at least partially a function of human desires concerning the type of environment in which people want to live. These desires are expressed in many ways, including environmental programs and regulations promulgated by elected representatives at the state and federal levels. Thus, future environmental water requirements in the Powder/Tongue River Basin will be determined, at least partially, by existing and new legislation dealing with environmental issues at the state and federal levels, and how that legislation is implemented by federal and state agencies.

Examples of such legislation include Wyoming Statutes §41-3-1001 to 1014, which stipulate that instream flows are a beneficial use of Wyoming's water and specify procedures for establishing such flows using unappropriated water. This legislation authorizes the WGFD to specify stream segments and flow requirements for an instream flow filing. The WWDC is authorized to file an instream flow application with the State Engineer and perform hydrologic analyses on filings recommended by the

WGFD. The State Engineer can then issue a permit for an instream flow water right following a public hearing.

Future water requirements for instream flows in the Powder/Tongue River Basin (and other river basins throughout the state) depend largely upon how Wyoming's instream flow legislation is implemented over the 30-year planning horizon. Projecting the outcome of this process quantitatively would be difficult, and is perhaps unnecessary because instream flows and other environmental water uses are largely non-consumptive. Instream flow designations can conflict with potential new out-of-stream uses at specific locations, however, a topic that is discussed below.

Instream Flows and Reservoir Bypasses

Wyoming's instream flow statutes recognize the obvious economic fact that Powder/Tongue River Basin water resources have value in non-consumptive uses such as instream flows. Such flows not only contribute to aesthetic character and biological diversity of the Basin, they also support recreational fisheries that are important to Basin residents and to the Basin's economy. The amenities provided by free flowing streams have been at least partially responsible for economic growth in the Sheridan and Buffalo area in recent years.

The WGFD has a goal of maintaining and enhancing existing fisheries in the Powder/Tongue River Basin through the statutory designation of instream flow segments and other management strategies. Procedurally, the WGFD identifies stream segments for instream flow filings and forwards the recommendations to the WWDC. The WWDC evaluates the recommendation to assure there is available water and then files the application with the State Engineer's Office. The State Engineer then issues a permit if the application is approved. To date, a total of six applications involving six stream segments in the Little Bighorn, Tongue, and Powder River Drainages have been filed with the State Engineer.

The extent to which current filings and future instream flow requests may conflict with potential storage developments for supplemental irrigation water in the Basin is unknown, but the potential for conflicts does exist. These conflicts would have to be resolved on a case-by-case basis, weighing the potential benefits of water to the state in instream versus out-of stream uses.

Another tool for maintaining fisheries habitat is the provision of minimum flow bypasses at reservoir sites. Currently, only three reservoirs in the planning area have minimum flow bypasses included as requirements in their permitting documents; Park, Tie Hack, and Twin Lake Reservoirs (HKM, 2002b). The development of additional reservoir storage in the future would likely bring about requests by the WGFD and others for such minimum flow bypass requirements. As discussed elsewhere, the likelihood of additional storage being developed will be greatly influenced by future trends in cattle and forage prices and state funding mechanisms available to irrigators in need of supplemental water.

Minimum Reservoir Pools

Another environmental water use is the provision of minimum reservoir pools for fish and wildlife purposes. Six reservoirs in the Basin have minimum pools listed in their permitting documents; Park, Dull Knife, Willow Park, Kearney, Cloud Peak, and Tie Hack. Given the current federal regulatory environment and public desires to maintain and enhance recreational fisheries in the Basin, it is likely that any additional storage developed in the future will have a portion of its storage devoted to fish and wildlife purposes.

Wildlife Habitat

Another important environmental use of water is the provision of habitat for wildlife. Wildlife habitat exists in wetland and riparian areas on public and private lands throughout the Basin, some of it occurring naturally and some of it as a result of human activity. A tabulation of wetlands wildlife habitat areas in the planning area has been undertaken as a part of the geographical information system developed for this study. A description of the information in this database is contained in a separate technical memorandum.

Three federal programs, the Conservation Reserve Program (CRP), the Wetlands Reserve Program (WRP), and the Wildlife Habitat Incentives Program (WHIP) encourage the development of wildlife habitat on private lands. The CRP program is administered by the Farm Service Agency of the U.S. Department of Agriculture (USDA), and provides incentive payments for various conservation practices that will enhance wildlife habitat, as well as improve water quality and reduce erosion.

The WRP is administered by the Natural Resources Conservation Service (NRCS) of the USDA. It is a voluntary program that that provides financial and technical assistance to private landowners to reestablish wetlands on their property. The WHIP is also administered by the NRCS, and provides technical and financial assistance to private landowners interested in improving wildlife habitat on their property. None of these programs result in significant amounts of consumptive water use. As a result, no projections of future water needs for such programs were developed as a part of this water plan.

Direct Wildlife Consumption

There are no current estimates of consumptive water use by wildlife for the Powder/Tongue River Basin. An estimate developed for the Green River Basin puts consumptive use by big game and wild horses at about 500 acre-feet of water annually (Tyrrell, 2000). A similar figure is probably roughly correct to the Powder/Tongue River Basin. This level of consumptive use is relatively small and is not expected to change significantly over the planning horizon.

SUMMARY AND CONCLUSIONS

The Powder/Tongue River Basin is endowed with numerous streams, lakes, and reservoirs that provide excellent opportunities for water-based recreation. Existing resources appear adequate to meet both current needs for recreation, but will come under increasing pressure in the future as the demand for fishing opportunities increases among residents and tourists. Future activities that denigrate fisheries would have significant negative impacts upon recreation, while activities that enhance fisheries habitat would have significant benefits. The WGFD is committed to preserving existing stream fisheries through instream flow recommendations and other management techniques. Instream flow permits will, to some extent, dictate the geographic availability of water for out-of-stream developments.

Other environmental uses of water in the planning area are largely for the maintenance and development of wildlife habitat. These activities involve only minor amounts of consumptive use and are not expected to conflict with other water uses.

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