OPTIONS FOR MEETING FUTURE WATER DEMANDS

OPPORTUNITIES, STRATEGIES, AND TOOLS

Unallocated Water

The following information on sources of water that may be available for new appropriations is summarized from more detailed information provided in individual basin reports. Overall, the availability of water for new appropriations varies across the state and is subject to both physical water availability and existing legal demands (Table 7 and Figure 24). Many of the basins located in the western third of the state are generally closed to new surface water appropriations. Exceptions may be available for various consumptive and non-consumptive uses depending upon the closure. Applications for new groundwater uses are not prohibited in closed basins, but they generally require reallocating water from an existing surface water or groundwater use through a mitigation or aquifer recharge plan. Options have increased in recent years to facilitate mitigation and mitigation banking as explained below.

Opportunities for new appropriations for surface water or hydraulically connected groundwater may also be limited outside closed basins because of irrigation claims, hydroelectric rights, or instream water rights for fisheries, wildlife, and recreation. Exceptions include the Yellowstone River downstream of the Bighorn River, the Missouri River downstream of Morony Dam, the Kootenai River, and intermittent and ephemeral drainages in eastern Montana. Surface water is available seasonally or on limited reaches of other streams. The potential for new appropriations of groundwater from aquifers that are hydraulically connected to surface water is typically limited by the legal availability of flows in the connected surface water source.

CHANGES IN USE – REALLOCATION OF WATER FOR NEW USES

The place of use, point of diversion, purpose of use, and place of storage are all elements of an existing water right that may be changed upon proof that the proposed change will not cause adverse effect to other water users. The Water Use Act also includes special provisions for changes for aquifer recharge and mitigation, temporary changes, and temporary leases. These provisions provide water marketing opportunities along with the ability to

Table 7: *General availability of surface water and connected groundwater for new appropriation*

Basin	Limitations on New Appropriations
Clark Fork / Kootenai	Basin closures in the Bitterroot, Upper Clark Fork, and several smaller sub-basins limit appropriations to surface water exceptions and groundwater subject to 85-2-360, MCA. Hydroelectric rights at Noxon and Kerr dams limit new appropriations; instream flow rights for fisheries and recreation limit new appropriations in the Bitterroot, Rock Creek, Blackfoot, Middle Fork and North Fork Flathead, Tobacco, and several smaller tributaries
Lower Missouri	Basin closures on the Milk and its southern tributaries, and the Musselshell limit appropriations to groundwater subject to 85-2-360, MCA and surface water for small domestic and stock uses (southern tributaries). Compact closures limit appropriations on Big Sandy Creek, Beaver Creek, Sage Creek, Cut Bank Creek, Frenchman Creek, Poplar River, Porcupine Creek, Rock Creek Whitewater Creek, Big Muddy Creek, Milk River, and tributaries to Fort Peck Reservoir. Irrigation diversions limit new appropriations on the specific reaches of the Judith River, Big Spring Creek, Warm Spring Creek, Arrow Creek, and Flatwillow Creek. New appropriations are possible on intermittent and ephemeral tributaries, the Missouri River, and Fort Peck Reservoir.
Upper Missouri	Basin closures on the Missouri and its tributaries including the Teton, Sun, Smith, Jefferson, Madison, Gallatin, Boulder, Beaverhead, Big Hole, Ruby and Red Rock rivers limit appropriations to exceptions including groundwater subject to 85-2-360, MCA. Hydroelectric rights at Great Falls and throughout the Upper Missouri limit new appropriations of all types. New appropriations are possible from the Marias during early irrigation season. Lower Marias flows are regulated by Tiber for instream flows and existing diversions.
Yellowstone	A basin closure on Rock Creek for the irrigation season limit appropriations of surface water to exceptions including groundwater subject to 85-2-360, MCA. Compact closures limit appropriations in the Bighorn, Little Bighorn, Pryor and Rosebud sub-basins. Water may be available from conservation district reservations downstream of the mouth of the Bighorn River. No permits have been issued on the Powder, Tongue, and Big Porcupine since 1995. New appropriations may be available from the Yellowstone above Billings. New appropriations may be possible at selected times including during high spring flows on the Shields River.

STATEWIDE BASIN CLOSURES

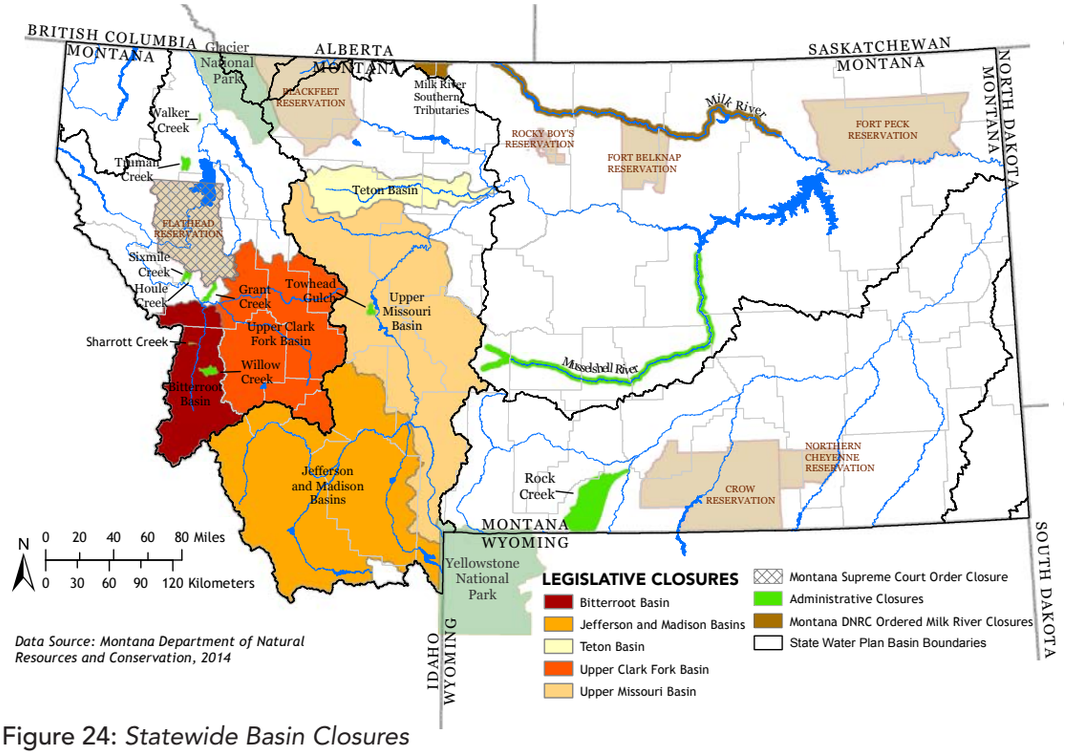

Figure 24: *Statewide Basin Closures*

permanently or temporarily reallocate water for future needs.

Water Use Changes

Under a change authorization a water user may permanently reallocate water to a new purpose while preserving the priority date for the underlying water right. Because a change is doing something new on a source and other water rights exist on that source, a change in use is limited to the historic period of diversion, historic diverted volume, and historic consumptive use (collectively referred to as historic use). These limitations are important to ensure that a proposed change will not adversely affect other water users on the source. Increases in the amount of consumption or changes in the pattern of use from the historic use of the water right can affect other water right holders who depend on that historic pattern of use and amount in making their own use of water. One person's return flow may be another's water supply. Therefore, the historic use analysis also looks at the timing and location of return flows.

Over the past 40 years, the DNRC has developed an extensive set of data, policies, and rules to assist water users in identifying relevant evidence to establish the parameters of historic use. However, potential adverse effects to other water users is often a limiting factor in the ability to change a water right.

A traditional change is an effective means of permanently reallocating water to a new use. Permanent changes also provide a means for mitigating new groundwater uses that deplete surface water and potentially cause adverse effect on over appropriated surface water sources and in closed basins. Changes for mitigation require identification of the specific water right for which mitigation is being provided. The applicant is typically required to demonstrate that the water right being changed will provide sufficient water in timing, location and amount to mitigate potential adverse effect either by leaving the water instream or through use of aquifer recharge.

Mitigation and Aquifer Recharge

In 2011, the Montana Legislature adopted an innovative approach to facilitate the reallocation of existing water rights for the purpose of mitigation or aquifer recharge to allow new uses of water in water short areas. Water for mitigation or aquifer recharge is used to offset depletions to surface water sources from new groundwater wells. Unlike the traditional change process discussed above, the new approach enables a water user to prospectively change all or a portion of a water right to mitigation and have that mitigation water available for lease or sale to applicants seeking new water rights from the DNRC. This process is similar to a water bank for mitigation uses. This new statutory tool provides greater predictability for new water users who need to mitigate depletions from a proposed use and provides existing water users with the opportunity to market water while preserving their existing use. More research is needed in the area of aquifer recharge as a tool for the mitigation of new withdrawals.

Temporary Changes

A water user may temporarily change a water right with DNRC approval pursuant to §85-2-407 and 408, MCA. A temporary change may be approved for up to 10 years, with an opportunity to renew for 10 more years, and there is no limit on the number of renewals. The water user must identify the proposed change and how long it will be needed, as well as meet other criteria. If granted, the temporarily changed appropriation has the same priority date as the existing water right. Unlike a permanent change, temporary changes automatically revert to the original use at the expiration of the term. Therefore, they can be an effective method for providing water for temporary or short term needs.

Temporary changes and leases pursuant to §85-2-408 and 436, MCA, provide the only means for a private water user to maintain or enhance instream flows to benefit the fishery resource. Under §85-2-436 MCA, FWP can change or lease an existing diversionary right to an instream-flow use to benefit the fishery resource consistent with the requirements of §85-2-408 MCA. Section 436 also provides FWP with the authority to make a permanent conversion of a diversionary water right to instream flow on no more than 12 stream reaches.

Temporary Leases

In 2013, the Montana Legislature adopted §85-2-427, MCA, which provides the opportunity to lease a water right for 2 years within a 10 year period. While the volume of water that may be leased is limited to 180 acre-feet per year, the statute provides a simplified and faster procedure. This new statutory tool enables water to be temporarily reallocated to serve short term needs and provides existing water users with the opportunity to market water while preserving their existing use.

Salvage Water

Pursuant to §85-2-419, MCA, a water user may retain the right to the beneficial use of water "salvaged" by implementing a water-saving method. However, the right to the use of salvage water for any purpose or in any place other than that associated with the original water right requires prior authorization by the DNRC and is subject to the change provisions of §85-2-402, MCA. In practice, water users have had limited success in proving the existence of salvaged water and lack of adverse effect to other water users due to the fact that many efficiency improvements result in increased consumption or otherwise alter conditions on the source relied upon by other water users.

Voluntary Water Management

Locally initiated water management plans are also an effective tool for stretching Montana's water supplies during times of shortages. All of these efforts are highlighted by some common elements: voluntary cooperation from a wide range of stakeholders, local solutions to fit local needs, joint sacrifices and sharing of shortages. The tension that develops between irrigated agricultural interests and advocates for instream flow during times of shortages is typically the genesis for the development of these plans. Although the parties may have competing water use interests, they are united in their desire to improve water management for the benefit of their local communities. The success of these water management plans is

dependent on strong local leadership, access to timely and relevant information to support decision making, and a willingness on the part of all parties to support the plan within the prior appropriation framework. Technical support from state and federal natural resource agencies is also a critical component of successful local planning efforts. Examples of successful locally developed water management plans and can be found in watersheds across Montana.

OPPORTUNITIES FOR RESEARCH AND INVESTMENT

The reallocation of existing water rights to new uses will require (1) improved methods for calculating historical consumptive use and (2) expanded stream gaging to measure the available supply and evaluate physical and legal availability of water for appropriation.

DNRC calculates historical consumption associated with pre-1973 water right claims from various sources of information. Historically irrigated acres are derived from water resource survey maps, historical aerial photography, and affidavits from water users. Consumptive water use is then calculated by applying standard engineering equations on crop water demands to county level agricultural statistics. Given the site specific nature of irrigation practices and crop water needs, the use of county level agricultural data may over estimate consumption in some cases and under estimate consumption in others.

More accurate methods of determining consumptive use are needed as competition increases for limited water supplies and the knowledge of irrigation practices used prior to 1973 fades with time. Advances in the development of computer modeling software to calculate water consumed by crops using commercially available information generated from NASA's Landsat Program provide an opportunity for Montana to bring a higher degree of accuracy to the water right change process.

OPPORTUNITIES FOR STORING SPRING RUNOFF

Basins with Hydrology that Could Potentially Support New Storage

The hydrology of streams in Montana, particularly in mountainous areas, might be suitable for new reservoir storage because much of the annual flow volume in Montana is produced during the relatively short spring-runoff period. Water is potentially available for storage during runoff when water supply conditions meet or exceed median conditions and where existing storage capacity is small relative to the total volumes of water produced annually in the watershed. As an illustration, Figure 25 depicts median daily flows for the Missouri River near Toston, including simplified delineations of when water might be stored and again released to ease shortages. Canyon Ferry Reservoir, downstream of Toston, regulates the flow of the Missouri River and at least partially stores, and releases water similar to this illustration.

In the Upper Missouri planning basin, existing reservoirs in the Marias, Teton, Sun, and Beaverhead basins store relatively large volumes of water when compared to the amount of water produced annually in these watersheds and, therefore may not be attractive locations for additional storage from a hydrologic standpoint. In comparison, the Gallatin and Big Hole watersheds may be more attractive from a hydrologic standpoint because the existing storage capacity is small compared to the total flow produced.

In the Clark Fork and Kootenai Basins the existing storage capacities are small compared to the total flow produced. Exceptions are the Flathead and

MISSOURI RIVER AT TOSTON MEDIAN DAILY FLOW

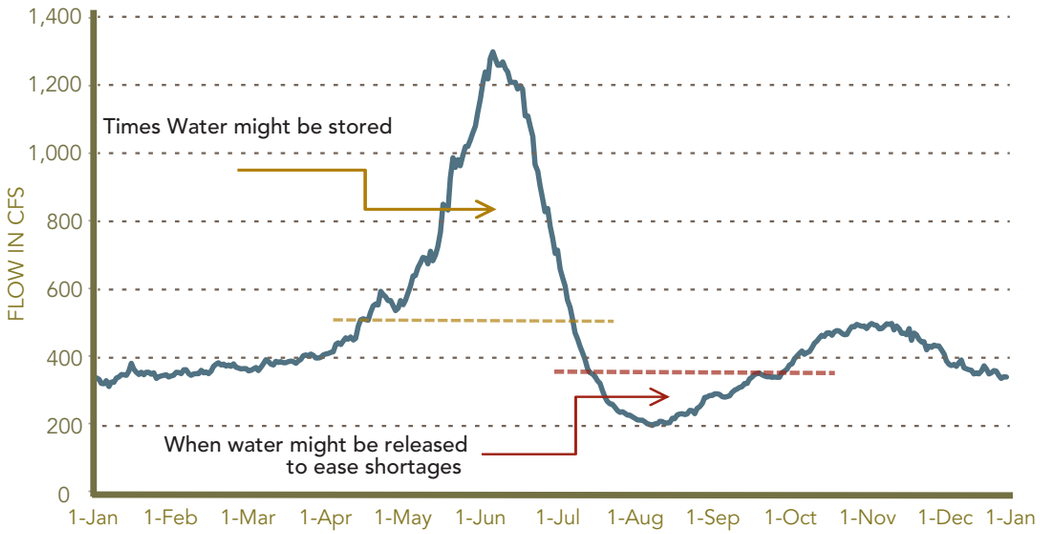

Figure 25: *Median daily flow of the Missouri River at Toston depicting times of potential storage and releases*

Kootenai Rivers. The strongest demand for new or additional storage will likely be heard in the Upper Clark Fork, Bitterroot, and Blackfoot River watersheds, where demand for water is high and the water supply conditions are some of the lowest in the basin. These basins store less than 10% of the total flow. Water is potentially available for storage during runoff when water supply conditions meet or exceed median conditions.

Most eastern Montana prairie streams do not produce large water yields and are therefore not good candidates for traditional water storage. Exceptions exist, based solely upon hydrologic characteristics, on some streams draining snowpack from island mountain ranges of central Montana. Horse Creek and Flatwillow Creek are two streams in the Musselshell Basin that have been studied for potential future storage projects to provide late-season water for irrigation.

The Judith River is another stream exhibiting flow patterns that might accommodate additional storage (Figure 26). High flows arising from the melting snowpack typically peak in late May, before there is demand for irrigation water. The river recedes rapidly after the peak, leaving only 5,800 acre feet of water stored in the watershed, at Ackley Lake.

Several storage alternatives were explored by the USBR on small streams arising in the Little Rocky and Bears Paw Mountains. Analysis determined that although storage projects were technically feasible on a hydrologic basis, they failed on the basis of economics.

Options for storage on the main stem of the Yellowstone River are limited by the lack of suitable dam sites and environmental concerns. The potential for storage on the Wyoming tributaries, Clarks Fork of the Yellowstone, Big Horn, Tongue and Powder River basins is limited by the lack of suitable dam sites, environmental concerns, and physical availability of water to store. The Yellowstone Water Reservations do provide water rights for three off-stream storage projects located mid-basin and north of the Yellowstone River. A 1983 U.S. Bureau of Reclamation preliminary report estimated the following firm-yields (i.e. the amount delivered every year) for the three projects: Buffalo Creek Reservoir (near Bighorn confluence with main stem) could provide 24,000 acre-feet; Starved-to-Death Creek Reservoir (north east of Forsyth) could provide 29,000 acre- feet; and Sunday Creek Reservoir (north of Miles City) 189,000 acre-feet—the latter project would involve importing water from the lower Missouri basin.

Water might be available to store in a basin during the wettest years or even moderately wet years; however, a new reservoir might not be viable if it is not able to store water during a sequence of dry years. Furthermore, storage water rights for existing reservoirs may impose a potentially significant constraint on the feasibility of new traditional storage. Streams where high spring flow could be considered available based on stream flow and local water rights, might affect the ability of downstream reservoirs to store water. For example, new storage development upstream of Canyon Ferry could encroach on Reclamation's senior storage rights unless Reclamation is able to accommodate that new storage through contractual arrangements for Canyon Ferry exchange water.

Another alternative might be to enlarge an existing storage facility to accommodate a greater volume of water. Many facilities may have been potentially undersized when constructed, and based on the hydrology of their basins could store additional water if structural capacity was increased. Fresno Dam on the Milk River has been investigated for storage capacity enlargement.

JUDITH RIVER NEAR MOUTH MEDIAN DAILY FLOW

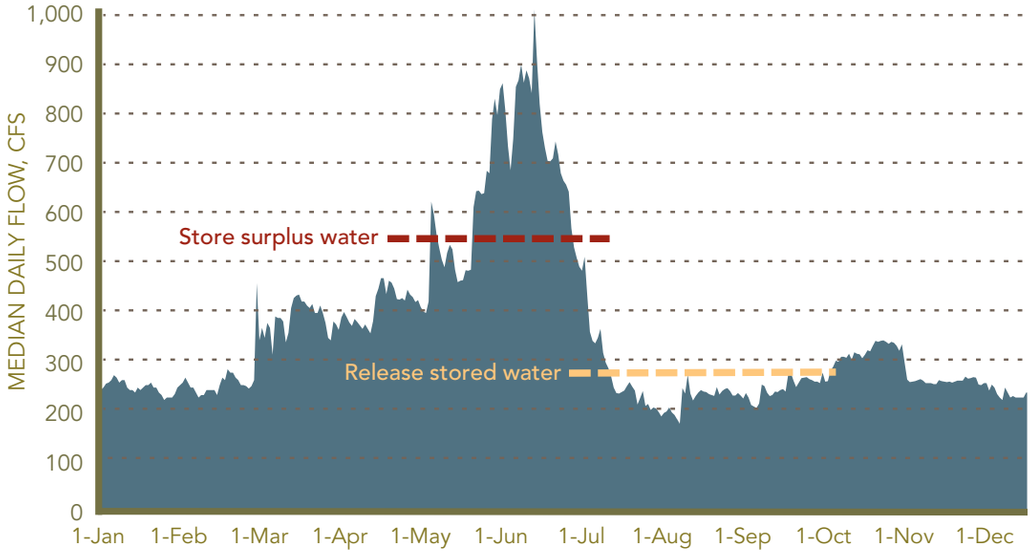

Figure 26: *Median daily flow near the mouth of the Judith River depicting times of potential storage and releases*

FEASIBILITY AND CONSTRAINTS ON NATURAL STORAGE & RETENTION

Floodplains with healthy riparian areas act to slow runoff and promote groundwater recharge; effectively storing water and releasing it slowly back to the surface water system. In this way, these natural systems fill a role similar to traditional reservoirs. The natural storage and retention benefits of these systems can be maintained and potentially enhanced by limiting the encroachment of urban development and impervious surfaces, controlling storm water discharge, protecting vegetation from overgrazing, minimizing stream incision and channelization, and preventing erosion through good forest and range management practices.

Artificial recharge of alluvial aquifers and floodplains may provide additional opportunities to store water when the physical supply exceeds legal demands. The groundwater flow systems in nearly all of the watersheds of western Montana and the large watersheds of eastern Montana have been substantially altered by recharge from irrigation canals and the practice of flood irrigation. Significant volumes of water from irrigation conveyance and application practices are stored in alluvial aquifers and released naturally to support late season streamflows. Water users in these watersheds have grown dependent on these late season return flows. However, aquifer recharge is a consequence of the primary beneficial use of the water.

Existing irrigation infrastructure provides ready means for augmenting the recharge of shallow groundwater systems. In some areas it may be feasible to run water through these systems outside of the normal irrigation season for the purpose of recharging shallow groundwater aquifers. This activity would require a change authorization from DNRC to ensure other water users are not adversely affected.

There may also be opportunities to take advantage of the natural storage potential of shallow aquifers by diverting unallocated flows into constructed wetlands or retention basins. The feasibility of an artificial recharge project will depend on a number of factors including, but not limited to, site specific geologic conditions, and the physical and legal availability of surface water to divert and store.