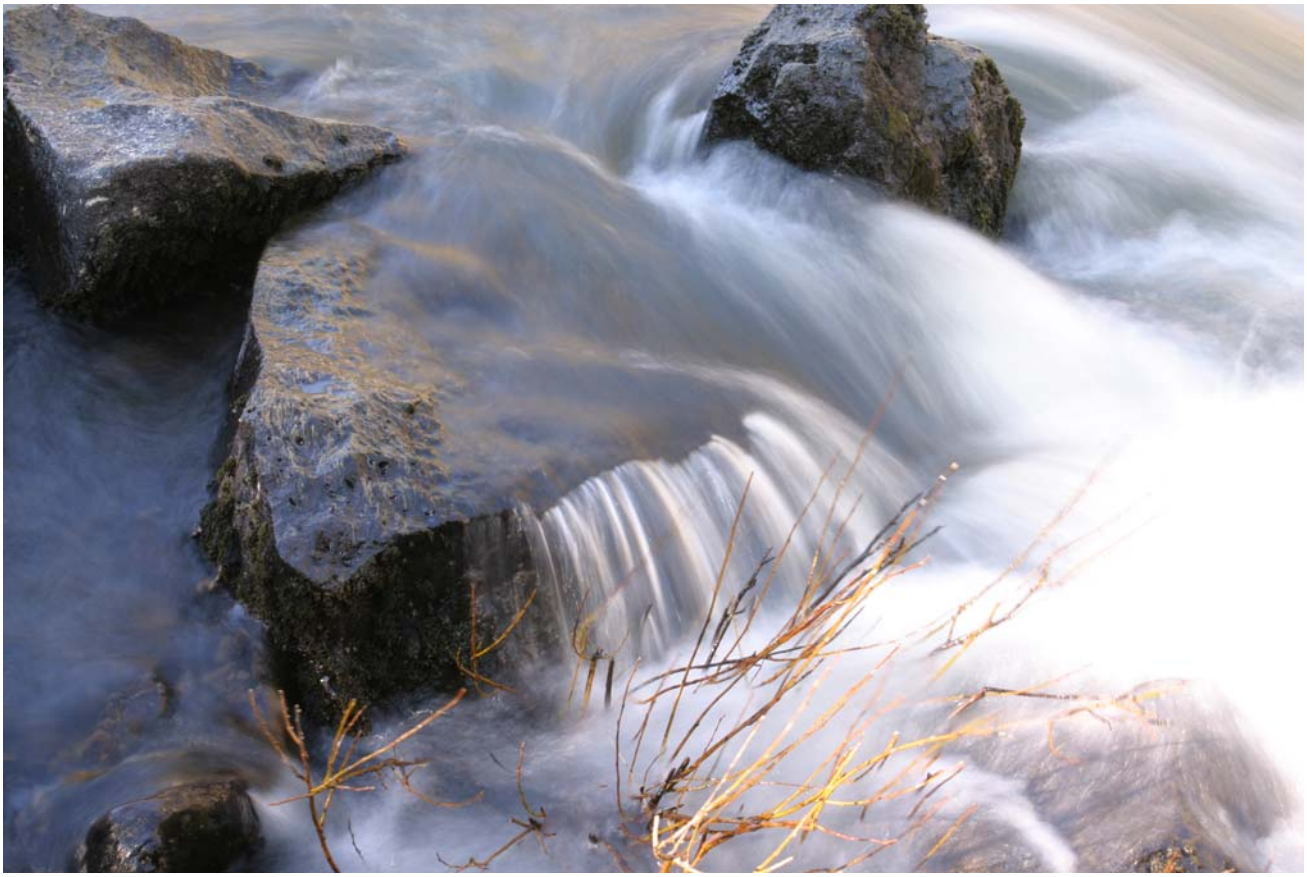
Deschutes Ground Water Mitigation Program

Five-Year Program Evaluation Report



February 29, 2008

State of Oregon
Water Resources Department

5-Year Evaluation of the Deschutes Ground Water Mitigation Program

Contents

Special thanks to Kyle Gorman, WRD,
for photographs used in this report

Introduction

The Deschutes Ground Water Mitigation Program was developed to provide for new ground water uses while maintaining scenic waterway and instream water right flows in the Deschutes Basin. The program is authorized under ORS 537.746 and House Bill 3494 (2005 Oregon Law) and implemented in Oregon Administrative Rules (OAR) Chapter 690, Divisions 505 and 521.

Much of the mainstem Deschutes River and its tributaries are protected by scenic waterway designations and instream water rights. There are also existing surface water rights on the Deschutes River and its tributaries for out of stream uses, such as irrigation and municipal. In the Deschutes Basin above Lake Billy Chinook there is a hydraulic connection between ground water and surface water flows. Because of this connection, ground water withdrawals affect surface water flows. Since scenic waterway flows and instream water rights are not always satisfied, the Department may not approve new ground water permits unless the impacts are mitigated. The mitigation program provides a set of tools that applicants for new ground water permits can use to establish mitigation and, thereby, obtain new permits from the Department.

Every five years the Water Resources Commission (WRC) is required to evaluate the effectiveness of the mitigation program. The purpose of this evaluation is to ensure that scenic waterway and instream water right flows continue to be met on at least an equivalent or more frequent basis compared to flows within a representative base period. Depending upon the outcome of this evaluation, the Commission may modify the program accordingly. This may include adjusting the allocation cap on new ground water uses that was established under the program. The Commission may also initiate proceedings to declare all or part of the basin a critical ground water area, close all or part of the basin to additional ground water use, or take other administrative action. This report provides the background and evaluation material to help inform the Commission as it reviews the program.

Mitigation Review Criteria

- *Whether scenic waterway and instream water right flows continue to be met on at least an equivalent or more frequent basis as compared to long-term, representative base period flows established by the Department;*
- *Evaluation of the mitigation program, associated mitigation, the zones of impact; and*
- *Evaluation of the effectiveness of mitigation projects and mitigation credits that involve time-limited instream transfers, instream leases and allocations of conserved water from canal lining and piping projects.*

The Basin

The Deschutes River Basin covers about 10,700 square miles in central Oregon, making it the second largest watershed in the state and one of the major subbasins of the Columbia River system. The basin is bounded on the west by the Cascade Mountains, on the south by lava plateaus, to the east by the Ochoco Mountains and the plateau between the Deschutes and John Day Rivers, and to the north by the Columbia River. The basin measures 170 miles in the north-south direction and ranges up to 125 miles at its greatest width.

The major tributaries feeding the Deschutes River include the Little Deschutes River, Tumalo Creek, Fall River, Shitike Creek, the Crooked River, the Metolius River, Whychus Creek, Trout Creek, the White River, and the Warm Springs River (Figure 1).

Deschutes Ground Water Study

The U.S. Geological Survey (USGS) initiated a ground water study in 1993 to provide much needed information on the ground water resources of the upper Deschutes Basin. The study was conducted in cooperation with the Water Resources Department (WRD); the cities of Bend, Redmond and Sisters; Deschutes and Jefferson counties; the Confederated Tribes of the Warm Springs Reservation of Oregon; the U.S. Environmental Protection Agency and the Bureau of Reclamation. The area of the study is shown in Figure 1.

Conclusions from the study demonstrated that nearly all ground water originating in, or flowing through, the upper Deschutes Basin discharges into relatively short reaches of the Deschutes, Metolius and Crooked Rivers above and within Lake Billy Chinook.

The study concluded that:

- Virtually all ground water not consumptively used in the upper Deschutes Basin discharges to surface water near Pelton Dam;
- Virtually the entire flow of the Deschutes River at Madras is supported by ground water discharge during the summer and fall; and
- Ground water and surface water are directly linked, and removal of ground water will ultimately diminish streamflow.

Based on initial study conclusions available in 1998, Department determined ground water use in the Deschutes Ground Water Study Area (DGWSA) had the potential for substantial interference with surface water and the measurably reduce" standard in the Scenic Waterway Act (ORS 390.835) was triggered.

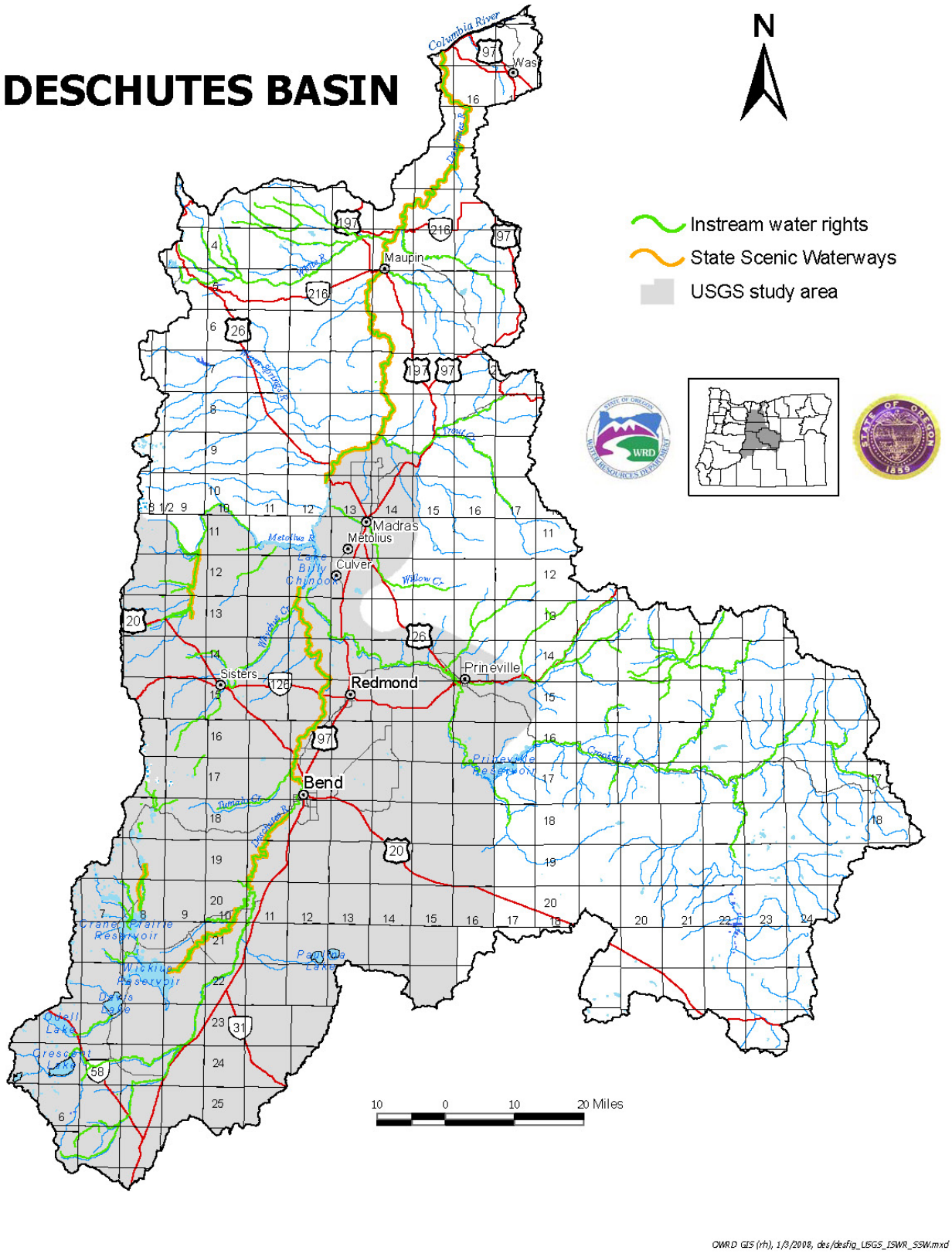


Figure 1. Deschutes River Basin and ground water study area.

Mitigation Program Development

The 1995 amendments to the Scenic Waterway Act require the examination of each ground water right to determine whether the ground water use will "measurably reduce" surface flows necessary to maintain the free flowing character of the scenic waterway. If such a reduction occurs, the proposed permit application cannot be approved. A use measurably reduces if it individually or cumulatively reduces streamflow by 1% of average daily flow or 1 cubic foot per second (cfs), whichever is less. The statute requires conditioning of permits issued after 1995 to allow for regulation in the future if the measurably reduce standard is triggered, and requires mitigation by new ground water applicants once the measurably reduce standard is triggered.

Based on the Deschutes Ground Water Study, in 1998 the Department determined that the measurable reduction standard was triggered. At that time, pending and new ground water applications were put on hold while the Department explored various options for the basin. Growth pressures in the Deschutes River Basin had increased demand for new water supplies, with a particular emphasis on ground water as additional surface water was not available.

Beginning in late 1999, the Department convened a diverse group of stakeholders to develop mitigation strategies to offset impacts of new ground water permit appropriations on the Lower Deschutes River. This working group became known as the Deschutes Basin Steering Committee. The Department worked with this group for almost four years.

In 2001, mitigation concepts for the Deschutes Basin began to take shape. In June 2001, House Bill 2184 was enacted into law, authorizing a system of mitigation credits and banking arrangements. The Department issued two drafts of the Deschutes Basin Ground Water Mitigation Rules for public review, one draft in September 2001, and another in April 2002. On September 13, 2002, the WRC adopted the Deschutes Ground Water Mitigation Rules (Division 505) and the Deschutes Basin Mitigation Bank and Mitigation Credit Rules (Division 521).

Mitigation Program Goals

The goals of the Deschutes Mitigation Program are to:

- Maintain flows for Scenic Waterways and senior water rights, including instream water rights;
- Facilitate restoration of flows in the middle reach of the Deschutes River and related tributaries; and
- Sustain existing water uses and accommodate growth through new ground water development.

Elements of Mitigation Program

The mitigation program has five basic elements:

- Requires mitigation for all new ground water permits in the DGWSA;
- Identifies tools for providing mitigation through either a mitigation project or by obtaining mitigation credits;
- Establishes a system of mitigation credits, which may be used to offset the impacts of new ground water permits,
- Provides the process to establish mitigation banks; and
- Provides for adaptive management through annual evaluations and review of the mitigation program every five years.

Deschutes River below mouth of Tumalo Creek

Establishing New Ground Water Uses

The process for establishing a new ground water use in the Deschutes Basin is depicted in Figure 2. For each ground water application submitted, the Department reviews the application and notifies the applicant of their "mitigation obligation." The "mitigation obligation" is expressed as a volume of water in acre-feet and is equivalent to the consumptive portion of the use proposed in the permit application. Groundwater applicants mitigate for this consumptive portion of their proposed use. Consumptive use is calculated using average consumptive use data for different types of use (i.e. irrigation, municipal, etc.) obtained from the U.S. Geological Survey and Department's own information on consumptive use. In certain cases, there may be information available in the application record that suggests that the consumptive use portion should be calculated differently. The Department takes that information into consideration with evaluating the application.

Mitigation must be provided in the amount (mitigation water) and in the location (zone of impact) specified by the Department. Zones of impact are based upon where the proposed use will primarily impact surface water flows. Each applicant has five years from the date the final order is issued to provide the required mitigation. Applicants must provide mitigation before a new permit may be issued.

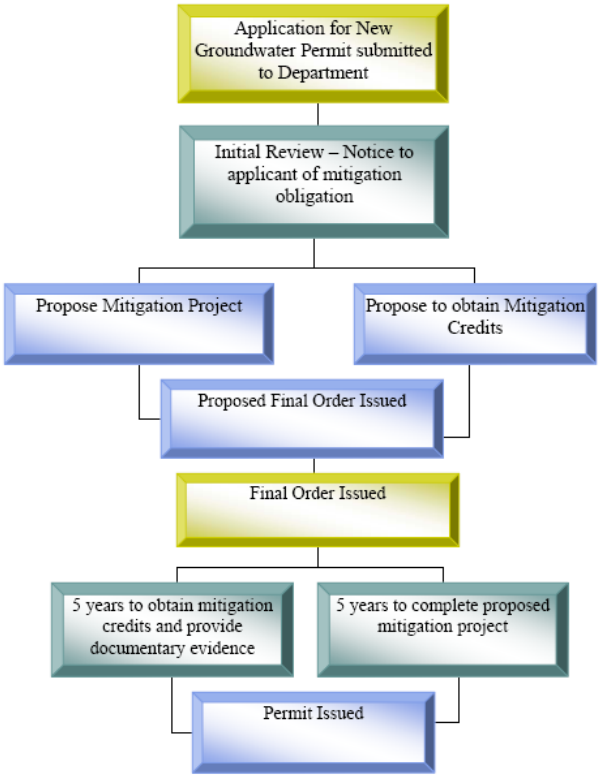


Figure 2. Process to establish new ground water uses under the Deschutes ground water mitigation program.

Status of the 200 cfs Allocation Cap

The Deschutes Ground Water Mitigation Program is a performance based, adaptive approach to managing new ground water permits in the Deschutes Ground Water Study Area. As part of this adaptive approach, the program included a cap on how much new ground water use can be approved. Department may issue final orders approving ground water permit applications for a cumulative total of up to 200 cfs. This limitation is one of the elements of the program that is to be reviewed as part of the evaluation of the program. The 200 cfs cap represents the rate up to which water may be withdrawn from the ground water resource. It is important to note that this rate-based limitation is different from the consumptive use portion (in acre-feet) for which ground water permit applicants must provide mitigation.

Since adoption of the rules in September 2002, 66 new ground water permits with associated mitigation have been issued, totaling 52 cfs of water (Figure 3). An average of 13 new ground water permits have been issued annually since the program began.

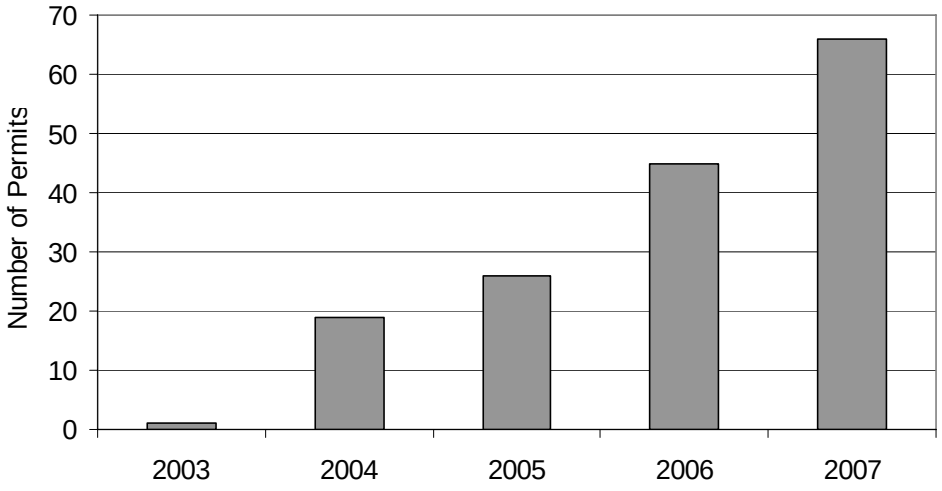


Figure 3. Cumulative total permits issued by year.

Permits for those applications that have been issued final orders[1] with proposed approvals can be issued if the required mitigation is received by the Department. Each applicant has five years from the date the final order is issued to provide the required mitigation. The final order approving the use expires if mitigation is not provided within the five year period. Of the final orders issued without permits, 10 of those (totaling approximately 18.0 CFS) have five year deadlines to provide mitigation that end in 2009.

[1] A final order is the last stage of the permitting process prior to issuance of the permit.

As shown in Figure 4, the cumulative amount of water approved in new permits and in permit applications with final orders is 85 cfs. This is roughly 42% of the total amount allowed under the allocation cap. A summary by type of use is provided in Figure 5.

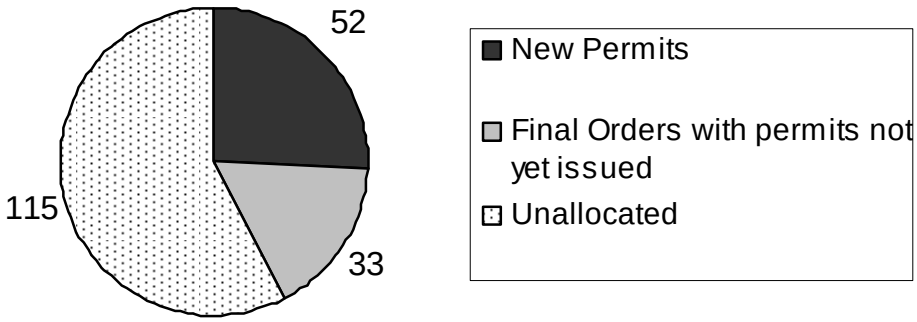


Figure 4. Amount of water in cfs of the 200 cfs allocation cap that has been allocated under new permits and final orders and the amount unallocated.

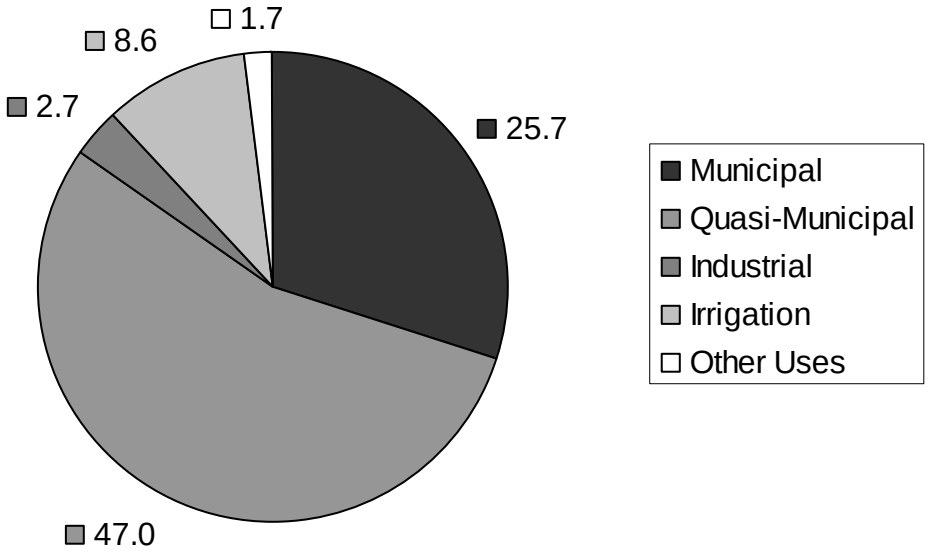


Figure 5. Amount of water in cfs of the 200 cfs allocation cap that has been allocated under new permits and final orders by type of use.

There are currently 40 applications pending without final orders that total approximately 144 cfs (see Figure 6). Ten of these pending applications fall outside of the 200 cfs cap and are not being processed by the Department, even in cases where the use is non-consumptive and has no mitigation obligation. As applications move up in the application "cue", the amount requested is sometimes modified to reduce the requested rate or the application is withdrawn or denied. As this occurs, other applications can be processed within the 200 cfs cap. For example, since adoption of the rules, 26 applications (totaling approximately 24 cfs) have been withdrawn and five applications (totaling approximately 2 cfs) have been denied. These five applications were denied when the applicants failed to respond to the Department's request for mitigation information.

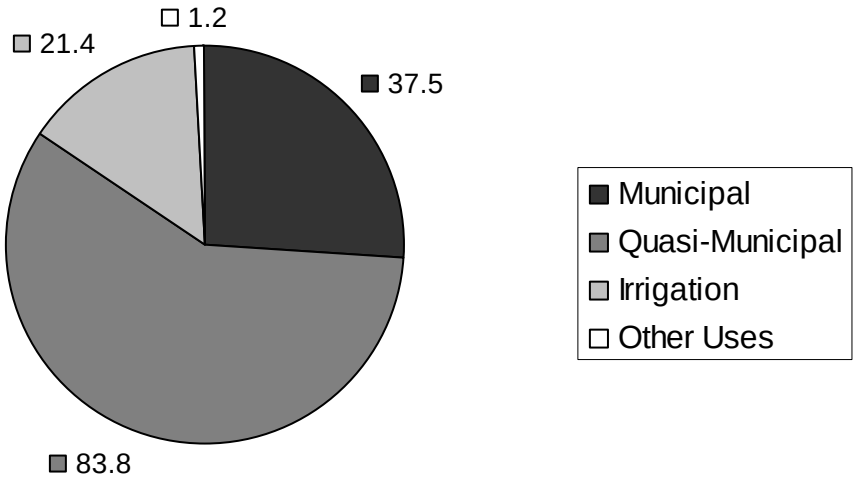


Figure 6. Amount of water in cfs of pending groundwater applications without final orders by type of use.

Allocation Summary

- *66 new ground water permits issued*
- *42% of cap allocated under final orders and new ground water permits*
- *Pending applications exceed remaining balance of the 200 cfs cap*

Establishing Mitigation Water and Credits

The Deschutes Basin Ground Water Mitigation Rules provide ground water permit applicants two options to satisfy the requirement to mitigate: 1) completion of their own mitigation project or 2) acquisition of mitigation credits.

The rules identify several types of projects that can be used to establish mitigation water:

- Instream Leases[2]
- Time-Limited Instream Transfers
- Permanent Instream transfers
- Allocations of Conserved Water
- Aquifer Recharge
- Releases of Stored Water

For each mitigation project submitted, the Department identifies the amount of water resulting from the project that can be used for mitigation purposes. The resulting protectable water, expressed in acre feet, is also referred to as "mitigation water" or "mitigation credits". One acre-foot of mitigation water is equal to one mitigation credit. For each project submitted, the Department also identifies the primary zone(s) of impact in which the mitigation water provides instream benefits and may be used for mitigation purposes.

Mitigation credits are simply a means of accounting for mitigation water made available by completion of a mitigation project by an individual or organization. Mitigation credits, unless generated by instream leases or time-limited instream transfers, may be held by anyone. Credits can be conveyed from a "mitigation credit holder" to a ground water permit applicant and used to satisfy the mitigation obligation of the proposed use.

To use mitigation credits, ground water permit applicants show that they have obtained the needed mitigation credits by submitting a documentary evidence form (developed by the Department). This form must be completed by the mitigation credit holder and the permit applicant. The documentary evidence form is submitted to the Department for review. If the mitigation credits conveyed to the ground water applicant match the mitigation obligation, a new permit may be issued.

[2] Instream leases and time-limited instream transfers may only be used by mitigation banks to establish mitigation credits.

The Department maintains an accounting record of mitigation projects and mitigation credits with links to any associated ground water permits. Sources of mitigation include instream transfers and instream leases. As shown in Figure 7, in each year that the program has been in place, there has been sufficient mitigation to meet the needs of ground water permits issued under the program. This includes mitigation that is maintained as "reserve" credits by the mitigation banks.

Mitigation banks that use instream leases to generate mitigation credits are required to hold in reserve one matching credit for each credit they assign to a ground water permit. Leases are allowed for periods of one to five years and can be terminated early so the active number of leases fluctuates from year to year. The reserve mitigation credit provides some backup for ground water permit holders and additional assurance for streamflow protection.

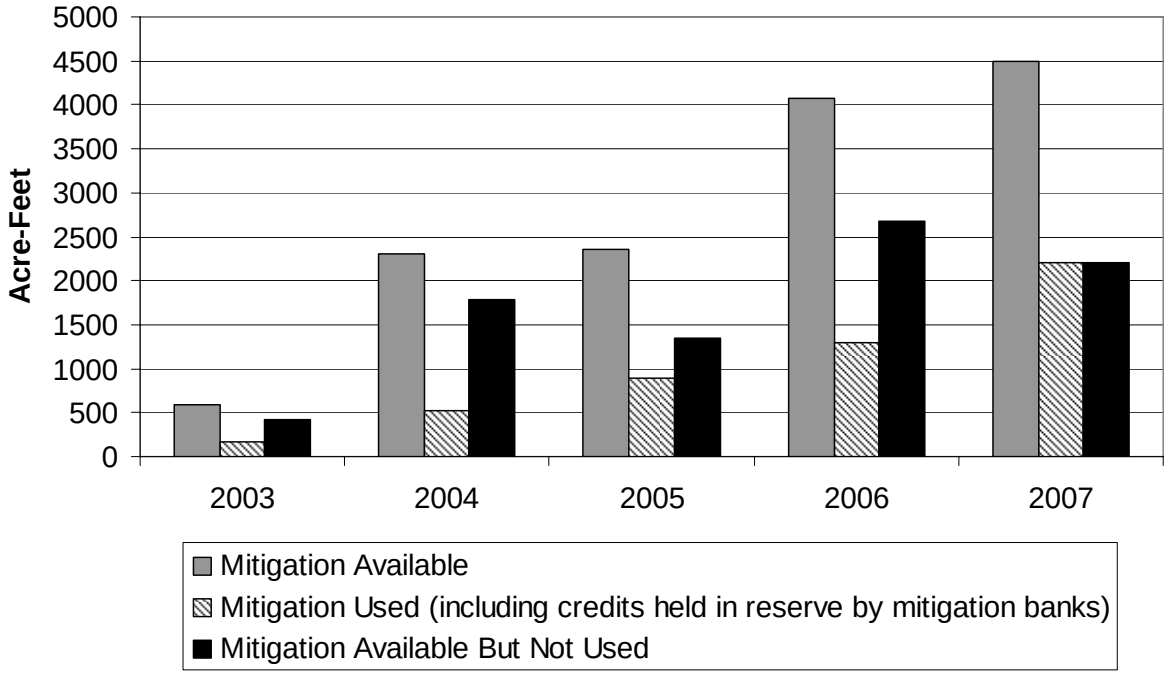


Figure 7. Total mitigation available compared to mitigation used by new ground water permits and used as bank "reserves." The amount of mitigation established but not used is also shown.

Mitigation Summary

Mitigation established each year has consistently exceeded the amount needed (including for reserves) on average by 66%.

Mitigation Banks

The Deschutes Basin Mitigation Bank and Mitigation Credit Rules (Division 521) provide for the formation of mitigation banks for the Deschutes Basin. Anyone may apply to become a mitigation bank. Successful applicants must enter into an agreement, called a mitigation bank charter, with the Department. Each charter must be approved by the WRC. The charter describes the types of mitigation credits that may be held by the bank, how credit transactions should be conducted and reported to the Department, and requires the mitigation bank to submit an annual report to the Department.

The types of mitigation credits that can be held by a bank include:

- Permanent Credits – based upon instream transfers and allocation of conserved water projects.
- Performance Dependant Credits – based upon storage release and aquifer recharge projects.
- Temporary Credits – based upon instream leases and time-limited instream transfers.

Deschutes River at Lower Bridge

There are two mitigation banks in the Deschutes Ground Water Study Area.

Deschutes Water Exchange Mitigation Bank

The first mitigation bank to be established was the Deschutes Water Exchange (DWE) (affiliated with the Deschutes River Conservancy, DRC). The DWE Mitigation Bank was authorized under a charter agreement approved by the WRC in February 2003. The primary source of mitigation in the DGWSA has been mitigation credits held by the DWE Mitigation Bank. They brokered the first mitigation credit transaction under the mitigation program in 2003. The DWE has worked extensively with ground water applicants and permit holders to provide assistance, education and outreach on the mitigation program. They have partnered with irrigation districts and landowners in the basin to lease water rights to instream use and use those instream leases to generate mitigation credits. DWE is the sole mitigation bank in the basin that may broker in this type of temporary credits.

Demand and supply of mitigation credits from the DWE Mitigation Bank has increased progressively over the last five years in both quantity of mitigation credits and in the number of mitigation clients contracting with the bank to obtain mitigation credits (1 mitigation client in 2003 to 33 clients in 2007).

In 2007 the DWE Mitigation Bank began to hold permanent mitigation credits based upon an instream transfer. The 40 permanent mitigation credits were assigned to five groundwater permit holders that had been using temporary mitigation credits. These permit holders now have a permanent source of mitigation. These permanent credits were acquired and marketed in cooperation with the Deschutes Water Alliance (DWA). The DWA is a cooperative group working to equitably redistribute surface water coming off of developing lands. The DWA includes the DRC, Deschutes Basin Board of Control, the cities and counties among its stakeholders.

Deschutes Irrigation Mitigation Bank

The second mitigation bank, Deschutes Irrigation (DI) LLC is operated by John Short and deals only with permanent credits. The DI Mitigation Bank charter was approved by the WRC in May 2006. To date, DI has not completed any mitigation credit transactions as a bank. Deschutes Irrigation LLC, acting solely as a company, has established mitigation credits based upon instream transfers. DI LLC has completed many mitigation credit transactions with ground water permit applicants and permit holders to provide those ground water users with a permanent source of mitigation. To date, none of these transactions have been brought through the DI LLC Mitigation Bank.

Effectiveness of Mitigation Projects

Under the Deschutes Ground Water Mitigation Rules, the WRC is required to specifically evaluate the effectiveness of mitigation projects that involve instream leases, time-limited instream transfers, and allocations of conserved water.

As shown in Figure 8, mitigation projects have been dominated by instream leases and instream transfers, with instream leases representing on average 86% of the total volume of mitigation water (in acre-feet) established under the program each year.

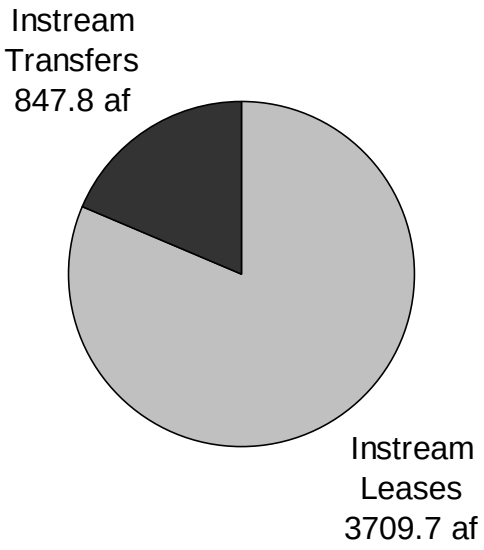


Figure 8. Distribution of mitigation water in acre feet (af) between instream leases and instream transfers in 2007.

Instream Leases

An instream lease is a temporary conversion (for up to five-years) of all or a portion of an existing water use to an instream water right. Since the mitigation program began, each year the amount of temporary mitigation credits generated by instream leases has far exceeded the amount needed to satisfy the mitigation obligations of those permits using these credits as their mitigation source and to meet "reserve" credit requirements (Figure 9). Temporary credits based on instream leases have also been sufficient in each zone of impact where these credits were used. Presently, only the DWE can use instream leases to establish temporary mitigation credits.

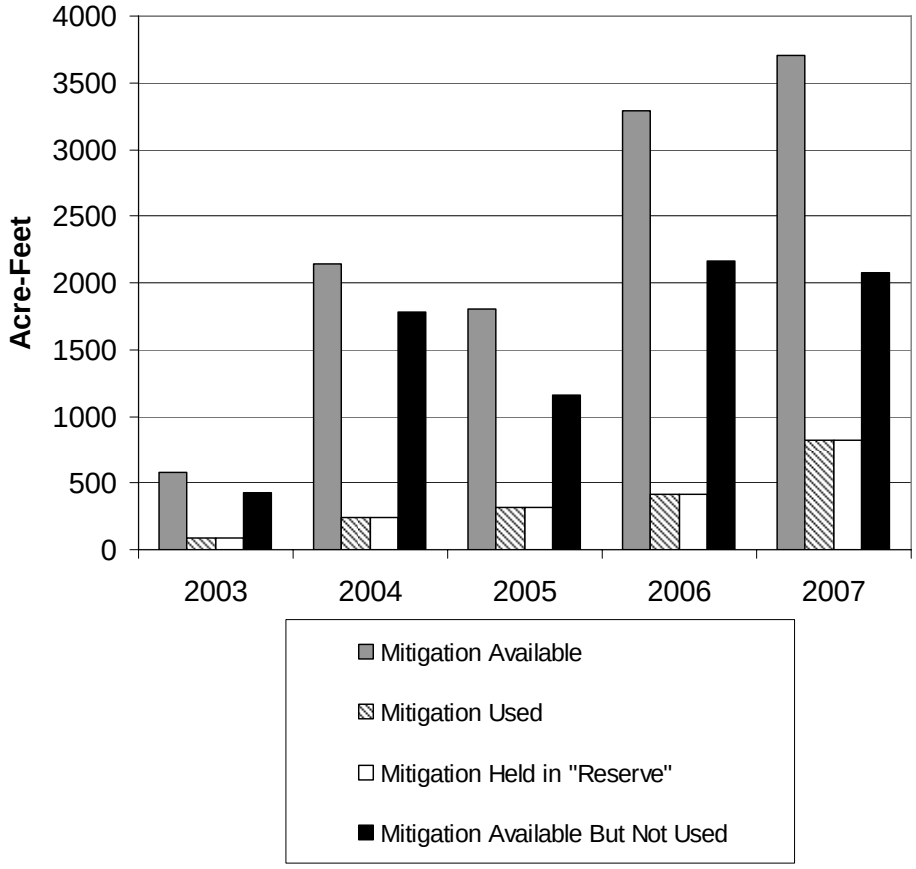


Figure 9. Mitigation created through instream leases.

While instream leases may fluctuate from year to year, overall, the annual volume of mitigation water provided through instream leases has increased over time (Figure 9). However, there was a reduction in 2005 in the quantity compared to the previous calendar year. This was likely due to the outcome of a legal challenge of the mitigation program that resulted in a brief suspension of the program at that time. Several instream leases that had initially been submitted as mitigation projects were modified to exclude mitigation and proceeded through the instream lease process solely as

streamflow restoration projects. These modified instream lease applications did not result in any mitigation water (credits). The majority of instream leases used to establish mitigation credits have been for multiple year periods. However, leases used to establish mitigation in the Whychus Creek and Crooked River Zones of Impact have been for periods of one year.

In the five years of the program, only one issue has been encountered involving an instream lease used to generate mitigation credits. In 2004, several water rights were leased instream under a single lease on Paulina Creek, tributary to the Little Deschutes River. This instream lease resulted in mitigation credits within the Little Deschutes Zone of Impact. However, while this lease was in effect, difficulties were encountered in keeping the leased instream flows in the stream channel itself. Following an effort to correct this problem, this lease was terminated early by the Department, prior to the 2005 water use period. No credits resulting from this project were used during the 2004 calendar year, the only year that this mitigation project was active.

Permanent Instream Transfers

Any ground water permit applicant or other individual can use permanent instream transfers to generate mitigation credits. As the mitigation program has grown, the number of mitigation projects submitted involving instream transfers has increased steadily each year (Figure 10).

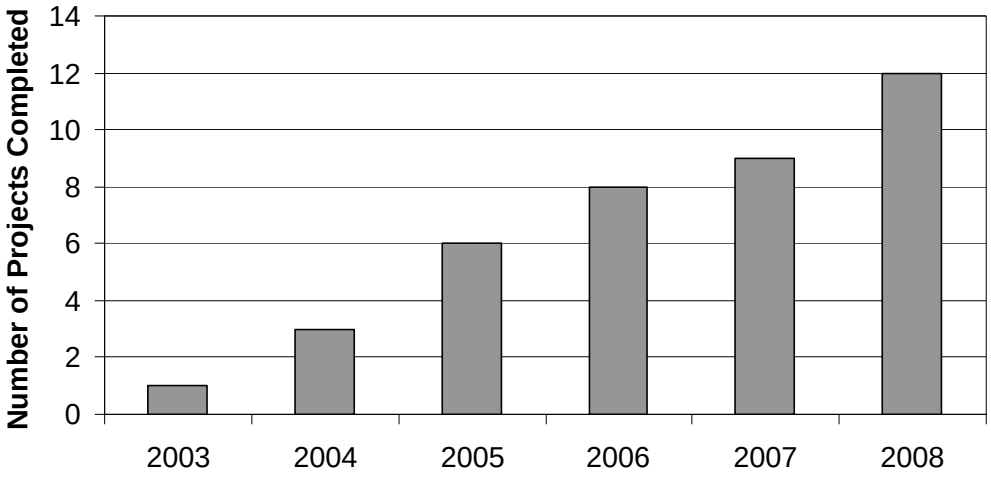


Figure 10. Cumulative number of mitigation projects involving permanent instream transfers.

Mitigation credits generated from projects based upon instream transfers are permanent in nature. Water is permanently protected instream as a result of the completion of an instream transfer application, resulting in a new instream water right. Use of these types of credits by a ground water permit holder does not require any ongoing maintenance of credits by the ground water user. Use of temporary mitigation credits (based on instream leases) requires annual ongoing maintenance of the credits.

In each year that the mitigation program has been in place, not all of the mitigation credits established by instream transfers have been used to provide mitigation to new ground water permits (Figure 11). Some of these mitigation credits have remained available. As more ground water permit applications are processed through to permit, more of these mitigation credits will be used.

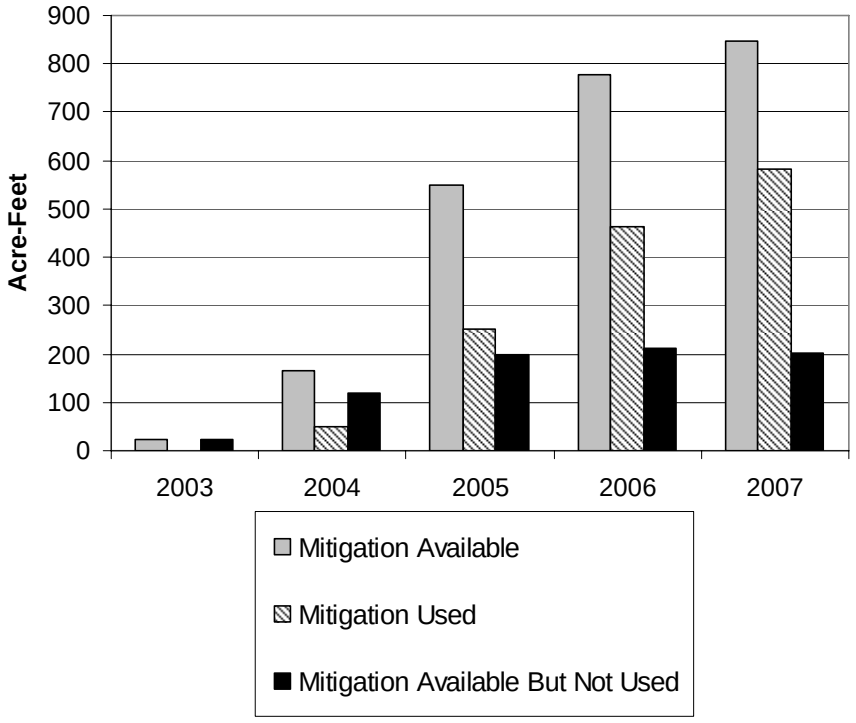


Figure 11. Mitigation created through permanent instream transfers.

Aquifer Recharge

One mitigation project has been proposed to the Department involving an aquifer recharge project. This project application has been protested, and the applicants are working with the Department to resolve the issues raised by the protest.

Other Mitigation Project Types

To date, no mitigation projects have been proposed to the Department involving time-limited instream transfers, allocations of conserved water, or release of stored water. Time-limited instream transfers differ from instream leases in that they can be issued for any length of time specified in the application. An allocation of conserved water is the reduction in the amount of water diverted to satisfy an existing beneficial use by improving the method of transporting or applying the water, with all or a portion of the conserved water going to instream use. Releases from storage could be used to generate mitigation credits based upon the annual volume of water released.

Mitigation Project Effectiveness Summary

- *In the first five years of the mitigation program, mitigation has been provided solely by instream leases and instream transfers.*
- *Temporary mitigation credits established from instream leases has consistently provided sufficient mitigation to meet ground water permit needs and reserves.*
- *Each year, the cumulative amount of permanent mitigation provided by instream transfers has increased.*

Zone of Impact Evaluation

As part of the five year evaluation, the WRC is required to evaluate the zones of impact identified by the Department. This evaluation may include analysis of where the zones are located, whether adequate zones are identified, and whether the mitigation program is doing an effective job of distributing mitigation water to the affected stream reaches within each zone of impact.

Ground water users with permits issued under the mitigation program are required to provide mitigation in a zone of impact identified by the Department. The purpose of these zones of impact is to target mitigation in and above stream reaches, on a subbasin level, where impacts on streamflows by ground water pumping are expected to occur.

Mitigation projects establish mitigation water within at least one zone of impact and may establish mitigation in more than one zone. Such a project would result in water that would benefit flows in each zone of impact identified. If credits are used in one zone they are also subtracted from use in the other zones in which they were available.

There is a general zone of impact to address regional impacts to surface water and local zones of impact for localized impacts. The general zone of impact is defined as anywhere in the Deschutes Basin above the Madras gage, located on the Lower Deschutes River, below Lake Billy Chinook. Ground water users with a general impact on surface water (i.e. impacting the regional confluence area of the Deschutes, Crooked and Metolius Rivers) may provide mitigation anywhere within the general zone of impact provided that the mitigation water (protected instream) flows into the impacted reach.

Mitigation within a local zone of impact is required for ground water uses that impact surface water on a localized level (e.g. impacting the surface waters of Whychus Creek). To define boundaries for the local zones of impact, the Department considered subbasin boundaries, locations where instream water rights or scenic waterway flows were not being met, general ground water flow information, and other hydrogeologic information, including identification of where stream reaches were influenced by groundwater discharge. By defining the boundaries for each of the local zones of impact, mitigation may be targeted in areas where mitigation projects may provide the greatest instream benefits.

To pinpoint the location of the lower boundary within each local zone, the Department used one of the following criteria:

1. For some local zones of impact, the lower boundary of the zone was defined as the point located below the lowest ground water discharge area. This allows the Department to target mitigation in and above areas of a stream basin where flows are influenced by groundwater discharge.

2. For other local zones of impact, the lower boundary of the zone was the point within the lowest ground water discharge area where instream requirements are not met above that point. Existing streamflow data was used to identify the approximate point at which instream flow needs begin to be met as water flows downstream through the affected ground water discharge area. This allows the Department to target mitigation water in areas of a local zone of impact where surface water flows are impacted by ground water discharge, where instream flow needs are not being satisfied, and where additional flows are needed.

The Department identifies the location (the zone of impact) in which a groundwater permit applicant must provide mitigation. This determination is made by considering the proposed well's proximity to surface water and to an area of groundwater discharge. The Department also considers well construction information, well depth and the portion of the aquifer that the well will water from, general ground water flow direction, and other hydrogeologic information. Using this information, the Department identifies whether the groundwater application must provide mitigation in the general zone of impact or in a local zone of impact.

The zones of impact are shown in Figure 12 and described as:

- General – In the Deschutes Basin above Lake Billy Chinook;
- Middle Deschutes River – In the Deschutes Basin above River Mile 125 on the Deschutes River;
- Crooked River – In the Crooked River subbasin above River Mile 13.8 on the Crooked River;
- Whychus Creek – In the Whychus Creek subbasin above River Mile 16 on Whychus Creek;
- Upper Deschutes River – In the Deschutes River basin above River Mile 185 on the Deschutes River;
- Little Deschutes River – In the Little Deschutes River subbasin above the mouth of the Little Deschutes River;
- Metolius River – In the Metolius River subbasin above River Mile 28 (the confluence with Jefferson Creek) on the Metolius River.

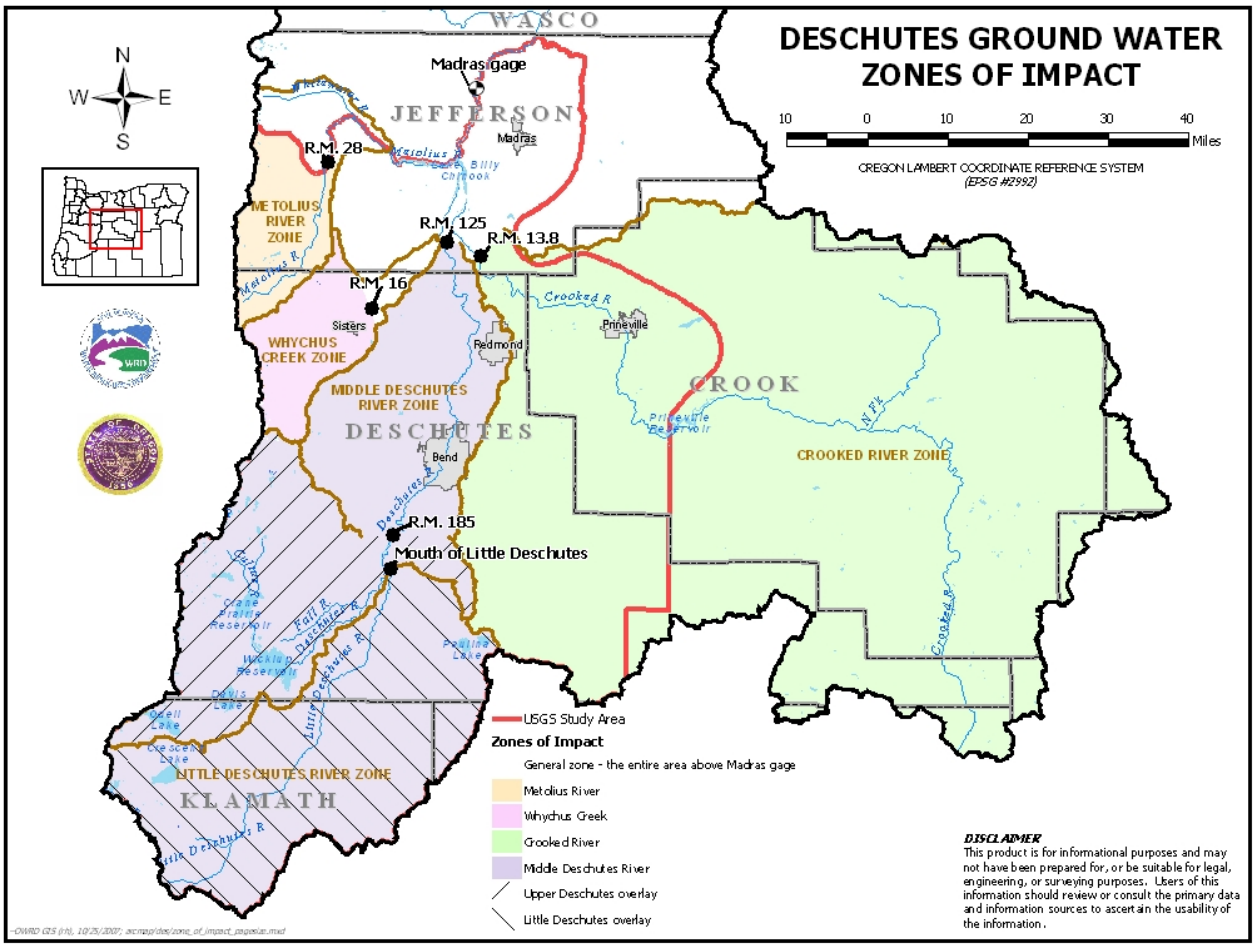


Figure 12. Map showing the location of each zone of impact identified by the Department.

As demonstrated in Figure 13, the majority of new ground water uses were found to have an impact on the General Zone of Impact. The quantity of permits by zone is shown in Table 1.

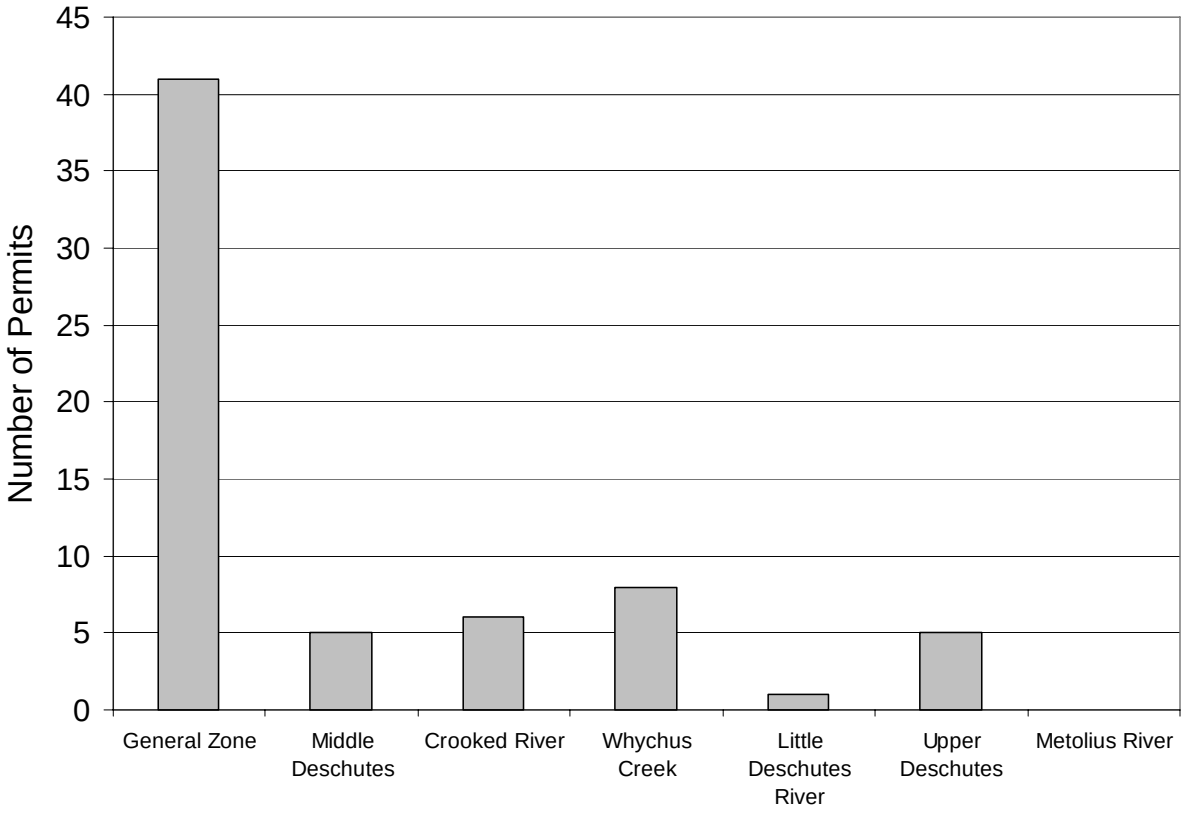


Figure 13. Number of ground water permits issued by zone of impact from 2003 to 2007.

Table 1. Summary of ground water permits by zone.

Zone of Impact	Number of Permits	Rate (cfs) Approved by Permit	Maximum Volume (AF) Approved by Permit	Total Mitigation Obligation (AF)
General	41	46.1	9,715.8	4,558.2
Middle Deschutes	5	0.67	162.0	94.1
Crooked River	6	1.93	1,295.5	527.0
Whychus Creek	8	2.40	571.5	321.2
Little Deschutes	1	0.22	159.3	0.0
Upper Deschutes	5	0.29	76.8	46.1
Metolius River	--	--	--	--
Totals	**66**	**51.6**	**11,980.8**	**5,546.6**

During the five years of the program, more mitigation than needed for each new ground water use has been provided in the appropriate zone of impact as described below and shown in the Figure 14.

General zone: The primary source of mitigation water in the General Zone is instream leases and some permanent instream transfers. Most of the mitigation water available in the General Zone of Impact originated in other upstream zones. Many of these mitigation projects have protected instream flows through the middle reach of the Deschutes River and down to Lake Billy Chinook. However, a few of the mitigation projects that established mitigation credits in the General Zone did not protect water instream into that zone but still provided instream benefits. For example, projects on Whychus Creek protected flows only to the mouth of Whychus Creek. While instream flows are not protected into the mainstem Deschutes, the flows in the Deschutes River at the confluence with Whychus Creek are at such a high level that there is still an instream benefit even considering downstream users.

As identified above, most mitigation projects in the General Zone originated in upstream zones of impact. For this reason, in part, there has been a steady supply of mitigation water in this zone. Another reason is urbanization. The General Zone encompasses an area supplied by large irrigation districts, containing expanding urban areas, and surface water rights that are more easily transferred or leased instream for mitigation purposes as the use of water on these lands changes over from agricultural to residential and other urban purposes.

Middle Deschutes: Only five new ground water permits have been approved in this zone. Mitigation projects generated in this zone established mitigation water (credits) for this zone and the General Zone of Impact. Some mitigation water was also generated by mitigation projects in upstream zones of impact, such as the Little Deschutes. The majority of the mitigation water was used to provide mitigation for uses in the General Zone of Impact and originated from a combination of instream leases and permanent instream transfers.

Like the General Zone, there has been a steady supply of mitigation credits in the Middle Deschutes Zone in part due to the urbanization of agricultural lands located in and around the cities of Bend and Redmond.

Whychus Creek: The amount of mitigation water generated in the Whychus Zone has generally increased each year, except in 2007. Mitigation projects in this zone of impact also generated mitigation water in the General Zone of Impact. Mitigation water was used by ground water permit holders in both zones.

Mitigation water in this zone has primarily originated from instream leases, which have generally been for one year periods, through the Three Sisters Irrigation District. There has only been one permanent instream transfer that established mitigation water in this zone.

There may be fewer opportunities to generate mitigation water in this zone of impact and continued increase in supply of mitigation water is less certain than in the Middle Deschutes and General Zones of Impact. Land use in the Whychus Creek Zone of Impact tends to be more agricultural based and there is less urbanization.

Crooked River: The amount of mitigation water generated in the Crooked River Zone of Impact has fluctuated each year with no mitigation water available in the first year (2003) of the mitigation program. Mitigation water in this zone of impact has been more difficult to establish. Up until 2007, mitigation projects (two instream leases and one instream transfer) in this zone were generally small and with individual landowners. In 2007, North Unit Irrigation District along with the DWE Mitigation Bank requested that their annual instream lease be used (for the first time) to generate mitigation credits. Mitigation projects in this zone also generated mitigation water in the General Zone of Impact. Mitigation water was used by ground water permit holders in both zones.

Little Deschutes River: None of the mitigation water established in the Little Deschutes has been used to provide mitigation for new uses within this zone. Presently there is only one new ground water permit within this zone. This permit is for a non-consumptive use (commercial heat exchange) and has a mitigation obligation of zero acre feet. All mitigation projects within this zone have originated from instream leases. One mitigation project generated temporary mitigation credits in this zone in 2004. This project was terminated early by the Department due to regulatory issues. In 2006, another two instream lease applications established temporary mitigation credits in this zone. Credits from these projects were available for use as mitigation also within the Upper Deschutes, Middle Deschutes, and General Zones of Impact. Water from these projects was protected instream in the Little Deschutes River and into the mainstem Deschutes River. Credits from these projects were used to provide mitigation to ground water permits in the Upper Deschutes Zone of Impact.

Upper Deschutes: Mitigation credits for the Upper Deschutes Zone of Impact first became available in 2006 and are based upon instream leases. The mitigation projects that were used to establish mitigation in this zone did not originate in the Upper Deschutes area. The two projects that established mitigation in this zone originated in the Little Deschutes Zone of Impact. However, mitigation water (protected instream flows) provided instream

benefits to flows in the impacted stream reach of the Upper Deschutes Zone of Impact.

Metolius River: To date, no mitigation projects have been proposed that would establish mitigation water within the Metolius Zone of Impact. No ground water applications to date have received notices of mitigation obligation within this zone.

Metolius River

Zone of Impact Summary

- *Majority of ground water mitigation provided in general zone of impact*
- *Mitigation provided in each zone met requirements for new ground water uses for each zone*
- *More than 39 cfs of instream flow as a result of permanent and temporary mitigation*

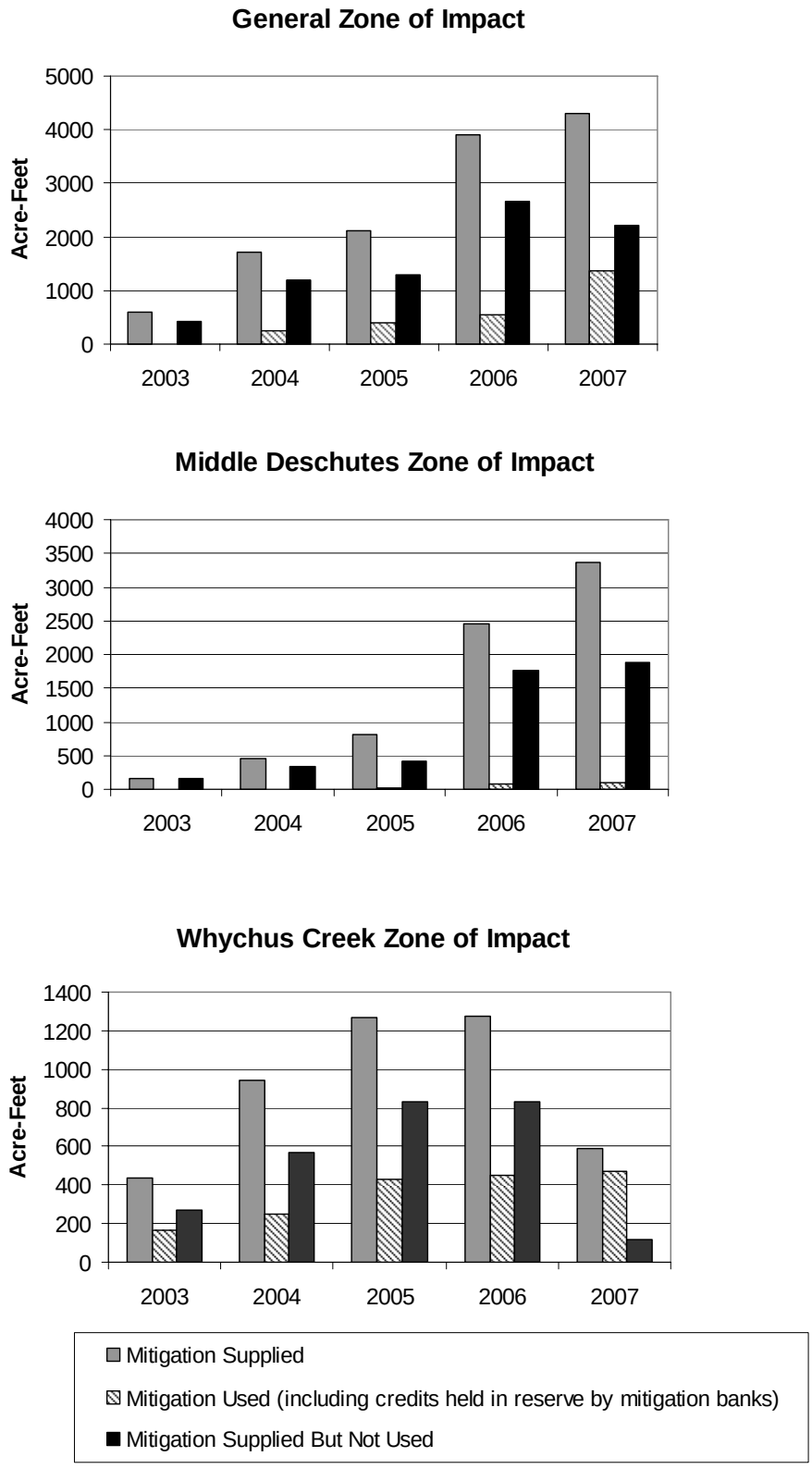


Figure 14. Total mitigation supplied and used for each zone by year.

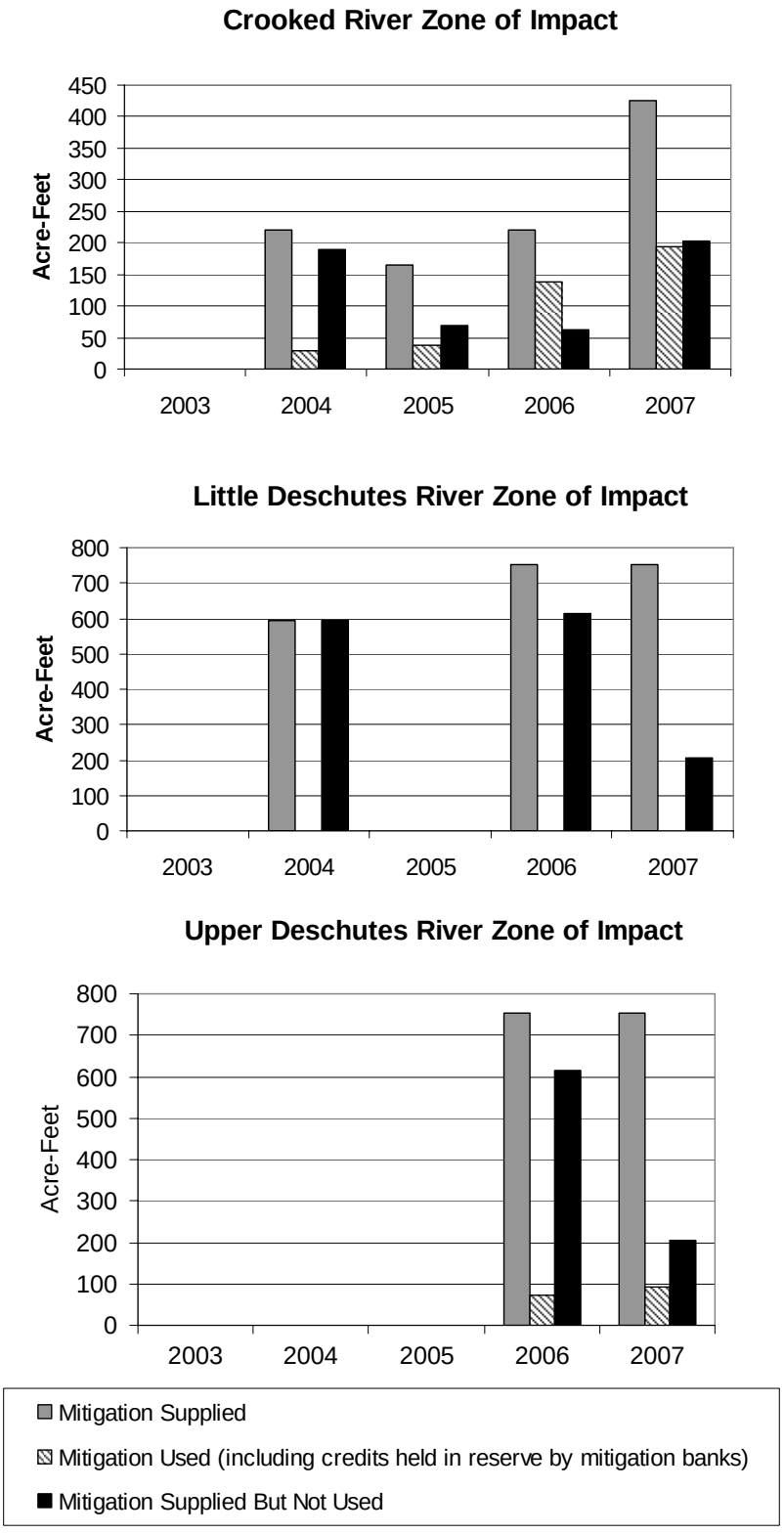


Figure 14 continued. Total mitigation supplied and used for each zone by year.

Scenic Waterway & Instream Water Right Flow Evaluation

On a five year cycle, the WRC is required to evaluate mitigation activity in the Deschutes Basin to determine whether scenic waterway flows and instream water right flows continue to be met on at least an equivalent or more frequent basis as compared to long-term, representative base period flows established by the Department.

Instream Flow Model

To monitor the impact of new ground water permits and mitigation on scenic waterway flows and instream water right flows, the Department developed a streamflow monitoring model using historic streamflow data. The streamflow model was constructed using a base period of flows from 1966 to 1995 at selected gaging stations around the basin. This base period represents river flows during a period of time after all of the dams were constructed and before the Scenic Waterway Act was amended to include consideration of ground water impacts.

The model considers the effects of new permitted groundwater use and mitigation projects on streamflows.[3] In addition to mitigation projects, which protect water instream, there are also ongoing streamflow restoration projects throughout the Deschutes Basin. Given that the purpose of this streamflow model is to track the effects of new permitted groundwater use and mitigation projects on streamflows, other restoration projects are not included in this model.

Table 2 shows the model results through mid-2007 for all gaging station sites used in the model. With only one exception, instream requirements are met or improved compared to base line conditions. Based on modeled results, streamflow overall has improved by as much as 27 cfs in some areas due to mitigation.

Gaging station on Deschutes River below Bend

[3] R.M. Cooper, Assessing the Impact of Mitigation on Stream Flow in the Deschutes Basin. Draft not yet available. Peer review scheduled in 2008.

Table 2. Modeled results showing baseline and changes in the percent of time instream requirements are met.

Gage Site	Base Line % Time Instream Requirements are met	Change in Percent of Time Instream Requirements are Met	Annual change in streamflow (cfs)
Deschutes River at Mouth	96.2	+0.02	1.17
Deschutes River below Pelton Dam	69.3	+0.59	1.17
Deschutes River Downstream of Bend	28.6	-0.36	15.2
Deschutes River Upstream of Bend	22.7	+2.34	27.3
Little Deschutes River at mouth	45.3	+3.55	8.74
Deschutes River below Fall River	63.5	0	0
Deschutes River below Wickiup	58.7	0	0
Metolius River at Lake Billy Chinook	99.7	0	0

Instream flows for the Deschutes River below Bend showed a slight decrease in the percent of time the instream flows are met. However, streamflows overall were increased by 15 cfs. The mitigation effects on streamflow for the reach below Bend are unique to the mitigation program in that the instream requirements are met less on a *percentage basis* after mitigation than before. This result is peculiar in that there is an overall *increase in stream flow* (i.e., *volume* of water increased) in the reach.

To understand why this seemingly conflicting result occurs, two facts related to the mitigation program need to be explained. First, mitigation debits (i.e., new groundwater withdrawals) produce a decrease in streamflow that is uniformly distributed over the year (Cooper 2008), while mitigation credits (e.g., instream transfers and leases) generally increase stream flow seasonally—during the irrigation season. Second, the instream requirements for the river below Bend are very close to historical flows during the winter, but the summer instream requirements far exceed historical flows (Figure 15).

Since mitigation produces a slight decrease in flow (~4 cfs or 0.6 percent) during winter (red line, Figure 15), and because the instream requirements are close to the historical flows, the decrease in flow also decreases the percent of time the mitigated flow meet the instream requirements.

Conversely, during summer, the instream requirements far exceed historical summer flows. Therefore, even though there is an increase in summer flows due to mitigation, the increase is of insufficient magnitude to increase the percent of time the instream requirements are met (Figure 15). The overall result is that the instream requirements are met less often during winter due to a decrease in flow, while the increase in flow during summer does not change the percent of time the instream requirements are met. This result occurs even though there is an overall increase in the annual flow below Bend.

Note that this trend of increasing streamflow overall, but decreasing the percent of time the instream requirements are met (annually) will continue until the mitigated summer flows reach the instream requirements (~250 cfs). At this point, this trend will reverse with the percent of time the instream requirements being met increasing with the overall increase in stream flow.

In the Whychus Zone of Impact, the Department installed an additional gage at Camp Polk Road in May 2007 to monitor groundwater inputs through springs. This gage is specifically designed to monitor localized impacts to the ground water system near Sisters and surrounding areas by local well pumping. In addition, the Department added a gage on the Metolius River just downstream of Camp Sherman to monitor similar effects. Lastly, the USGS and the US Department of Interior's Bureau of Land Management installed a gage on the Crooked River near Osborne Canyon some years ago to additionally monitor ground water fluxes in that reach of river.

Real-time Streamflow Records

The Department primarily uses a database and streamflow model to monitor the effectiveness of the mitigation program. However, over time, yearly real-time streamflow records can also be tracked at appropriate gaging stations or other measurement locations. In the short term, streamflow data will not provide information on how the system is responding, given changes in climatic conditions and other variables. It is not possible to correct real-time data for effects of year-to-year changes in weather (or other variables) with sufficient accuracy. In addition, it may be years before the effects of mitigation activities and ground water use reach equilibrium though trends may become apparent over a longer period of time.

Because of the variability of the system, streamflow records will not be able to detect changes due to mitigation activity. One exception is the Deschutes River below Bend which a combination of mitigation, conservation, flow restoration, and changes in water management are detectable. This is shown in Figure 15.

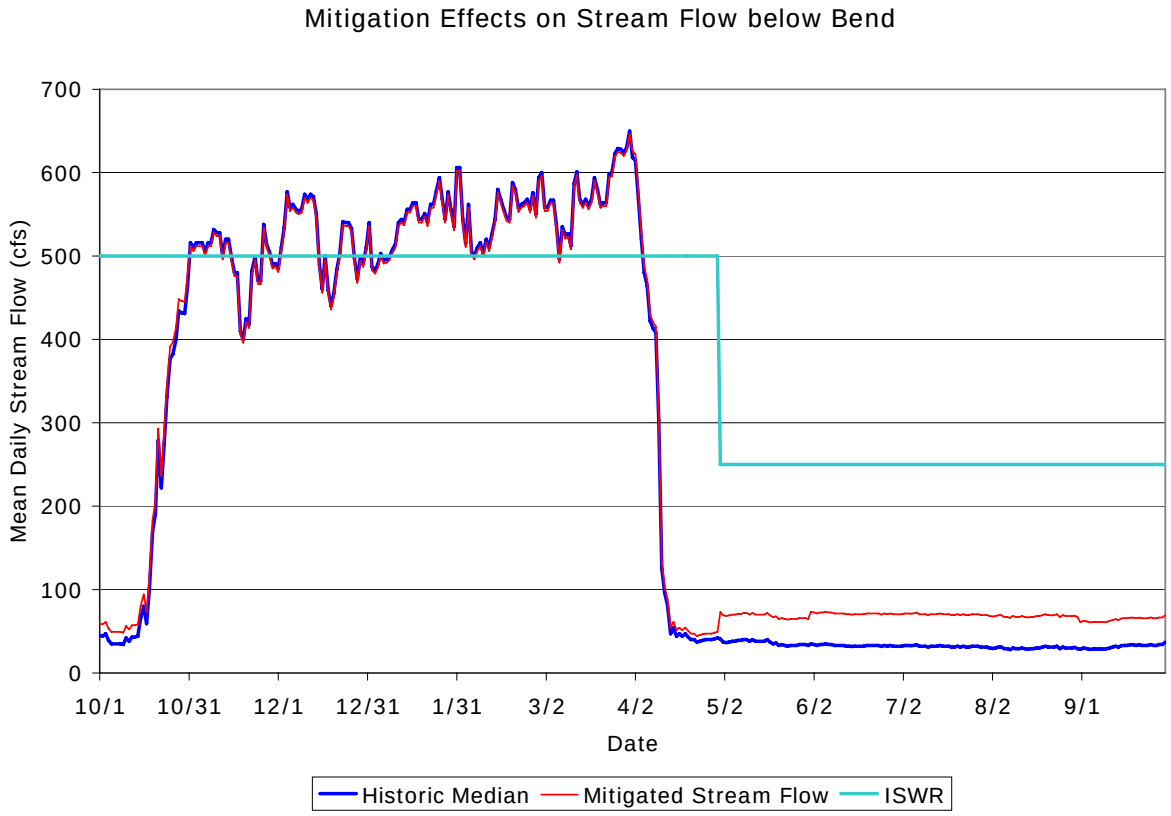


Figure 15. Historical median flows (base period flows) and mitigated streamflow in cubic feet per second on the Deschutes River below Bend compared to instream requirements.

Streamflow Summary

- *In general, instream requirements are being met or have been improved as compared to base line conditions.*
- *Based on modeled results, streamflow overall has improved by as much as 27 cfs in some areas due to mitigation.*

Summary

The Deschutes Ground Water Mitigation Program has been in place since 2002. To date, 66 permits have been issued in the ground water study area for irrigation, industrial, quasi-municipal and municipal uses. Permits and final orders awaiting mitigation total over 85 cfs of ground water. Pending ground water applications exceed the quantity available under the 200 cfs cap.

Mitigation has been available to meet the needs of new permits in all zones of impact identified in the basin. The majority of that mitigation has been provided through temporary credits through the Deschutes Water Exchange Mitigation Bank. With only one exception, instream requirements are met or improved compared to base line conditions. Based on modeled results, streamflow overall increased by as much as 27 cfs in some areas due to mitigation.

Evaluation Summary

- *66 new ground water permits have been issued since the Mitigation Program was adopted by the Commission.*
- *42% of the 200 CFS cap has been allocated under final orders and new ground water permits.*
- *Pending applications exceed the remaining balance of the 200 CFS cap.*
- *Mitigation established each year has consistently exceeded the amount needed (including for reserves) on average by 66%.*
- *In the first five years of the mitigation program, mitigation has been provided solely by instream leases and instream transfers.*
- *Temporary mitigation credits established from instream leases has consistently provided sufficient mitigation to meet ground water permit needs and reserves.*
- *Each year, the cumulative amount of permanent mitigation provided by instream transfers has increased.*
- *The majority of ground water mitigation has been provided in the general zone of impact.*
- *Mitigation provided in each zone met requirements for new ground water uses for each zone.*
- *More then 39 CFS of instream flow as a result of permanent and temporary mitigation.*
- *Scenic waterway and instream water right flows are met or have been improved as compared to base period flows.*
- *Overall streamflows have been improved by as much as 27 CFS in some areas due to mitigation.*