4. Planning Step 4: Develop Integrated Solutions for Meeting Long-Term Water Needs

The DBWC will describe and seek to prioritize the approaches/tools below individually, identify all interdependencies between them and then attempt to integrate each into a comprehensive, detailed and forward-looking plan for Upper Deschutes Basin water management that will be implemented over a defined and realistic timeline. The following are key issues pertaining to DBWC's development of an Integrated Water Resource Strategy consistent with state policy and guidance.

4.1 Water Conservation

The water conservation option considered specific tools related to agricultural and municipal demands, including piping district canals, piping privately owned laterals, on-farm infrastructure upgrades (e.g., flood-to-sprinkler shifts in irrigation), and household improvements. Water conservation can decrease demand in particular areas, making water available to meet other water needs in the basin and possibly increasing water security for other users.

4.1.1 District canal & lateral piping

Central Oregon irrigation districts began working with private and public partners in the 1990s to reduce water losses by piping sections of their open distribution canals. This is a proven tool that capitalizes on the fact that these canals, which are dug into porous volcanic basalt, can lose up to 50% of the water they convey into the underlying aquifer. The districts used Oregon's ACW statute to restore instream flows to the Middle Deschutes River and key tributaries during the irrigation season, and, to a lesser extent, firm up their water supply reliability. Through the 2010s, for example, COID had permanently restored 68.47 cfs to the Crooked and Deschutes rivers through implementation of piping projects and use of the ACW statute and rules.

Under the summary of water management options in the Basin Study, the opportunities for piping district-owned canals are described as varying widely between and within irrigation districts. Canal piping projects that the BSWG viewed as relatively more cost-effective were estimated to result in approximately 120,000 AF of water savings at total cost of $720M, or an estimated average cost of $6,000 per AF [**Question to PT**: Outdated, from 7 years ago – consider order of magnitude water savings and relative costs between tools instead?].

[*Insert photograph of pipe or piping project*]

Over the last five years, since the BSWG completed these estimates, the districts have primarily shifted the objective of their canal piping efforts away from restoring flows in the Middle Deschutes to improving flow in the Upper Deschutes River during the winter to help meet the requirements of the Deschutes River Basin Habitat Conservation Plan (HCP), completed in late-2020 by the US Fish and Wildlife Service (USFWS). The HCP is an agreed-upon set of conservation measures to benefit Oregon spotted frog and other aquatic species that enables continued water use through issuance of an Incidental Take Permit (ITP) under the Endangered Species Act.

The HCP is intended to deliver predictability to water managers through 2050 by providing certainty on activities covered under the ITP, such as water storage, release, diversion, and

return. For the most recent phase of piping activity, the districts, organized through the Deschutes Basin Board of Control (DBBC), have worked with the Natural Resources Conservation Service (NRCS), Farmers Conservation Alliance, and other basin stakeholders to develop Watershed Plan-Environmental Assessment (EA) documents (i.e., Watershed Plans) to describe district canal and lateral piping projects and meet National Environmental Policy Act requirements. Table 1 shows the amount of water to be saved by each district under the existing approved Watershed Plans.

Table 1. Water savings under existing Watershed Plans.

Entity	Project	Status	Date	Miles Piped	Water Made Available for Instream Flow (AF)
Arnold ID	AID Infrastructure Modernization Project	Final EA Approved	Aug-22	11.9	10,446
Central Oregon ID	Smith Rock-King Way Infrastructure Modernization Project	Final EA Approved	Jul-20	7.9	9,392
Lone Pine ID	LPID Infrastructure Modernization Project	Final EA Approved	Aug-21	10.9	1,600
North Unit ID	NUID Infrastructure Modernization Project	Final EA Approved	Jan-23	27.5	N/A
Ochoco ID	OID Infrastructure Modernization Project	Final EA Approved	Dec-20	16.8	2,046
Swalley ID	SID Infrastructure Modernization Project	Approved, moving to construction	Apr-19	16.6	6,172
Tumalo ID	TID Irrigation Modernization Project	Approved, moving to construction	Sep-18	68.8	15,115

The Watershed Plans align with the requirements of the federal Watershed Protection and Flood Prevention Program (PL-566), making significant funding available through NRCS (which has approved each Watershed Plan based on its public review process and issuance of a Finding of No Significant Impact). The approved Watershed Plan documents for each of the six irrigation districts that utilize water from the Upper Deschutes detail where specific irrigation improvements will occur, how much water will be saved, and the future use(s) to which the water savings will be put.

The primary outcome of each approved Watershed Plan is authorization for NRCS to provide technical and financial assistance for project implementation through PL-566. Approximately 75% of the funding for the canal piping projects detailed in the Watershed Plan documents is coming (or expected to come) from NRCS through the PL-566 funding program. NRCS provides technical and financial assistance to states, local governments, and Tribal entities through this program for a range of purposes, including agricultural water management and fish and wildlife benefits.

Each Watershed Plan is leveraging approximately $31M in non-federal funding to provide the 25% project match, primarily from the State of Oregon. These state sources include the Oregon Water Resources Department's Water Projects Grants and Oregon Watershed Enhancement Board, primarily using funding received from the federal Pacific Coastal Salmon Recovery Fund. In addition, some districts have used the Oregon Department of Environmental Quality's Clean Water State Revolving Fund.

Unlike funding from the State of Oregon, NRCS does not require commitments of water instream under PL-566. However, primarily to satisfy the regulatory commitments made under the HCP, the Upper Deschutes irrigation districts have agreed in their Watershed Plans to restore instream an amount of water representing most of what is being saved, as described below.

North Unit Irrigation District Supply and Winter Flows in the Upper Deschutes

About half of the water savings generated by the projects NRCS has approved to-date are being shared with North Unit Irrigation District (NUID) to firm up that district's supply and proportionally reduce reliance on water that NUID historically has stored in Wickiup Reservoir for release and use in Jefferson County during the irrigation season. Winter reservoir releases will equate to the volume of actual water received by NUID from Arnold (AID), Central Oregon (COID), and Lone Pine (LPID) irrigation districts during the previous irrigation season. While the planned rates of release are detailed in the Watershed Plans and described below, this volume of water may be adaptively managed by the USFWS and released according to a different rate and schedule to provide maximum benefit for the Oregon spotted frog.

[*Insert photograph of upper Deschutes River*]

Per its Watershed Plan, AID will bypass diversion of 100% of the cumulative volume of water saved through its piping projects (up to 10,526 acre-feet when the right is in full priority) for use by NUID (Figure 1). The other mainstem Deschutes irrigation districts have agreed to allow this volume of water to be diverted out of priority by NUID. In perpetuity, NUID will annually release from Wickiup Reservoir the volume of water equivalent to what it receives from AID at an estimated rate of 32.5 cfs to increase Upper Deschutes winter flow.

Per its Watershed Plan, COID will deliver 100% of the cumulative volume of water saved (up to 9,392 acre-feet when the right is in full priority) through the completed Smith Rock-King Way piping projects for use by NUID (Figure 2). COID will spill the volume of water it shares from the bottom of its system into NUID's canal at a location slightly southeast of Terrebonne. The other mainstem Deschutes irrigation districts agree to allow this volume of water to be diverted, spilled, and used out of priority by NUID. In perpetuity, NUID will annually release from Wickiup Reservoir the volume of water equivalent to what it receives from COID at an estimated rate of 29.4 cfs to increase Upper Deschutes winter flow if released steadily throughout the storage season.

Figure 1. Arnold Irrigation District canal piping pathway diagram.

[Pathway diagram to be updated with clarified OWRD Legal Tools]

Figure 2. Central Oregon Irrigation District canal piping pathway diagram.

[Pathway diagram to be updated with clarified OWRD Legal Tools]

Per its Watershed Plan, LPID will bypass diversion of 76% of the cumulative volume of water saved (up to 1,598 acre-feet when right is in full priority) through its piping projects for use by NUID (Figure 3). The other mainstem Deschutes irrigation districts have agreed to allow this

volume of water to be diverted out of priority by NUID. In perpetuity, NUID will annually release from Wickiup Reservoir the volume of water equivalent to what it receives from LPID at an estimated rate of 5.3 cfs to increase Upper Deschutes winter flow.

Figure 3. Lone Pine Irrigation District canal piping pathway diagram.

[Pathway diagram to be updated with clarified OWRD Legal Tools]

In sum, AID, COID, and LPID will save up to 21,516 AF of water annually through the piping projects detailed in each approved Watershed Plan that will be shared with NUID. [PLACEHOLDER – a process to ensure water conservation, delivery to NUID, and instream protection is under development between OWRD and project proponents. Once finalized, it will be described here. This pathway approach is being developed due to the limitations on Oregon's ACW statute that prohibit water conserved being protected in a different season than authorized for use on the originating water right.]

These releases will contribute to compliance with the HCP goals by increasing alignment over time of water operations with the life-history needs of covered species. The winter minimum flow from Wickiup is 100 cfs for the first seven years of the HCP, then increases to 300 cfs for years 8 through 12, and finally increases to 400–500 cfs for the remainder of the permit term (years 13 through 30).

Winter flows in the Upper Deschutes River are an essential element to the HCP, because, historically, that was the time of year when water was stored in the reservoirs, which reduced the downstream river flow to such low levels that fish and wildlife (specifically the Oregon spotted frog) were stranded or killed. Providing these winter flows and increasing them over time to allow for the system and species to adapt, will provide better year-round habitat for fish and wildlife in the Upper Deschutes River for the first time since the reservoirs were constructed over 80 years ago.

Finally, NUID expects to save up to 6,089 AF of water annually upon completion of the projects detailed in its Watershed Plan (finalized in January 2023). Three-quarters of the water savings will eventually be used to shore up district supply each year while 25% will be released from Wickiup Reservoir to help meet flow requirements detailed in the HCP.

LPID Supply and Irrigation Season Instream Flows

A portion of the water saved (505 AF) by LPID, all the water saved (6,172 AF) by Swalley Irrigation District (SID), and (15,116 AF) by Tumalo Irrigation District (TID) will go to other uses. The smaller share of LPID's saved water will firm up patron supply on existing irrigated lands. The entirety of SID's water savings will be put through OWRD's ACW Program, with 75% of it permanently improving instream flows in the Middle Deschutes River during the irrigation season and 25% used to firm up the district's supply (Figure 4). Similarly, TID's saved water will be put through the ACW, though all of it will be used to permanently improve instream flows on Crescent and Tumalo creeks and protected through the Middle Deschutes (Figure 5). TID intends to dedicate a portion of the saved water as an instream water right on Crescent Creek in fall and spring at a rate and volume determined by the USFWS. The remaining

portion of saved water will be allocated at a variable rate and volume as an instream water right on Tumalo Creek during the irrigation season.

Figure 4. Swalley Irrigation District canal piping pathway diagram.

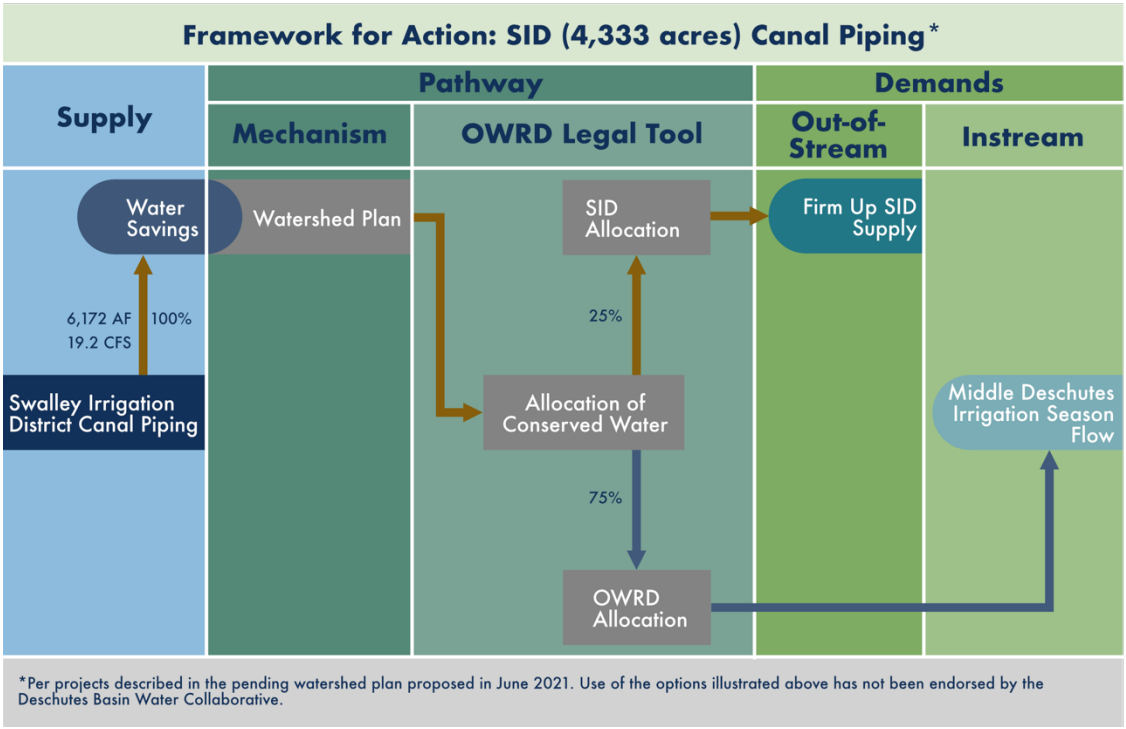
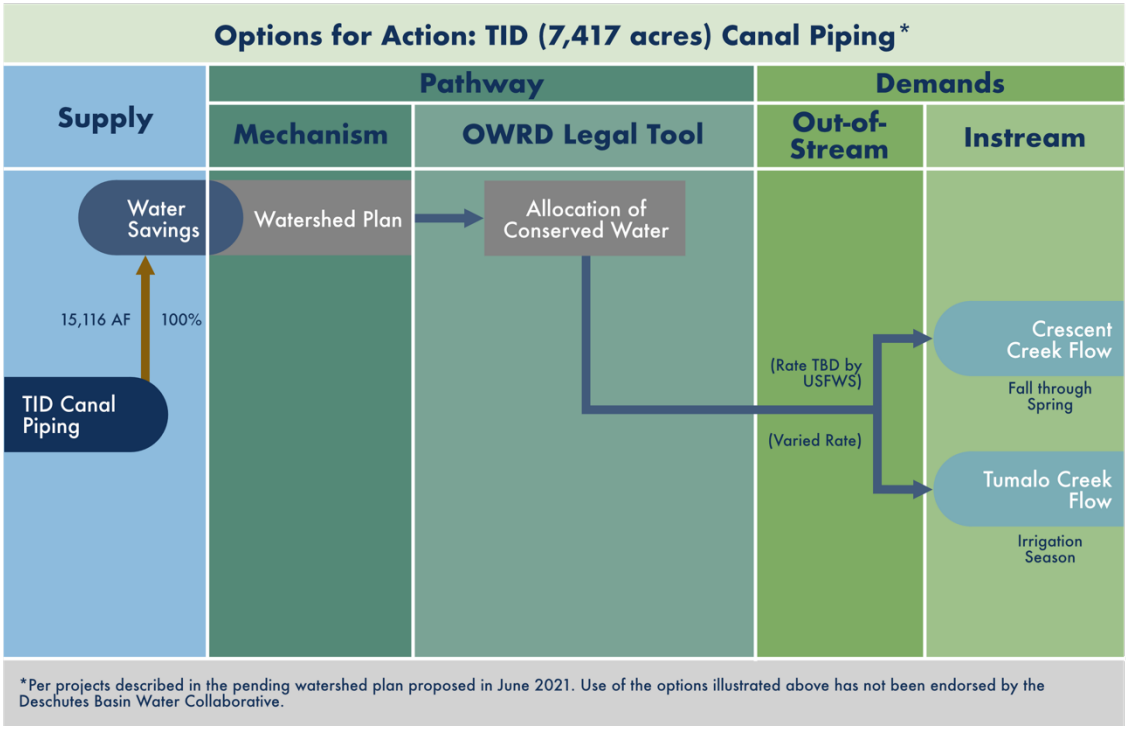


Figure 5. Tumalo Irrigation District canal piping pathway diagram.



Anticipated Outcomes

Irrigation district canal piping efforts will benefit the agricultural and instream legs of the three-legged Deschutes basin stool. Depending on whether COCO's case for winter mitigation credits is accepted by OWRD and other stakeholders, these efforts may also benefit the municipal leg of the stool. LPID, SID, and NUID patrons will benefit from increased water supply reliability on existing water-righted acres, the latter from both its own piping efforts as well as the water savings shared with it by AID, COID, and LPID that result from their completed projects. Winter flow on the Upper Deschutes will increase through NUID's releases from Wickiup Reservoir. This reservoir management change also means that in a typical year artificially high flows on the Upper Deschutes in the summer months will be reduced by a similar amount to the winter releases, resulting in a more balanced annual hydrograph for the reach between Wickiup and Bend. Water savings generated by SID will improve summer flows on the Middle Deschutes below Bend and TID's water savings will improve instream flow on Crescent and Tumalo creeks and the Middle Deschutes during the irrigation season and during the shoulder seasons.

In addition to generating water savings, piping district conveyance infrastructure will give district water managers the ability to more precisely measure water throughout their systems, providing them with the control that they need to better account for and manage water. This will enable district patrons to share water for other uses through either on-farm efficiency improvements or water marketing activities. (Per below, additional conveyance infrastructure improvements are required by patrons that utilize private laterals to receive water deliveries.)

Future COID Piping Projects

Besides COID, the other five mainstem Deschutes irrigation districts have detailed all their planned piping projects in each respective Watershed Plan. COID, on the other hand, is in the planning stages for Phases 2-14 of the Pilot Butte Canal piping projects. COID estimates that these projects will cost $250M, with receipt of $187.5M in PL-566 funds anticipated through NRCS and the remaining $62.5M coming from required match sources. If necessary, COID could pursue funding from additional sources other than just OWRD and OWEB for their next project phases given the substantial cost of the project.

[*Insert table from DBBC detailing COID phases 2-14 of canal piping project*]

The volume of water expected to be saved through these piping projects would allow COID to share up to an additional 126 cfs with NUID, spilling the water at the bottom of its system into NUID's canal. Once these COID projects are complete, up to 212.4 cfs will be shared with NUID by the three participating irrigation districts. This shared water will substantially contribute to the HCP flow targets through year 12 and still provide about half of the ultimate flow target of up to 500 cfs.

Because of the large magnitude of the planned federal funding request, COID is required to complete an Environmental Impact Statement (EIS) instead of an EA for the remaining phases of the Pilot Butte Canal piping projects. The regulatory requirements for an EIS are more detailed and rigorous than the requirements for an EA. Further, the EIS process will provide ample

opportunity for interested stakeholders to inform the planning process by commenting on COID's proposed projects.

Implementation Obstacles

While the approved canal piping projects are moving forward per the details of each approved Watershed Plan, there are a few existing obstacles to implementation. First, project budgets have grown due to inflation-related price increases on labor and materials. These increases have made securing sufficient match more difficult as well, resulting in the potential for budget shortfalls. Second, in the urbanized areas within the boundaries of both AID and COID, resistance from local residents has made project implementation more challenging. Finally, specific to LPID, NRCS must approve a new bridge over the Crooked River to carry the planned piping. The DBBC anticipates being able to address each of these obstacles as it moves towards project completion.

Issues Flagged for Stakeholder Consideration

Consensus is lacking amongst stakeholders regarding the status of conveyance (or carry) water allocated under the 1934 Duffy Decree, with some stakeholders asserting that historical conveyance water no longer remains part of the district's water rights once saved through piping. However, conveyance water is part of district water right certificates and will be legally accounted for when shared with NUID.

[PLACEHOLDER – a process to ensure water conservation, delivery to NUID, and instream protection is under development between OWRD and project proponents. Once finalized, it may inform discussion in this section. This pathway approach is being developed due to the limitations on Oregon's ACW statute that prohibit water conserved being protected in a different season than authorized for use on the originating water right.]

Central Oregon Cities Organization (COCO) has asked the DBWC to consider the opportunity to put a portion of restored winter water into a water bank to serve as future mitigation credits that address the seasonality of impact issue. COCO asserts that this should be considered given the overall net positive benefits of the DBWC's integrated plan on water availability. Upper Deschutes municipalities intend to provide more information to the DBWC regarding the basis for groundwater mitigation credits being generated from restored winter flow.

4.1.2 Private Lateral Piping

In some circumstances, private laterals are used to convey water from district-owned canals and laterals to patron owned properties. Under the summary of water management options in the Basin Study, it was estimated that approximately 35,000 AF/year could be saved through piping of COID's private laterals at an average cost of $1,000 per AF (with other districts expected to have similar costs) [**Question to PT**: Outdated, from 7 years ago – consider order of magnitude water savings and relative costs between tools instead?].

To date, most of the effort and investment in irrigation infrastructure improvements has been focused on piping COID's main canals and sublaterals. This has primarily occurred because

larger volumes of water savings can be generated through single projects, and the districts' sole control over their conveyance infrastructure creates a comparative ease of project implementation. On the other hand, piping privately owned conveyance laterals requires action and/or agreement by private landowners and can require more complicated and uncertain pathways to using saved water to help meet the needs of the other legs of the stool.

The most effective private lateral improvement projects involve all landowners on a single district lateral in order to both maximize the amount of water savings generated, as well as enable the district's efficient management and conveyance of the piped water to all participating patrons. Thus, these project areas should be tied into segments of district main canal and laterals that have also already been piped to improve water accounting and delivery of the water savings to other designated uses. Such improvements will also give district water managers the control that they need to account for water shared by patrons that were historically served through rotation agreements.

Potential Uses of Water Savings

Water saved through private later piping could be used to increase water supply for NUID, allowing NUID to then use stored water to increase critical winter flows in the Upper Deschutes (as is primarily being done with savings resulting from district piping projects).

Water savings could also be dedicated through OWRD's ACW program to an instream water right on the Middle Deschutes River from Bend down into Lake Billy Chinook (Figure 6). Due to the Deschutes Groundwater Mitigation Program rules, these non-consumptive water savings could not be allocated through the ACW program to another water user as consumptive use without mitigation of the new use. Thus, using water savings for irrigation could only happen as a result of a district and patron informally shoring up their supply reliability with savings generated from these projects.

Anticipated Outcomes

In the near-term, of the water anticipated to be saved by piping private laterals, very little will be available to meet other uses in the Upper Deschutes. A more realistic short-term goal is for COID and its RCPP partners to demonstrate the efficacy of measuring and accounting for water once a conveyance system is fully piped through private laterals to patron lands. Partners can then seek to build off the RCPP pilot to fully pipe select private laterals so COID can begin sharing or reallocating saved water to meet other basin needs, in particular additional supply for NUID in exchange for winter releases from Wickiup Reservoir. This water would benefit water-short NUID farmers and help DBBC achieve its HCP obligations. The fully piped systems would contain sufficient measuring devices to account for water savings and efficiently distribute water to the intended use(s). Such improvements would also enable the use of market mechanisms, particularly temporary water sharing, by enabling districts to track individual patrons' water use and easily shut off delivery to a patron who is participating in such an agreement.

Broader Implementation Obstacles

COID has described the challenges of administering and managing the water that patrons seek to reallocate, whether savings resulting from on-farm efficiency projects or historical consumptive use through water marketing mechanisms. More specifically, it has pointed to the challenge of accurately quantifying and delivering water savings to other uses (both the rate at any moment and the overall volume during an irrigation season). Addressing these water management obstacles should be a key component of any effort to pipe private laterals.

Issues Flagged for Stakeholder Consideration

Oregon Revised Statute 545.287 authorizes irrigation districts to "construct or maintain improvements" for the distribution or delivery of water to any tract of land within a district. Further, district boards "may levy and collect an assessment upon all tracts specially benefited by the improvement." DBBC does not encourage districts to proactively make improvements themselves without landowner approval, instead favoring voluntary, patron-driven initiatives. Therefore, the irrigation districts can engage with the DBWC and key basin stakeholders to encourage and support private lateral piping projects developed and implemented by patrons. In particular, district boards can develop, fund and install measurement devices to better meet the water management challenges resulting from piping district and private conveyance systems. These efforts are best pursued initially on a collaborative, demonstration basis in specific service areas, starting with the RCPP project area. The districts can consider and apply the lessons learned as they seek to fully pipe one or more private laterals.

4.1.3 On-farm Irrigation Efficiency Projects

On-farm infrastructure upgrades include approaches such as converting from flood irrigation to sprinklers. Referencing data developed by Farmers Conservation Alliance (FCA) in 2017, the Basin Study estimated that approximately 65,000 AF could be saved annually through on-farm infrastructure improvements at an average cost of $9,700/AF. However, it was also estimated that about half this amount of water, 30,000 AF/year, could be saved from the most cost-effective COID and NUID on-farm projects at an average cost of $4,000 per AF [**Question to PT**: Outdated, from 7 years ago – consider order of magnitude water savings and relative costs between tools instead?].

Historically, a limited amount of water savings has been generated through on-farm efficiency projects that has then been made available to meet other water demands in the basin. Rather, much of it has been implemented to improve district and patron water supply reliability, particularly within NUID, which has faced the biggest delivery reductions due to the district's relatively junior priority water right.

However, several public and private entities are currently collaborating with COID to demonstrate the efficacy of generating and accounting for water savings through on-farm efficiency projects. Under NRCS's Regional Conservation Partnership Program (RCPP), a group of partners including DRC, COID, and the Deschutes County Soil and Water Conservation District are implementing a project called *Smith Rock Irrigation Modernization & Conservation*.

The project area is located northeast of Redmond in the Smith Rock-King Way area, where COID recently piped 7.9 miles of their Pilot Butte Canal. The stated objective of the RCPP is to improve both conveyance and on-farm water efficiency that will conserve water in COID that can be accounted for by project partners. The long-term goal of the project is to demonstrate the potential for creating a fully piped and pressurized system that is operable on-demand, thereby maximizing on-farm water conservation opportunities. Projects are being primarily funded by NRCS, with additional funds provided by Deschutes County (received through the American Rescue Plan Act) and by OWRD through a Water Projects Grant.

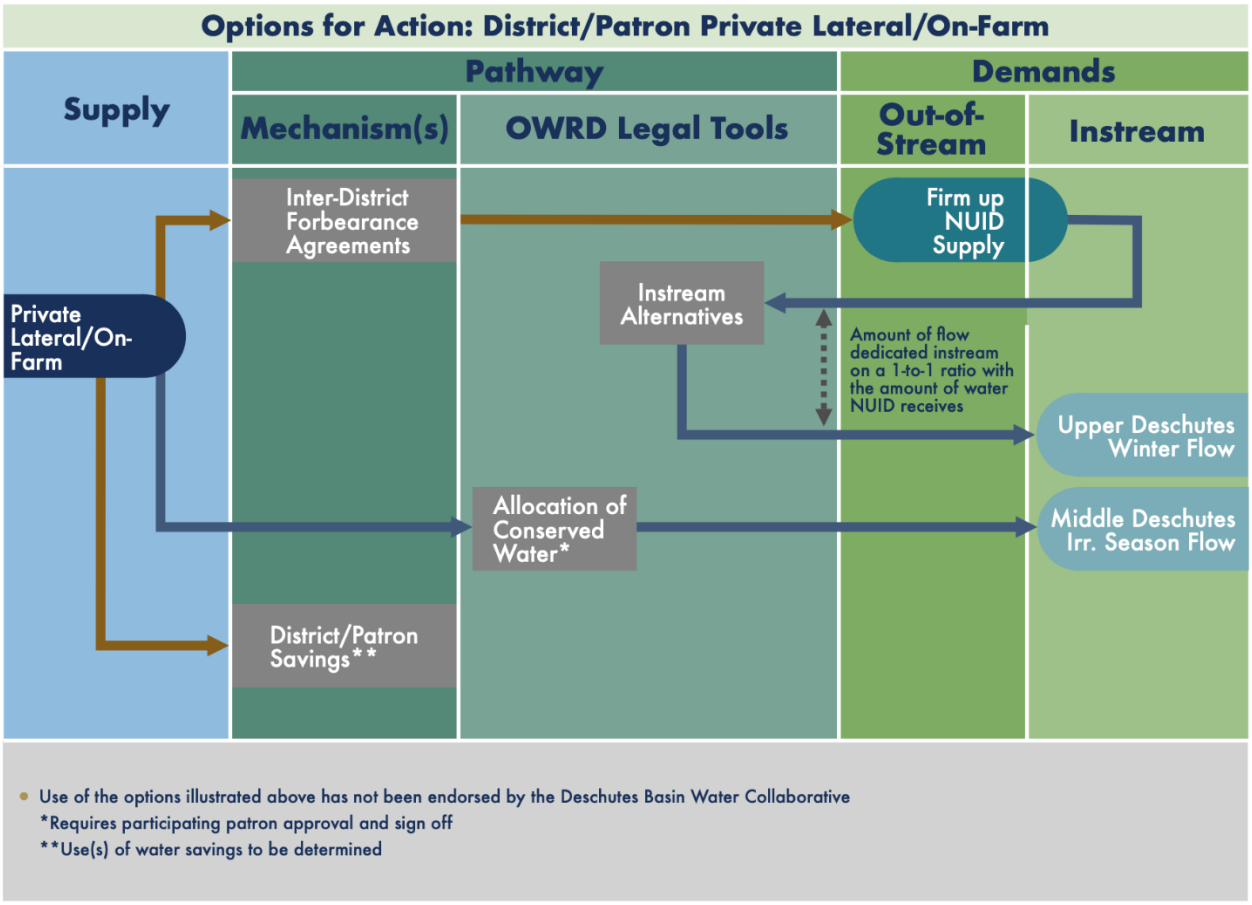
[*Insert project highlight box*]

Potential Uses of Water Savings

Since the focus of the RCPP is primarily on accounting for water savings resulting from the pilot projects, little has been determined regarding use of these and potential future savings resulting from piping private laterals and implementing on-farm irrigation application efficiency improvements. The RCPP proposal described that the objective of the initiative was to increase water supply for NUID, thereby allowing NUID to use stored water to increase critical winter flows in the Upper Deschutes (as is primarily being done with savings resulting from main canal piping projects).

Water savings could also be dedicated through OWRD's ACW program to an instream water right on the Middle Deschutes River from Bend down into Lake Billy Chinook (Figure 6). Due to the Deschutes Groundwater Mitigation Program rules, these non-consumptive water savings could not be allocated through the ACW program to a new consumptive water user without mitigation of the new use. Thus, using any project water savings for irrigation could only happen as a result of a district and patron informally shoring up their supply reliability on existing water righted acres.

Figure 6. District/patron private lateral/on-farm efficiency pathway diagram [Will need to be broken out into two pathways – one for private laterals, one for on-farm].



Anticipated Outcomes

In the near-term, of the water anticipated to be saved through these projects, very little will be available to meet other uses in the Upper Deschutes. A more realistic short-term goal is for COID and its RCPP partners to demonstrate the efficacy of measuring and accounting for water savings generated from improving on-farm application efficiency once entire sections of the conveyance system, from the main canal to the individual farm deliveries, has been fully piped. Partners can then seek to build off the RCPP pilot to fully pipe select private laterals down system from a district piping project, upgrade on-farm irrigation application systems, and begin sharing or reallocating the water savings to meet other basin needs, in particular additional supply for NUID in exchange for winter releases from Wickiup Reservoir. This water would benefit water-short NUID farmers and help DBBC achieve its HCP obligations.

Broader Implementation Obstacles

RCPP project sponsors have indicated that the current group of participating landowners are primarily interested in increasing their water supply reliability when improving their on-farm irrigation systems. Thus, potential lack of landowner willingness to share water savings for alternative uses could be an obstacle to their participation in publicly funded projects whereupon

the objective is to generate water savings that can be shared to meet other demands under the three legs of the stool. Nonetheless, some patrons have expressed a desire to use less water than currently delivered to them, creating potential opportunities for this water sharing approach.

Issues Flagged for Stakeholder Consideration

DBBC does not encourage districts to proactively make improvements on private lands without landowner approval, instead favoring voluntary, patron-driven initiatives. Therefore, the irrigation districts can engage with the DBWC and key basin stakeholders to encourage and support water saving projects developed and implemented by patrons. These efforts are best pursued initially on a collaborative, demonstration basis in specific service areas, starting with the RCPP project area. The districts can consider and apply the lessons learned as they work with other patrons.

4.1.4 Household level conservation programs (NOT YET DEVELOPED)

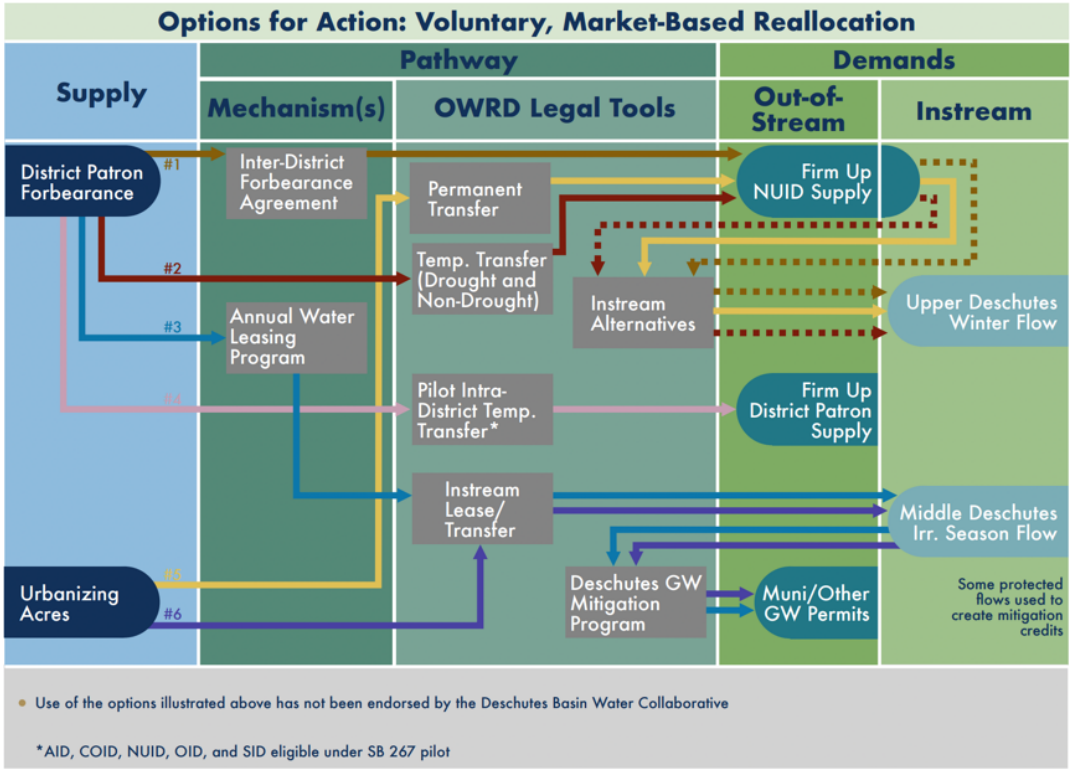
[FORTHCOMING from GSI/COCO – discussion of enabling conditions, actions, roadblocks, etc.]

4.2 Market-Based Approaches (previously Section 4.3 – Transfers and Rotations)

Under the summary of water management options in the Basin Study, the market-based option considers the use of price incentives to promote efficient water use and make water supply available to other users and uses. Tools relevant to Upper Deschutes irrigation districts and patrons include the 1) temporary lease of water rights (fallowing acres on an annual, split-season, or multi-year basis), 2) voluntary duty reduction (incentives to reduce water use per acre), and 3) permanent sale of water rights (transferring irrigation water rights off appurtenant acres in perpetuity) (Figure 7).

Market-based approaches can effectively decrease consumptive demand in one area, making water available to meet other needs in the basin, such as moving it from one irrigator to another, or keeping it instream to improve flow and create mitigation for groundwater users. Assuming district and patron willingness, the Basin Study estimated that market-based approaches provide an opportunity to permanently save up to 160,000 AF of consumptively used water at a total cost of $65M, or an estimated average cost of $400 per AF. (The unit cost of this estimated amount of "economically available" water is based in part on a discount rate being applied to temporary costs to generate a permanent value). The districts have raised concerns about their ability to administer and manage their conveyance systems over time if this volume of consumptive use water is shared to meet demands outside of their boundaries. Thus, market-based tools should also be integrated with current efforts to pipe the district's canals and laterals (including private laterals), complete with installation of measurement devices, to address and manage the challenges with distributing and accounting for water to meet both instream and irrigation uses.

Figure 7. Market-based reallocation pathway diagram.



4.2.1 Temporary Water Leasing

For a quarter century, DRC has worked with willing irrigation districts and individual water users to administer an annual water leasing program (AWLP) in the Upper Deschutes (pathway #3). When water is leased instream through OWRD, it is protected with the same priority date as the original water right – providing significant instream benefits to the Middle Deschutes River between Bend and Lake Billy Chinook, Tumalo Creek, and other reaches throughout the basin. In addition to the flow benefits, an instream lease satisfies the beneficial use requirements that prevent the water right from being subjected to potential forfeiture if not used for irrigation, benefiting the patron and the district. On average, water rights holders are paid $7 per acre-foot to participate in a lease, but half of the AWLP's instream leasing participants donate their water at no cost.

Eligible district patrons have the following leasing options available to them:

- Five-year lease (with annual option to opt out);
- One-year standard lease; and
- Split-season lease (water used instream part of the season).

Participating districts determine patron eligibility to participate in the AWLP and some districts limit the annual volumes that can be leased instream.

Over the past 25 years, an average of 60 cfs and 21,000 AF has been temporarily restored instream to the Upper Deschutes during each irrigation season. On average, approximately $z

have been invested through the AWLP, with funding provided from Avion Blue Water Program, Bonneville Environmental Foundation (BEF), the Columbia Basin Water Transactions Program (CBWTP), Deschutes Brewery, and Oregon Watershed Enhancement Board (OWEB). DRC also maintains a groundwater mitigation bank through which it generates temporary credits based on restored flow that it sells to parties needing mitigation credits, generating revenue for future leasing efforts.

In addition to helping meet the instream leg of the stool, water can be temporarily moved within (pathway #4) irrigation districts to improve irrigation supply reliability of existing patrons on their water-righted acres. AID, COID, NUID, OID and SID all have pilot authority from OWRD to temporarily transfer water from one patron to another within each district during the irrigation season. Such a temporary transfer would be expected to result from one patron compensating another for the use of their water to improve supply reliability in a given irrigation season. Like with an instream lease, the temporary movement of water between water users also requires approval of the relevant irrigation district board.

OWRD also authorizes water to be temporarily moved from the patron of one district to the patron of another district with the approval of both irrigation district boards (pathway #2). OWRD's temporary transfer process can be cumbersome to use for an annual lease of a water right across districts. Thus, the agency has developed a quicker, easier process to use during a drought declaration when patron demand for additional irrigation water might be greatest. Both the drought and non-drought processes formally reallocate water temporarily between patrons from different districts. This is distinct from the informal forbearance of water by the patron of one district for use by the patron of another district as has recently occurred under the pilot water bank developed by COID and DRC to temporarily share water with NUID patrons in conjunction with partial (25%) winter releases from Wickiup Reservoir (see summary below).

4.2.2 Duty Reductions

Despite being highlighted under the Basin Study, OWRD does not currently authorized "partial-duty" leases or transfers. Thus, any effort to share water derived from diverting and applying less to specific parcels over the course of an irrigation season would need to occur informally. This approach could potentially be developed further as part of the nascent Deschutes Water Bank (see below).

4.2.3 Permanent Water Transfers

Compared to temporary leases, the permanent reallocation of water instream (pathway #6) or within and across irrigation districts (pathway #5) has been limited to date (primarily due to the lack of support by district boards based on administrative and management concerns). If board support exists, OWRD is authorized to approve the permanent transfer of water from a district's historical point of diversion to a dedicated instream water right, downstream through the Middle Deschutes River, or from one place of use to another.

Earlier in the DRC's history, a memorandum of understanding (MOU) was developed with COID and SID to permanently transfer instream a small portion of the two districts' overall water rights that were appurtenant to acreage that had been converted from agriculture to residential development in Bend and Redmond. COID permanently transferred nearly 38 cfs

instream in the Middle Deschutes by selling the water rights appurtenant to 2,166 urbanized acres. In addition to the purchase price paid for the water rights, payment in the form of "exit fees" were made to the two districts to offset the corresponding reduction in future patron assessment fees. The resulting instream water rights were also the basis for the issuance of permanent groundwater mitigation credits for the City of Bend and Avion Water. These transfers occurred through an earlier iteration of Deschutes Water Alliance's Water Bank, administer by the DRC, which faded as concerns rose within the districts about the potential impacts of additional permanent instream transfers on water rights administration and management.

OWRD also authorizes the permanent transfer of water rights either within or across the Upper Deschutes irrigation districts with board(s) approval (pathway #5). Such transfers would involve a change in the point of diversion and place of use, with the original priority date remaining intact for the recipient district/patron. Demand for more senior and reliable water rights exists in the Upper Deschutes, particularly from NUID farmers who have seen a decrease in their irrigation water supply under recent drought conditions due to their relatively junior priority date. [PLACEHOLDER – a process to ensure water conservation, delivery to NUID, and instream protection is under development between OWRD and project proponents. Once finalized, it will be described here. This pathway approach is being developed due to the limitations on Oregon's ACW statute that prohibit water conserved being protected in a different season than authorized for use on the originating water right.] The districts are temporarily sharing water with NUID, primarily water saved through canal piping projects with the potential to share lateral and on-farm savings and consumptive use water made available from annual irrigation forbearance agreements.

In the near-term, DRC and DBBC are rebuilding the Deschutes Water Bank, initially focused on allowing for the temporary sharing of forborne consumptive use water from willing COID patrons to NUID. If political support increases for authorizing the permanent reallocation of water rights through OWRD's transfer processes, particularly from acreage that has experienced residential development, the mechanism could be a cost-effective tool for increasing instream flow in the Middle Deschutes River in perpetuity and potentially issuing groundwater mitigation credits for municipalities and/or increasing water supply reliability for NUID patrons and releasing water from Wickiup Reservoir in the winter as required under the HCP.

Both private and public funding sources could be readily accessed to cover the cost of a water purchase and any associated exit fees required to keep the participating district whole. Funding from private entities like BEF and public programs such as the CBWTP and OWEB's Water Acquisition Program would be invested with the primary objective of restoring flow to the Middle Deschutes in summer and the Upper Deschutes in winter. Other public sources like the NRCS PL-566 program could be a potential source of funding with the primary objective of enabling NUID to improve its water supply reliability while simultaneously meeting the requirements of the HCP. Finally, private and public water suppliers would be interested in purchasing permanent mitigation credits derived from the transfer of water to the Middle Deschutes in perpetuity.

AID is currently demonstrating the efficacy of this approach as it transfers portions of its water right from remnant parcels that have been urbanized to instream water rights on the Middle Deschutes Rivers to serve as the basis for permanent groundwater mitigation credits.

4.2.4 Groundwater Mitigation Credits

As described in Section 3.2.2 [and further considered in section 4?], the Deschutes Groundwater Mitigation Program was developed to provide for new groundwater uses while maintaining scenic waterway and instream water right flows in the Deschutes Basin. To date, the most effective and utilized approach for generating mitigation credits has been through the temporary lease or permanent transfer of the consumptive use portion of existing water rights. Under the earlier version of the Deschutes Water Bank, the portions of COID and SID water rights transferred instream from urbanized acres in perpetuity were the basis for the creation of permanent groundwater mitigation credits acquired by the City of Bend and Avion Water Company. As district reluctance to support permanent transfers of water rights has grown, the recent portfolio of groundwater mitigation credits has been primarily derived from leased water and are temporary in nature. Thus, many groundwater permit holders are currently relying on the ongoing generation of temporary credits from instream leasing on the Middle Deschutes for their permits to remain in compliance with the requirements of the Groundwater Mitigation Program. It is important to note that municipalities have prioritized securing a permanent and reliable supply of mitigation credits to support community water needs in perpetuity.

4.2.5 Deschutes Water Bank

As mentioned above, DRC and DBBC are rebuilding a basin-wide water bank (Deschutes Water Bank), initially through the receipt of a Water Marketing Strategy Grant from Reclamation in 2018 and continued as part of a subsequent $1.37M Drought Resiliency Program award from the federal agency in 2022. The first two years of the effort were spent developing and implementing a water market pilot program involving COID, NUID and Wickiup Reservoir/Upper Deschutes instream flow. The pilot program provided a small amount of water to NUID during the irrigation season (pathway #1) to mitigate drought-caused water supply shortages. Water was made available to NUID by compensating participating COID patrons (vetted and approved for participation by COID based on operational considerations) to forgo irrigation for a season. Winter flow in the Upper Deschutes was also increased through additional releases from Wickiup Reservoir tied to the amount of water shared with NUID. The program was limited to COID patrons served by the Pilot Butte Canal who have used water in at least one of the past two years.

Under the first two years of the pilot, NUID agreed to release the equivalent of 25% of the water it receives from COID through the Deschutes Water Bank from Wickiup Reservoir in the following winter to increase instream flows on the Upper Deschutes River as required under the HCP. Given the recent drought conditions in the Upper Deschutes Basin, there was general support for NUID's partial release of winter water relative to what they received from COID during the summer. However, some stakeholders advocate that the winter releases should be equivalent to what NUID receives during normal or wet years, particularly if the program is publicly funded in the future. Moving forward, the Deschutes Water Bank will need to resolve the question of the appropriate amount of NUID winter flow release relative to the summer irrigation water it receives.

The pilot water sharing program between DRC, COID, and NUID represented a first step to reestablish a water bank in the Deschutes Basin. Efforts are now ongoing to formalize and expand the role and impact of the Bank to help meet the water needs of the three legs of the stool in the Deschutes Basin. The Deschutes Water Bank has the potential to be an efficient and mechanism for moving water both between districts and between districts and the river. The operating vision for the reestablished water bank is a bank that helps increase supply reliability for the environment, irrigators, cities and all water users through voluntary, market-based transactions. A key goal for Bank development is creating a platform that all stakeholders trust and want to use to efficiently help manage their water now and in the future.

To meet this vision, the Water Bank team is considering a range of water sharing and reallocation tools and approaches for the Water Bank's portfolio, but only with the explicit support of key basin stakeholders that represent the three legs of the stool. This might include temporary sharing of water savings and the permanent reallocation of water rights from urbanized acreage.

4.2.6 Anticipated Outcomes

In the near-term, water made available for sharing through market-based approaches is expected to be temporary in nature and continue to primarily occur through the AWLP and the Deschutes Water Bank pilot. Water restored to the Middle Deschutes River through the AWLP is an important component of efforts to improve flows in this reach during the generally dry irrigation season. This restored flow will also serve as an important basis for the temporary mitigation credits that enable groundwater permit holders to comply with OWRD requirements. However, the opportunity to maximize the full potential of market-based tools as described in the Basin Study will continue to be limited by the reluctance of irrigation district boards to support this approach, particularly pertaining to the permanent reallocation of water.

4.2.7 Implementation Obstacles

The movement of water through use of market-based approaches is primarily limited by the lack of political support from the board of directors of Upper Deschutes irrigation districts and to a lesser extent concerns raised by individual patrons. The following issues underly the reluctance of the districts to embrace these tools despite their significant potential to cost-effectively help meet other demands in the Upper Deschutes:

- the operational challenge of conveying (or pushing) water down the system and managing water delivery at the lateral level if one or more parcels is dry (e.g., the rotation schedule used to deliver water along a lateral may need to be altered if one or more of the parcels along that lateral are dry);
- the administrative challenge of managing district water right certificate(s) as water is moved either temporarily or permanently to other uses;
- concern about letting water leave the district to meet other basin needs, particularly during water-short years; and
- equity concerns regarding how acquired water is provided to individual patrons and at what cost.

4.2.8 Issues Flagged for Stakeholder Consideration

Through engagement with the DBWC, the irrigation districts have an opportunity to develop, fund, and install measurement devices to better meet the water management challenges resulting from the use of market-based tools. These efforts are best pursued initially on a demonstration basis in specific service areas and built out and improved as experience is gained and lessons are learned. Stakeholders should also consider how best to address the district's water rights administration challenges that could result from more active use of these tools. Other topics for further discussion include the basis for the 25% Wickiup release percentage during pilot transfers and what the appropriate percentage should be for future temporary sharing or permanent transfers. Regarding the Groundwater Mitigation Program, municipalities will work with districts to expand the pool of mitigation credits from permanent transfers of water to instream use, and work to identify and advance other transactions and mechanisms for generating credits beyond what has currently been utilized.

4.3 Enhanced/New Storage (previously 4.2 – Built & Natural Storage)

Enhanced and new storage facilities could potentially support improved streamflows by relocating existing storage and/or adding capacity to provide additional flexibility in water operations. Potential strategies for enhancing or developing new storage include those related to built infrastructure, underground storage in aquifers, and natural storage, including forest management, floodplains, wetlands, and snowpack.

The existing storage system in the Upper Deschutes Basin (Wickiup, Crane Prairie, and Crescent Lake Reservoirs) are generally filled during the period outside of the irrigation season. To facilitate filling the reservoirs, flow released below the dams is limited during this period and can significantly reduce flows that benefit downstream ecological functions. During the irrigation season, water is released from the reservoirs to meet the needs of water users holding water rights for the use of the stored water. The Upper Deschutes River is used to convey the water to where it is diverted and used. This release of water can result in streamflows that are higher below the dams during the irrigation season than flows would have been prior to dam construction. Water rights mechanisms, such as the movement of conserved water and/or water rights to NUID (as a junior water rights district with lands located downstream in the basin) in exchange for storage releases, provide opportunities for managing storage differently to help address instream flow and other Basin Study objectives (Sussman, Grigsby, and Shropshire 2016).

The Deschutes Basin Habitat Conservation Plan included several conservation measures informing the management and operation of its existing system of reservoirs. These are discussed in Sections 2.1.8 and 3.5.

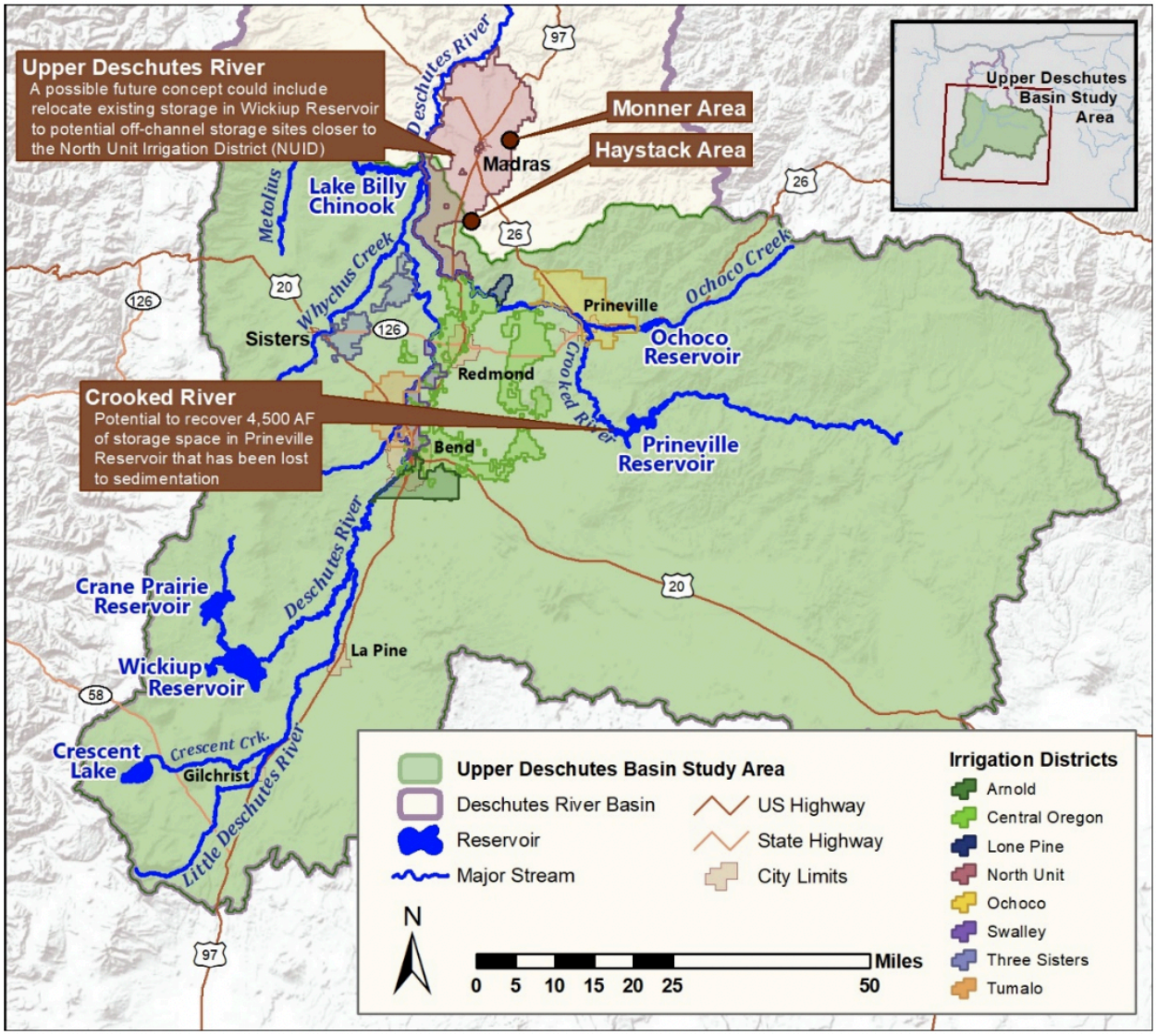
4.3.1 Relocated storage (previously 4.2.1 – Capacity & operations)

In the Upper Deschutes Basin, one potential strategy for enhancing the water storage system using built infrastructure is to relocate a portion of the existing storage in Wickiup Reservoir downstream to potential off-channel storage sites closer to NUID agricultural lands. The purpose of relocating storage downstream would be to facilitate increased winter (i.e., non-irrigation season) flows and to facilitate moderated irrigation season flows in the Upper Deschutes River.

The focus of this concept would be on NUID as the junior water district with agricultural lands in the downstream portion of the basin.

The Basin Study examined several off-channel storage concepts to evaluate the potential range of storage capacities and how water operations might be improved. The assessments were completed at an early planning level intended to inform stakeholder consideration of storage as a possible long-term component for future water management (Bureau of Reclamation 2018). The Basin Study identified several locations where off-channel storage facilities could potentially provide storage volumes ranging from less than 5,000 to approximately 70,000 AF. Storing some water in the winter at one or more off-channel facilities located farther downstream, rather than storing that particular volume of water at Wickiup Reservoir, could increase winter flows in the Upper Deschutes by an average of roughly 15 to 200 cfs. Storing water at one or more new facilities would involve using the NUID Main Canal to convey water and then pumping to raise water up to the new storage site(s). Stored water would then be released from the new facility for use by NUID during the irrigation season (Bureau of Reclamation 2018). Potential storage sites include the Monner area east of the city of Madras and near the existing Haystack Reservoir, both located in or near NUID service area (**Figure 8**).

Figure 8. Map of potential storage relocation sites in the Upper Deschutes Basin (Bureau of Reclamation and Oregon Water Resources Department 2019).



In the Monner area, a potential new off-channel dam could store water, which could be served to NUID agricultural lands. Storage in this potential new reservoir would be in lieu of storing particular volumes in Wickiup and could range from about 20,000 to 70,000 AF. In the Haystack area, off-channel storage would either be located just upstream of the existing Haystack Reservoir or an expansion of the existing Haystack Reservoir. Potential storage volumes could range from less than 5,000 to about 40,000 AF. For both potential reservoir sites, water would pass through Wickiup Reservoir and flow through the Upper Deschutes River during the winter non-irrigation season, to a diversion point in Bend, where it is then conveyed through the NUID Main Canal and pumped up to the reservoir (Bureau of Reclamation and Oregon Water Resources Department 2019).

Based on prior studies of other storage concepts, potential construction costs could range from $30 million for a smaller facility, like the 5,000 AF option at Haystack, to more than $300

million for the scale of the larger facilities considered. Ongoing costs after construction would include power costs for pumping water into, and in some cases from, new storage facilities. Power costs would be dependent on many concept-specific factors but may be $1 million or more annually. Significant additional costs would be incurred for other elements of any new storage project, such as: land acquisition; environmental impacts and mitigation; engineering design to address site-specific conditions; existing utilities, road, and other infrastructure; historic properties; cultural resources; permitting; and other issues (Bureau of Reclamation 2018).

All information in the Reclamation (2018) assessment was pre-decisional, and no project or plan is recommended or proposed; years of investigation would be needed before any particular project could be advanced, and numerous local, state, and Federal permits and approvals would be required before any project could be implemented. There are several funding programs offered by Reclamation to support the design and construction of these infrastructure projects. [More detail on funding forthcoming – WIFIA, etc]

[Include description of Lake Billy Chinook concept?]

4.3.2 Above & below (i.e., aquifer) (previously 4.2.2)

Given the high costs and onerous permitting requirements for storage projects, which require the construction of new infrastructure, other strategies may consider utilizing underground storage in the basin's regional aquifer as a strategy for expanding total storage capacity and addressing groundwater level declines. One such strategy includes managed aquifer recharge, in which excess surface water during high flow events is diverted off-channel and allowed to spread out over an area with porous soils to increase infiltration into the aquifer. This strategy could improve local groundwater levels, which would improve reliability of exempt groundwater wells and increase discharge from springs/seeps which support streamflow in the lower portion of the planning area.

Managed aquifer recharge was not evaluated as a water management option in the Basin Study. In the Upper Deschutes Basin, aquifer recharge has generally been seen as a non-starter strategy due to the state's permitting requirements for projects of this type. According to OWRD statute on artificial groundwater recharge, adopted in 1961, "the appropriation of water from any source for the purpose of recharging a groundwater reservoir requires a permit. Likewise, any beneficial use of artificially recharged groundwater in any such groundwater reservoir requires a secondary groundwater permit" (OAR 690-350-0120). This is particularly difficult to do in the Upper Deschutes Basin given that surface water (which would be used as the source for recharged water) is overappropriated and any permit allowing new uses of groundwater require mitigation under the Groundwater Mitigation Program. In addition, the interconnectedness of the regional aquifer in the Upper Deschutes Basin poses a challenge within the existing regulatory framework, which focuses on water being recharged and recovered from one confined aquifer. There is no regulatory framework to allow water to be recharged in one location and extracted somewhere else, as would be needed given the movement of groundwater throughout the Deschutes Basin. Another key issue is that exempt wells may potentially be the biggest benefactor from increased recharge, which poses the potential administrative challenge of requiring mitigation for exempt well users.

However, many of the administrative and regulatory challenges described above are based on the concept that recharged water would be extracted again for consumptive use. A potential new concept in which water is recharged for the purpose of benefitting groundwater levels and connected streamflow, without the intention of extracting it for consumptive use, could be explored further. OWRD may need to update its artificial groundwater recharge program rules to allow this type of activity, but in theory it would potentially only require one permit for the source water used for recharge. The legal and regulatory implications of such a recharge activity will need to be studied further as part of a feasibility study if this new concept were to be considered as a priority strategy.

One potential location for managed aquifer recharge activity could be on formerly agricultural lands, which were taken out of production. There are XXX acres of land in the Upper Deschutes Basin where agricultural water is no longer applied. Due to the porous soils of the Upper Deschutes Basin, a proportion of applied irrigation water seeps into the ground to recharge the aquifer. Once that land has been taken out of production, that source of artificial recharge is lost. In theory, fallowed agricultural lands could be used as spreading basins where water could be delivered, through existing conveyance infrastructure, for the purpose of infiltrating into the underlying aquifer. This concept would need to be explored further as part of a potential feasibility study if it were considered a priority strategy in the Upper Deschutes Basin. Specifically, the magnitude of recharge that has been lost from fallowed land or that will be lost from future land fallowing, and how much could potentially be restored via managed aquifer recharge, would need to be investigated and understood.

4.3.3 Natural storage (forests, floodplains, wetlands, snowpack) (previously 4.2.3)

Watershed restoration and forest stewardship are other ways in which storage can be enhanced, often with additional benefits for habitat and water quality. Natural storage refers to the ecological functions served by floodplains, wetlands, forests, and snowpack to help increase a watershed's capacity to store water. Health floodplains and wetland habitats act to store excess floodwater which can protect downstream property from flooding and release water slowly, later in the year (Oregon Water Resources Department 2024). They also filter pollutants and provide valuable habitat for fish and wildlife and are particularly important in the Upper Deschutes Basin for Oregon Spotted Frog habitat. In the uplands portion of the watershed, healthy, well-managed forests can store and filter water as well as reduce surface runoff and flood risk (USFS 2021). The State of Oregon's Draft 2024 Integrated Water Resources Strategy (IWRS) identified that "watershed restoration is needed at many scales, including uplands and lowlands, to improve degraded habitat, restore resiliency, improve water quality, and capacity for natural storage" (Oregon Water Resources Department 2024). The pathways through which natural storage can be enhanced include watershed restoration, forest stewardship, land acquisition, and land use changes.

Watershed restoration covers a broad category of conservation activities, which include channel restoration and floodplain enhancements, riparian vegetation planting, forest management, fish passage improvements, and decommissioning roads and trails impacting water quality. All of these projects, and others like them, are designed to protect, restore and improve watershed health and function (Source). Of these strategies, floodplain and wetland restoration most

directly benefit natural storage capabilities of the Upper Deschutes River. The Upper Deschutes Watershed Council (UDWC) is the lead organization on the implementation of watershed restoration activities in the Upper Deschutes Basin. Examples of wetland/floodplain restoration projects UDWC has completed include restoration of the Big Marsh wetland in 2018-2019, reconnection of the Upper Deschutes River to the Ryan Ranch marsh in 2019, and various riparian enhancement projects on Tumalo Creek, Fall River, and the Deschutes River in Bend (Source). UDWC often partnered with the USFS, ODFW, Trout Unlimited, private landowners, and other entities for these projects, which were mostly funded through Oregon Watershed Enhancement Board (OWEB) grants. Collaboration with UDWC and other entities can help identify and prioritize future watershed restoration projects to enhance hydrologic function and natural storage capacity. One of the areas of potential further study identified by the Basin Study was to "evaluate how increased flows interact with floodplain connectivity and wetlands" to help identify and prioritize habitat restoration efforts to optimize flow restoration (Bureau of Reclamation and Oregon Water Resources Department 2019). This will be discussed further in Section **Error! Reference source not found.** below.

Forest management in the headwaters of the Upper Deschutes Basin can provide benefits for water resources through partnerships between agencies and nonprofits. The Central Oregon Forest Stewardship Foundation (COFSF) has outlined a framework for shared stewardship of forest resources, with the goal of engaging multijurisdictional partners to proactively plan and identify a broader range of conservation concerns (Central Oregon Forest Stewardship Foundation 2021). For example, a State Park manager might work with the Bureau of Land Management (BLM), the Upper Deschutes Watershed Council (UDWC), and the Deschutes Land Trust (DLT) to engage in a project that advances watershed health, reduces hazardous fuels in a high-use recreation area, and increases public safety. It is important to continue to foster collaborations of this kind and identify opportunities where shared stewardship of forest resources could provide benefits to forest health, water storage capacity, and streamflow in the Upper Deschutes River. [Do we have any specific projects/collaborations we could identify here in the plan?]

Efforts to improve natural storage through watershed restoration and forest management often require land acquisitions or land use changes to ensure conservation benefits are realized. [More forthcoming – discussion of DLT/UDWC efforts and reference OSF recovery plan]

The anticipated outcomes from the actions discussed in this section are to improve watershed function and hydrology resulting from increased levels of protected and restored land.