


Intel Corporation

Restore Water Goal

2021 Annual Report

Prepared for Intel Corporation

May 2022

LimnoTech
Water Environment | Scientists Engineers

BONNEVILLE ENVIRONMENTAL FOUNDATION

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Introduction

Semiconductor manufacturing requires significant water use. That is why Intel has focused on sustainable water management for more than two decades and has taken action both within and outside its operations to manage water responsibly and reduce its impact to the watersheds where they operate, guided by its Global Water Policy. Intel's water strategy has three main objectives:

- **Conserve** the amount of water used in its operations;
- **Collaborate** on water initiatives with its local communities; and
- **Create** technology solutions to help others reinvent the way they use and conserve water.

As part of its 2030 sustainability goals, Intel has committed to achieve net positive water by 2030. To meet this goal, Intel will conserve 60 billion gallons of water (cumulatively) in its operations and through community partnerships, as well as enable restoration of more than 100% of its freshwater consumption globally. In 2020, Intel returned and restored approximately 90%[1] of its freshwater usage to its communities and in local watersheds.

This report provides a summary of Intel's 2021 progress toward its goal to restore more than 100% of its global freshwater consumption[2]. It describes Intel's water restoration activities during 2021, including a description of all projects funded by Intel (i.e., initiated projects) as well as the volume of water restored during 2021 (for completed projects or partially completed), as a result of Intel's project support. For those initiated projects that are funded but not yet completed, the report includes projections of volumetric restore benefits (hereafter referred to as restore benefits) that are expected once the projects are completed.

Intel's Restore Commitment

To achieve its ambitious 2030 goal, Intel is engaging local community groups, nonprofits, and conservation organizations to fund projects that benefit the watersheds where Intel operates. These projects aim to address local water issues and support the well-being of communities and the environment.

Project Selection Process

Intel considers a range of project types and evaluates them based on a set of criteria, including:

- Credible partner with proven project development record and capacity
- Located in source watershed, tied to water supply, or connected to the local community
- Feasible project timeline that includes project initiation and completion in the relative near-term

[1] Preliminary progress for 2020 through end of 2021 is estimated to be 15.4 billion gallons of water conserved and 3.5 billion gallons of water restored (source: Intel 10K Filings, 2022), cumulatively.
[2] For information on Intel's progress to achieve net positive water by 2030 and water conservation performance, visit www.intel.com/responsibility.

- Potential for long-term or permanent benefit[3] (i.e., able to deliver water benefit for multiple years)

Other criteria used to assess the overall value of projects include:

- Potential to catalyze and/or scale up water solutions
- Community and employee engagement
- Ability to leverage additional funding through matching grants or other sources
- Favorable project cost vs. benefit ratio

Benefit Quantification Approach

Intel's water restoration commitment is based on restoring a cumulative annual volume of water to the environment that exceeds the volume of freshwater consumed globally. The anticipated restore benefits are assessed for each project based on an estimated volume of water that is *saved, protected, treated, or returned* to the environment through funding and project implementation. Benefits are calculated and based on a comparison between a pre-project condition and the expected improved condition once the project is completed. Upon completion of each project, the restore benefit is quantified based on project results reported by implementing partners.

Restore water benefits are based on peer-reviewed quantification methodologies (Rozza et al., 2013) previously developed by LimnoTech in collaboration with The Nature Conservancy (TNC) (LimnoTech, 2017), and documented by the World Resources Institute (WRI) (Reig et al., 2019). The restore water benefit indicator calculated and the quantification methodology applied varies by project type and depends on the project objectives, the activities implemented, and the information and data available to support the calculation. It is recognized that the estimated benefits have some uncertainty. To reduce this uncertainty, scientifically defensible methodologies and conservative assumptions are employed in the quantification process, in combination with available data and project information.

Consistent with the established quantification methodologies, restore water benefits are counted in the year the project is completed or partially completed if actual benefits are achieved during the year, and in each subsequent year, provided that the project is maintained and continues to function as intended. Ongoing project performance verification is provided to Intel annually by the implementing partner.

In situations where there are multiple project funders and Intel funds cover less than 100% of the project cost, the restore water benefit is adjusted to reflect the Intel-funded portion of the total project cost (i.e., cost share). For projects where investments were made before Intel's involvement (e.g., land acquisition), the total project cost is estimated based only on investments that pertain specifically to creating measurable water benefits achieved as a result of Intel's financial support of the project.

Summary of All Projects

As of December 31, 2021, Intel has provided grants to implementing partners to support 38 collaborative community projects located in seven U.S. states, as well as India, Ireland, Costa Rica, and Malaysia. Some of these projects addressed critical short-term needs and are no longer active. Implementing partners to

[3] During 2021, one project was funded by Intel that provided restore benefits during 2021 only. This project was selected because of critical need in the Colorado River, due to high temperatures and prolonged drought. This project is included in this report and is noted as providing benefit during 2021 only.

date include American Forests, Arizona Land and Water Trust, Audubon Society, Calapooia Watershed Council, CLEAN International, Clean Water Institute, Colorado River Indian Tribes, Colorado Water Trust, Deschutes River Conservancy, Friends of the Tualatin National Wildlife Refuge, Fundecor, Greenbelt Land Trust, McKenzie River Watershed Council, National Forest Foundation, Ireland National Parks and Wildlife Service, The Nature Conservancy, TreeFolks, Trout Unlimited, and Watershed Management Group.

Table 1 summarizes the projects by location and presents the 2021 restore benefit in million gallons per year (MGY) for 23 projects that achieved benefits during calendar year 2021. Table 1 also presents the total estimated full restore benefit of all 32 active projects, upon completion; altogether, these projects are estimated to restore more than 2.4 billion gallons of water each year, once complete.

Table 1. All Intel-Funded Projects through December 31, 2021

Project location	Total Number of Active Projects During 2021	Restore Benefit Achieved in 2021 (MGY) [4]	Estimated Restore Benefit Upon Completion of all Funded Projects (MGY)
Arizona, Utah, Colorado (benefitting Arizona)	15	887.3	847.1
California	2	209.5	354.4
New Mexico	2	114.9	133.4
Oregon	7	902.2	922.2
Texas	1	0	0.2
Costa Rica	1	48.5	48.5
India	2	99.6	127.8
Ireland[5]	1	0	9.0
Malaysia	1	0	42.7
Total (MGY)	**32**	**2,262.0**	**2,485.3**

[4] Includes benefits from a 1-year project in 2021.
[5] Total estimated restore benefit is calculated using the average of the estimated range of benefits.

Summary of 2021 Restoration

Projects that achieved restore benefits during 2021 are shown in Table 2. Together, these projects are estimated to have restored 2,262 million gallons, or approximately 2.3 billion gallons, during 2021.

Table 2. Projects That Restored Water During 2021

Project Location	Project Name	Implementing Partner	Project Activity	Restore Benefit Achieved in 2021 (MGY)
Arizona	Barley Conversion	The Nature Conservancy	Crop conversion	38.0
Arizona	Long Valley Meadow Restoration	National Forest Foundation	Wet meadow restoration	20.0
Arizona	West Clear Creek Pipeline	The Nature Conservancy	Irrigation efficiency improvement	26.1
Arizona	Lower San Pedro Agriculture	Arizona Land and Water Trust	Crop conversion	0[6]
Arizona	Lower Salt River Restoration	National Forest Foundation	Invasive species removal	89.3
Arizona	Verde Valley Irrigation Conversion	The Nature Conservancy	Drip irrigation	14.4
Arizona	Groundwater Recharge in the Tucson Basin	Watershed Management Group	Infiltration structures	24.2
Arizona	Eureka Ditch Piping	The Nature Conservancy	Piping/system modernization	124.4
Arizona	Drought Contingency Plan System Conservation	Audubon Arizona	Water rights leasing	51.2
Arizona	Wallow Fire Reforestation	National Forest Foundation	Reforestation	38.0
Utah	Mountain Island Ranch Agriculture	Trout Unlimited - Utah	Crop conversion and fallowing	124.0
Utah	Price and Colorado River Winter Flow Restoration	Trout Unlimited - Utah	Conversion of consumptive use water right for instream winter benefits	111.4

[6] The Lower San Pedro Agriculture project is continuing but did not have benefits in 2021.

Project Location	Project Name	Implementing Partner	Project Activity	Restore Benefit Achieved in 2021 (MGY)
Colorado	15-Mile Reach (2021 Only)	Colorado Water Trust	Instream leasing (1-year)	226.3
Colorado	Rio Grande Projects for Water Resource Benefit	Trout Unlimited	Winter flow release	114.9
New Mexico		National Forest Foundation	Floodplain reconnection	
California[7]	Dynamic Water Management for Wildlife Program	The Nature Conservancy	Wetland habitat creation	209.5
Oregon	Middle Deschutes Instream Flow Restoration	Deschutes River Conservancy	Water leasing and instream protection	93.5
Oregon	Bowers Rock State Park Side Channel Restoration	Calapooia Watershed Council	Flow enhancement to side channel	376.0
Oregon	Horseshoe Lake Oxbow Restoration	Greenbelt Land Trust	Oxbow restoration	41.0
Oregon	Lower South Fork McKenzie River Floodplain Enhancement	McKenzie Watershed Council	Floodplain restoration	198.7
Oregon	Deer Creek Floodplain Restoration	McKenzie Watershed Council	Floodplain restoration	75.0
Oregon	Wapato Lake Restoration and Management	Clean Water Institute	Infrastructure replacement for water level management	118.0
India	Nanjapura Lake Restoration	CLEAN International	Lake desilting	45.3
India	Dyavasandra Lake Restoration	CLEAN International	Lake desilting	54.3
Costa Rica	Agua Tica Forest Protection	Fundecor	Forest protection	48.5
			TOTAL 2021 RESTORE BENEFIT =	**2,262**

[7] Two previously reported projects are being managed together so will be addressed as one project moving forward.

Project-Specific Results

The locations of projects achieving 2021 restore benefits are shown in Figure 1. This includes one continuing project that did not have benefits in 2021 but is expected to in 2022 and future years. Project-specific details are described in the remainder of this section.

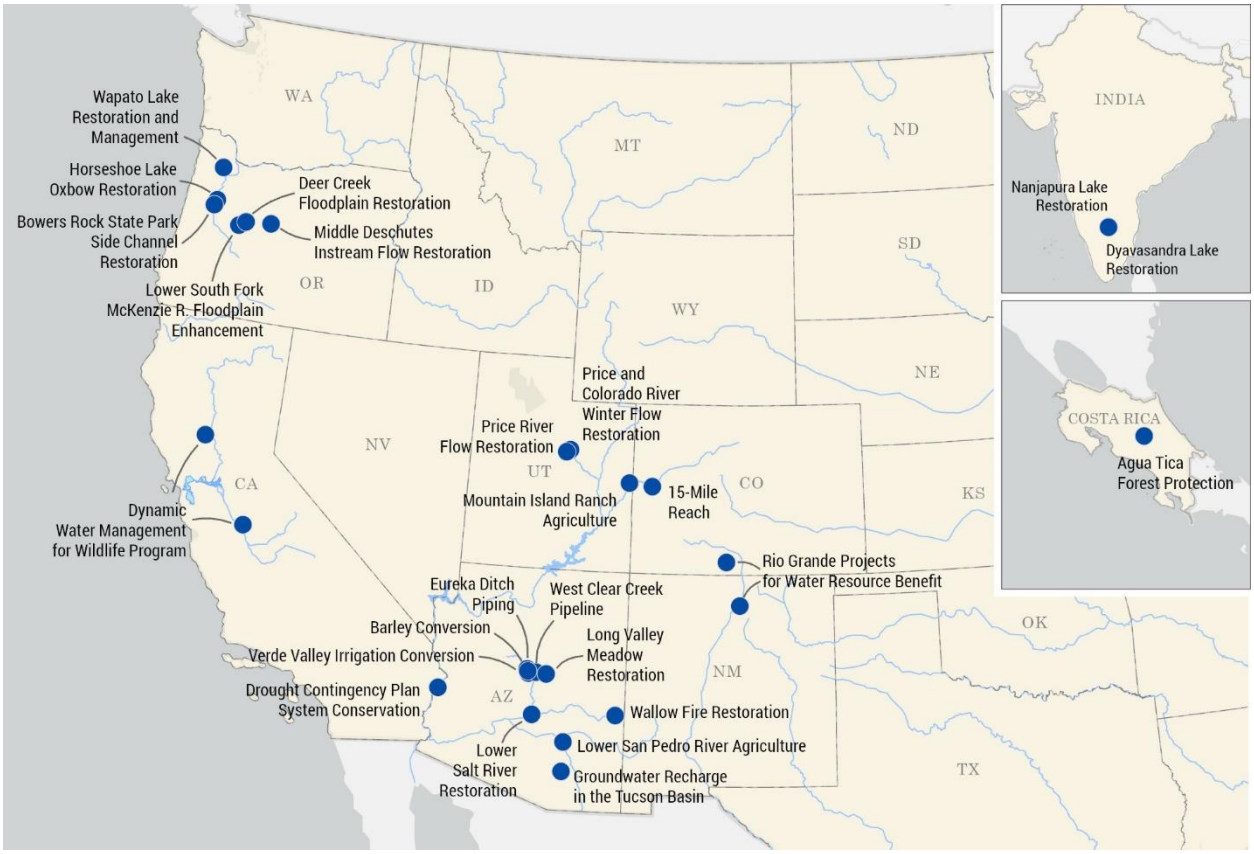


Figure 1. Locations of Projects with 2021 Restore Benefits

Barley Conversion

Location: Camp Verde, Arizona

Implementing partner: The Nature Conservancy (TNC)

2021 restore benefit: 38.0 million gallons

Project timeline:

Project initiation: 2017

Year of initial restore benefit: 2018

Anticipated benefit end date: 2027

Barley is harvested before the critical low flow summer period

(Photo credit: LimnoTech)

The Verde River is an important surface water source for the metropolitan Phoenix area and is a lifeline for wildlife in the American Southwest, including migratory birds, nesting bald eagles, rare species of reptiles and amphibians, and many species of native fish. The Verde River is one of only two places in Arizona with an active breeding population of river otter. Like many western rivers, streamflow is low or nonexistent in some reaches during the hot summer months when water availability is low and peak irrigation needs occur throughout the valley. Resulting low river flows impact ecosystem health and impede river-based recreation.

TNC leads this collaborative project with local partners, including Friends of the Verde River and Sinagua Malt. These organizations recognize that agriculture is an important part of the economic and cultural identity of the area, and they understand that there are innovative opportunities to reduce irrigation water use and support local economic development through crop switching.

Crop conversion contributes to increased stream flows in the Verde River

(Photo credit: TNC)

The objective of this crop switching project was to reduce the volume of water used for irrigation during the critical summer months, leaving more water in the river. Project funds were used to incentivize farmers to replace existing high-water consumption crops with barley, which has a lower consumptive water use. Funds were also used to invest in a local malt house (Sinagua Malt) to reduce transaction costs involved in malting barley. The malted barley is sold to craft breweries around the state and to smaller markets for candy and bakery products. In concert with many other water stewardship projects planned and underway in the Verde River, this project plays an important part in developing new pathways to support economic development alongside improved water stewardship. The restore benefit is calculated as the reduction in consumptive water use. The project was initiated in 2017, and barley has been planted each season as a result of Intel's grant. In 2021, 53.55 acres of barley planting occurred as a result of Intel funding.

Long Valley Meadow Restoration

Location: Verde River Watershed, Arizona

Implementing partner: National Forest Foundation (NFF)

2021 restore benefit: 20.0 million gallons

Project timeline:

Project initiation: 2017

Year of initial restore benefit: 2018

Anticipated benefit end date: None - provides a permanent/long-term benefit

Volunteers working in an eroded section of Long Valley meadow

(Photo credit: NFF)

Long Valley Meadow is a high elevation meadow located at the headwaters of the Verde River watershed in the Coconino National Forest. This meadow filters water that drains into the C.C. Cragin Reservoir, part of a system of reservoirs owned and operated by the Salt River Project (SRP). The SRP system delivers water to more than four million residents and businesses located in the greater Phoenix metropolitan area.

Long Valley Meadow has been degraded as the result of historical grazing. The loss of vegetation and soil compaction have increased surface runoff, which has carved deep gullies with actively eroding banks. These impacts have lowered the water table and limited the meadow's ability to store precipitation, attenuate peak floods, and support summer baseflow during dry periods.

Long Valley after restoration (2019)

(Photo credit: Spencer Plumb, NFF, 2019)

The objective of this meadow restoration project was to reduce erosion and increase infiltration and shallow groundwater storage by reconnecting an incised stream channel to the meadow floodplain. A total of 42 acres of wetlands were restored using the plug and pond technique on 1,500 linear feet of stream channel. This technique diverts water out of the incised channels and onto the meadow, restoring the floodplain connection and allowing surface water to infiltrate into the groundwater. By reconnecting the channel to the meadow, the soil storage capacity increases, keeping the soil wet for a longer duration in the spring and summer. Acting like a sponge, the restored meadow increases available water to support native habitat, birds, wildlife, and recreation. Additionally, the restoration increases native vegetative cover by limiting encroachment of pine trees into the meadow that occurs as a result of meadow drying. The project supports rare meadow habitat that is important for elk and mule deer that rely on meadows like Long Valley as a source of food in the summer. The tall meadow grasses also provide cover for newborn elk and deer.

The restore benefit is calculated as the increase in annual groundwater storage as a result of the restoration.

West Clear Creek Pipeline

Location: West Clear Creek, Arizona

Implementing partner: The Nature Conservancy (TNC)

2021 restore benefit: 26.1 million gallons

Project timeline:

Project initiation: 2018

Year of initial restore benefit: 2019

Anticipated benefit end date: None - provides a permanent/long-term benefit

West Clear Creek ditch

(Photo Credit: Intel, 2018)

West Clear Creek originates in a high mountain wilderness area and provides rare cold-water habitat on route to the Verde River. The lower reaches of the creek provide some of the most intact and valuable fish and wildlife habitat in the region, but irrigation diversions that dewater the lower 3-4 miles of the creek significantly curtail aquatic ecosystem function. This project is part of a larger, comprehensive TNC program that implemented a range of activities to reduce withdrawals from West Clear Creek. Together with local irrigators, TNC has upgraded irrigation infrastructure, converted from flood irrigation to drip irrigation, piped leaky sections of irrigation canals, established new head gates with improved control, and implemented high-tech soil moisture monitoring. The project provides a low-maintenance, durable solution to maximize water use efficiency in the watershed. Project funding supported the replacement of 1,600 feet of porous gravel irrigation canal with a high-density polyethylene pipe to eliminate transmission losses and reduce the volume of water diverted from West Clear Creek at its uppermost point of diversion.

This project helps achieve both regional and local water sustainability and conservation goals. The Salt and Verde Rivers supply critical water for the Phoenix Metro area and are also some of the most important rivers for native fish in the desert southwest. This project benefits these fish populations. Additionally, implementation of this project has attracted additional investment from downstream partners and has encouraged other ditch companies and landowners to step forward to improve and modernize irrigation operations.

The project was initiated in 2018 and completed in 2019 with 1,600 feet of irrigation canal replaced with a pipeline. The restore benefit is calculated as the reduced withdrawal from West Clear Creek for irrigation due to the elimination of transmission losses.

Lower San Pedro River Agriculture

Location: Lower San Pedro River, Arizona

Implementing partner: Arizona Land and Water Trust (ALWT)

2021 restore benefit: 0 million gallons

Project Timeline:

Project initiation: 2017

Year of initial restore benefit: 2019

Anticipated benefit end date: 2028

The middle and south agricultural fields (top, with south plot shown on the bottom) were previously flood irrigated to grow cotton and wheat. They have been converted to drought-tolerant native grasses that will not require sustained irrigation.

(Photo credit: Kerry Dinsmore (top), ALWT (bottom))

The San Pedro River flows through the Sonoran Desert in Arizona for 140 miles until it reaches its confluence with the Gila River, a tributary to the Colorado River. As the last major free flowing river in the southwestern U.S., the San Pedro River provides essential stopover habitat for millions of migratory birds and other wildlife. The health of this critical ecosystem is adversely impacted by extremely low flows and intermittent dry sections of the river due primarily to ground water depletion, localized pumping, and irrigation diversion.

The objective of this project is to help sustain dry season flows, critical riparian habitat, and a healthy water table in the Lower San Pedro River by reducing the volume of irrigation water withdrawn from the aquifer. Intel supported conversion of 63 acres of agricultural fields adjacent to the Lower San Pedro River. The fields were converted to drought-tolerant native grasses that will not require sustained irrigation over the long-term. The agricultural fields were historically leased for growing cotton and wheat, two water-intensive crops that were flood irrigated from two wells located near the river.

This project directly reinforces related efforts to protect and enhance the function of the San Pedro River ecosystem and serves as an important demonstration of how innovative water conservation agreements can help sustain landscapes while protecting and restoring critical riparian habitats. Additionally, the Lower San Pedro River corridor is a highly significant stretch of the Pinal County Birding Trail, which showcases the area's best sites to find birds and other wildlife. Intel's investment in this site, to restore former wheat fields to native, perennial pasture, has enabled a diversity of pollinators and wildlife at a publicly accessible site that will serve birders and benefit local residents and businesses.

The restore benefit is calculated as the reduced consumption from the conversion from cotton and wheat to native grass, based on metered volumes pumped. There were no volumetric benefits in 2021 because the Arizona Game and Fish Department was required to use its full water right allocation to avoid any "use it or lose it" risk of forfeiture. The partner expects to resume water conservation, and this project is expected to have restoration benefit in 2022.

Lower Salt River Restoration

Location: Salt River Basin, Tonto National Forest, Arizona

Implementing partner: National Forest Foundation (NFF)

2021 restore benefit: 89.3 million gallons

Project Timeline:

Project initiation: 2018

Year of initial restore benefit: 2020

Anticipated benefit end date: None - provides a permanent/long-term benefit

Invasive species

(Photo Credit: NFF, 2018)

Tonto National Forest, located north of Phoenix, is one of the most-visited National Forests in the U.S., with approximately 5.8 million visitors annually. In 2012, invasive and noxious weed infestations covered an estimated 514,361 acres of the forest. Most of these infestations (490,450 acres) have spread beyond the U.S. Forest Service's (USFS) capability to eradicate them. These invasions threaten native plant species by direct competition, limiting natural regeneration and reducing overall biodiversity and habitat for wildlife.

This project replaced dense stands of invasive *Arundo* (20 acres) and tamarisk (20 acres) with native species. Additionally, 30 acres burned by the Cactus Fire were replanted with native upland species. In total, 70 acres of riparian habitat were restored along a section of the Salt River frequently used for swimming, floating, hiking and bird watching.

Intel Volunteer Tree Planting Event

(Photo Credit: Intel, 2021)

The project was initiated in October 2018. Forty acres were cleared and replanted, and 30 burned acres were replanted by December 2019. In February 2020, some areas were treated again to eliminate invasive species. This retreatment occurred again in 2021 and pile burning - which was complementary and part of the USFS on-going management - was also completed.

In addition to providing financial support for this project, Intel hosted a volunteer event in 2018, with 164 volunteers (including 134 Intel employees, family and friends), who collectively planted 1,200 native trees. This project also catalyzed a larger effort to restore the Lower Salt River, with three other companies supporting this effort. In 2019, 175 volunteers (including Intel employees) helped to plant 2,000 native trees, including coyote willow poles and Fremont cottonwood.

The restore benefit is calculated as the reduced evapotranspiration from replacing invasive species with native species and the reduced runoff from revegetating the area burned.

Verde Valley Irrigation Conversion

Location: Verde River Watershed, Arizona

Implementing partner: The Nature Conservancy (TNC)

2021 restore benefit: 14.4 million gallons

Project Timeline:

Project initiation: 2019

Year of initial restore benefit: 2020

Anticipated benefit end date: 2029

Drip irrigation has been implemented to improve irrigation efficiency

(Photo credit: LimnoTech)

The Verde River supports a diverse population of rare native desert fish, including the Round Tail Chub, Colorado River Pikeminnow and Razorback Sucker. The Verde River also provides irrigation and drinking water supply for farms and cities in the region, including the Phoenix metropolitan area. The streamside forest habitat supports many bird species that are dependent on water in the river for its health and sustainability, including two threatened bird species, the Southwestern Willow Flycatcher, and the Yellow-billed Cuckoo.

The project area is located near Clarkdale, Arizona, on one of the first large irrigation ditches in the Verde Valley. The primary objective of this project is to reduce water withdrawals from the river and leave more water in the Verde River by converting from water-intense flood irrigation to lower water use drip irrigation, benefiting fish, as well as the streamside forest and wildlife. The project also aims to build on other activities in this watershed, focused on increasing stream flow in these waterbodies. Another project objective is to demonstrate the viability of drip irrigation for other farms in the Verde Valley.

The restore benefit is calculated as the reduced consumption of irrigation water as a result of converting 30 acres from flood irrigation to drip irrigation. In 2021, irrigation consumption of water was reduced by 14.4 million gallons.

Groundwater Recharge in the Tucson Basin

Location: Santa Cruz Watershed, Arizona

Implementing partner: Watershed Management Group (WMG)

2021 restore benefit: 24.2 million gallons

Project Timeline:

Project initiation: 2019

Year of initial restore benefit: 2020

Anticipated benefit end date: None – provides a permanent/long-term benefit

Ponded water accumulating in a wash as a result of this project, prior to infiltrating

(Photo credit: Mark Reid, 2019)

Tucson, Arizona has a hot desert climate, receiving only an average of 12 inches of precipitation per year that replenish surface water sources. As a result of limited surface water, groundwater is an important source of water in the region. Stream flows in Tucson-area creeks and rivers have been severely depleted by groundwater pumping, erosion, and decades of poor water management and drought. This has impacted riparian vegetation, groundwater reserves for Tucson, and natural springs. Tucson's efforts to trap and store increased groundwater are linked to Arizona's ability to reduce Central Arizona Project water deliveries to Arizona without compromising economic development in Phoenix and Tucson.

The objective of this project is to increase groundwater infiltration and facilitate groundwater recharge to increase groundwater levels and improve streamflow. Working with landowners and volunteers, a variety of stone structures were placed in degraded arroyos (steep-sided gullies formed by fast-flowing water) to reduce erosion, capture, and slow runoff and facilitate increased infiltration to groundwater. Multiple structures were placed at each location, depending on the restoration needs of each site. Structures included media luna (a half-moon shaped rock dam used across a channel to slow flow) ; one-rock dams (which stabilize the bed of the channel and gradually raise the bed level over time); and Zuni bowls (rock-lined "steps" and pools that slow flowing water, helping to prevent erosion and facilitate water retention). These structures are strategically placed to address channel erosion, restore floodplain habitat, capture runoff, slow the flow of water and increase infiltration to groundwater.

The restore benefit is calculated as the increased groundwater recharge as a result of this project. The project was expanded in 2021 with increased infiltration across 16.25 acres and a 2021 restore benefit of 24.2 million gallons of water.

Eureka Ditch Piping

Location: Verde River Watershed, Arizona

Implementing partner: The Nature Conservancy (TNC)

2021 restore benefit: 124.4 million gallons

Project Timeline:

Project initiation: 2019

Year of initial restore benefit: 2020

Anticipated benefit end date: None – provides a permanent/long-term benefit

Verde River

(Photo credit: TNC, 2019)

Established in 1895, the Eureka Ditch is one of the four major ditches in the Camp Verde area that draw water from the Verde River. Settlers began construction on the ditch in 1895 to service six farms located on the former Fort Verde Military Reservation. Today the ditch system provides water to over 200 individual property owners, including areas of the Pecan Lane Rural Historic Landscape along Montezuma Castle Highway.

The eight-mile-long earthen irrigation ditch withdraws up to 15 cubic feet per second from the Verde River and serves 375 acres in the Verde Valley. From the point of diversion located at the north end of the ditch to the end of the ditch, project partners have measured over 12% per-mile losses of water through ditch seepage and evaporation, although the loss rate varies over the length of the ditch due to variations in substrate and vegetation. The objectives of this project are to enhance river flows and improve water conveyance efficiency to benefit fish and wildlife habitat.

This is being accomplished by installing a pipeline across a half-mile section of Eureka Ditch that experiences high losses. The increased instream flow on the mainstem of the river is resulting in habitat and recreation benefits during critical periods of the year. Since the ditch piping project requires less maintenance and produces more reliable and efficient water delivery to irrigators, the project is playing an important role in building resilience for local farms and supporting food security. TNC collaborated water users to more efficiently convey water to farms and reduce the amount of water diverted from the Verde River. As a result of this project, diversions from the Verde River are reduced, enhancing flows to an 8-mile section of the Verde River that includes a section that suffers from low flow. Additionally, the Salt and Verde Rivers are critical water supplies for the Phoenix Metro area and are also some of the most critical rivers for native fish in the desert southwest. This project is expected to benefit these fish populations. Furthermore, this project has catalyzed more water benefits by attracting additional investment from downstream partners and has encouraged other ditch companies and landowners to improve their operations.

The restore benefit is calculated as the reduced volume withdrawn from the Verde River. The project was initiated in 2020, and by March 2021, 2,622 feet of pipeline had been installed, with a 2021 restore benefit of 124.4 million gallons of water.

Drought Contingency Plan System Conservation

Location: Colorado River Watershed, Arizona

Implementing partner: Audubon Arizona

2021 restore benefit: 51.2 million gallons

Project Timeline:

Project initiation: 2020

Year of initial restore benefit: 2020

Anticipated benefit end date: 2030

Lake Mead

(Photo credit: OakleyOriginals, 2008)

With the Colorado River experiencing long-term drought conditions, reservoir levels in Lake Mead have reached unprecedentedly low levels in recent years. In response, representatives of the Department of the Interior, Bureau of Reclamation, all seven Colorado River Basin states, and Mexico agreed to a Drought Contingency Plan (DCP). The plan is designed to reduce risks from ongoing drought by promoting conservation, reducing demand, and stabilizing water levels in Lake Mead and Lake Powell through projects that achieve system conservation.

The Colorado River Indian Tribes (CRIT) have lands that stretch along 56 miles of the lower Colorado, with the majority of their reservation located in Arizona. The CRIT have nearly 720,000 acre-feet of water rights which by law are to be used on the reservation. Due to stipulations in the DCP, CRIT is allowed to lease water for "system conservation" benefit for this project only in 2020-2022, making the CRIT an important partner in the DCP process and efforts to shore up declining lake levels in Lake Mead. The CRIT pledged to forgo irrigation water deliveries and fallow approximately 10,000 acres of farmland, leaving 150,000 acre-feet (48,878 million gallons) in Lake Mead. These water rights are among the most senior in the lower Colorado River, and therefore have priority over other rights and are more reliable.

The objective of this project is to lease water rights from CRIT to increase the volume of water in Lake Mead in order to reduce the likelihood that shortage declarations are triggered, which would curtail water deliveries to cities, businesses and farms, of which the greatest potential near-term impacts would be felt in Arizona.

The project was initiated in 2020 and is supported by Intel and other funders. Intel's investment supported the lease of 263 million gallons of water in 2020, and an additional 249 million gallons in 2021. In total, Intel's investment supported the lease of 512 million gallons, increasing the volume of water in Lake Mead and reducing the likelihood that deeper shortage declarations are triggered. The restore benefit is calculated as the reduced withdrawal volume, with an estimated 2021 restore benefit of 51.2 million gallons of water, reflecting a 10-year benefit claim duration for the leases supported by Intel.

Wallow Fire Reforestation

Location: Salt River Watershed, Arizona

Implementing partner: National Forest Foundation (NFF)

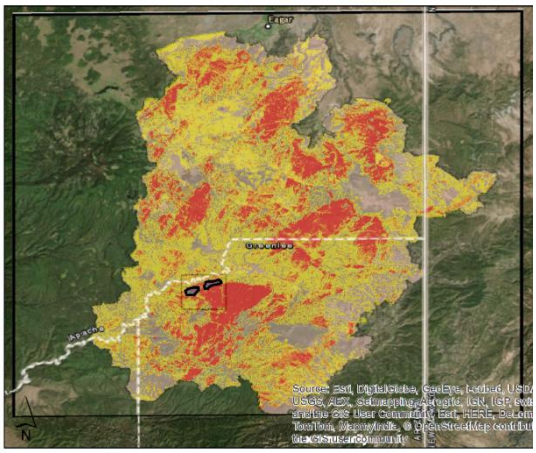
2021 restore benefit: 38 million gallons

Project Timeline:

Project initiation: 2019

Year of initial restore benefit: 2021

Anticipated benefit end date: None – provides a permanent/long-term benefit



Areas burned in the Wallow Fire at primarily moderate (orange) or high (red) intensity (top)**; Area burned by the Wallow Fire** (bottom).

(Fire intensity map: Youberg, 2015)

Forests in the southwestern U.S. have evolved in response to low and mixed severity fires that typically burned 250 acres or less. However, the severity and extent of fires has increased due to fire suppression, prolonged drought, and outbreaks of introduced and endemic pests and diseases. In 2011, the Wallow Fire burned 217,740 acres in Apache, Greenlee, and Graham Counties in Arizona and Catron County in New Mexico. An estimated 31% of the total area burned at either a high or moderate severity (Youberg, 2015).

NFF is working to restore forest cover within the burned area of the Apache-Sitgreaves National Forest by replanting native pine, fir, and spruce trees. The objective of this work is to restore an ecologically appropriate and fire-adapted forest that provides broad habitat and hydrologic benefits in the headwater forest locations. The planting prescription is 100 trees per acre planted in randomly sized clumps that mimic natural seeding patterns and reduce future wildfire risk. A total of 627 acres have been planted to date to restore a key headwater area of the forest burned by the Wallow Fire. An additional 55 acres are expected to be planted by the end of 2022, and the project is expected to cumulatively restore 41 million gallons once complete.

The restore benefit is calculated as the reduced runoff volume as a result of restoring forest cover on the burned site.

Mountain Island Ranch Agriculture

Location: Main Stem of Colorado River near Thompson, Utah

Implementing partner: Trout Unlimited (TU) - Utah

2021 restore benefit: 124.0 million gallons

Project Timeline:

Project initiation: 2017

Year of initial restore benefit: 2019

Anticipated benefit end date: None - provides a permanent/long-term benefit.

Colorado River at Mountain Island Ranch

(Photo credit: Intel, 2019)

Mountain Island Ranch holds grazing leases that support an organic cattle operation on roughly 100,000 acres of Bureau of Land Management land in Utah. The ranch is an environmental oasis in the midst of an arid landscape and is home to one of Utah's known Bald Eagle nesting sites, a heron rookery, and sensitive riparian areas that support endangered and threatened fish species. The owners of this multi-generational working ranch are committed to using resources responsibly and preserving and enhancing critical wildlife habitat.

Historically, water was diverted from the Colorado River to irrigate alfalfa and support other agricultural operations. Alfalfa is a relatively water intensive crop, and ranch owners recognized that crops with lower water demand could replace alfalfa as a food supply for cattle. Project funding supported fallowing of 39 acres and conversion of 506 acres of alfalfa to low water use pasture grasses and wetland grasses with lower water irrigation requirements. This fallowing and crop conversion reduces the volume of water diverted from the Colorado River while sustaining ranch operations and restoring wildlife habitat. Water conserved through these activities remains in the Colorado River as "system water" that helps shore up main stem Colorado River and Lake Powell water levels. This supports broad efforts across the Colorado River watershed to conserve water and help ensure that water supplies across the upper basin are adequate to meet delivery obligations downstream to Lake Mead, Arizona, and other lower basin states. From a Colorado Basin perspective, the project showcases solutions that support local ranching needs while freeing up water to help mitigate drought and support economic and community benefits for the more than 40 million people that rely on Colorado River water.

The restore benefit is calculated as the reduced consumption volume. The 2021 restore benefit is unchanged from 2020. The 39 acres that were taken out of production in 2018 remain converted to drought-tolerant grasses and not irrigated. Additionally, 421 acres of alfalfa remain converted to native perennial grasses. Eighty-five acres were replanted with sorghum to build the soil and there are plans to convert this area to native plants in the spring of 2022.

Price and Colorado River Winter Flow Restoration

Location: Colorado River Basin, Utah

Implementing partner: Trout Unlimited (TU) - Utah

2021 restore benefit: 111.4 million gallons

Project Timeline:

Project initiation: 2018

Year of initial restore benefit: 2020

Anticipated benefit end date: 2029

Scofield Dam

(Photo credit: J. Nielson, TU, 2019)

The Price River flows downstream to the Green River in Utah before joining with the Colorado River. An impoundment on a Price River tributary, Lower Fish Creek, creates Scofield Reservoir. Downstream of Scofield Reservoir, Lower Fish Creek is a Blue Ribbon Fishery. Due to drought and limited water releases from reservoirs in winter, a portion of the river has experienced chronic low flows and suboptimal winter habitat conditions for fish. The closing of the nearby Carbon Power Plant in 2015 provided an opportunity to re-water the creek downstream of the Scofield Dam outlet and generate water benefits for the Price River and Colorado River system.

Lower Fish Creek

(Photo credit: J. Nielson, TU, 2019)

Since 1956, the coal-fired Carbon Power Plant had exercised its water right for evaporative cooling, consuming the volume of water withdrawn. Following the closure of the power plant in 2015, certain water rights reverted back to ownership by the Carbon Canal Company. A portion of the Carbon Canal Company's water right became available in 2018 to benefit depleted river flows in three winter months. If this water right were not protected and designated to support river flows, it is likely that irrigators would seek to sell, transfer, use, or store the water, making it unavailable in winter months for instream flow and Colorado River system water benefits.

This project enables TU to lease the winter water right from the Carbon Canal Company for a 10-year period and assures that up to 3.5 cubic feet per second will be released from Scofield Reservoir between December and February to enhance depleted instream flows downstream of the dam. This water right was processed through the Utah State Engineers Office and provides ten years of instream winter flow benefit downstream of Scofield Reservoir. The increased volume released benefits Lower Fish Creek and Price River and increases flows in the Green River and Colorado River because there is little potential for users to divert this water in winter.

The restore benefit is calculated as the increased volume of water in creeks downstream of Scofield Reservoir to the Green River and ultimately to the Colorado River between December and February. The 2021 restore benefit is 111.4 million gallons of water.

15-Mile Reach Flow Restoration (2021 only)

Location: Colorado River, Colorado

Implementing partner: Colorado Water Trust (CWT)

2021 restore benefit: 226.3 million gallons

Project Timeline:

Project initiation: 2021

Year of initial restore benefit: 2021

Anticipated benefit end date: 2021

15-Mile Reach

(Photo credit: Colorado Water Trust, 2020)

The Upper Colorado River supports native threatened fish species such as the humpback chub and the endangered Colorado pikeminnow, which is the largest minnow in North America. During early spring and again in late summer through early fall, flows within the "15-Mile Reach" section of the Colorado River between Palisade and Grand Junction often fall so low they cannot support these species.

Although there is water available in upstream reservoirs that could be used to increase flows during critical periods, much of this water cannot be released to provide instream benefit without ensuring that it is used for a designated beneficial use. To fulfill this requirement, CWT, Grand Valley Water Users Association and Orchard Mesa Irrigation District entered into an innovative agreement to allow CWT to lease and purchase upstream water decreed for power generation and deliver it to the Grand Valley Power Plant (providing the necessary beneficial use) during times when the 15-Mile Reach is in need of additional flow for fish habitat that supports passage, rearing, and spawning. This provided an opportunity to lease and draw water from an upstream reservoir and deliver it downstream to benefit the river when flows are low. Intel's funding supported leasing in 2021.

One key, reliable source of the water for this project is from the Colorado River District and other owners of water rights in the Ruedi Reservoir. The increased flow to the 15-Mile Reach of the Colorado River complements water dedicated to the river by the U.S. Fish and Wildlife Service's Recovery Program and Historic Users Pool, a group of western Colorado water users that release water from Green Mountain Reservoir. Additionally, the dedicated water from this project remained instream for the entire 15-Mile Reach to support fish and wildlife.

The leased flows also benefit flows upstream on the Frying Pan and Roaring Fork Rivers. As a further benefit, any hydropower generated by the project creates carbon-free energy and additional revenue that can support rehabilitation of the Grand Valley Power Plant.

The restore benefit is calculated as the increased streamflow volume released in September 2021 as a result of the leasing agreement, with a one-time restore benefit of 226.3 million gallons of water.

Rio Grande Projects for Water Resource Benefit

Location: Rio Grande Watershed in Colorado and New Mexico

Implementing partner: Trout Unlimited (TU) and National Forest Foundation (NFF)

2021 restore benefit: 114.9 million gallons

Project Timeline:

Project initiation: 2018

Year of initial restore benefit: 2018

Anticipated benefit end date: 2027 for water leasing. Wetland restoration has a permanent/long-term benefit.

Conejos River downstream of Platoro Dam (fall 2019). Winter releases enhance flows in this reach of the Conejos.

(Photo credit: K. Terry, TU, 2019)

The Upper Rio Grande River extends from its headwaters in southern Colorado to Cochiti Lake in New Mexico. Its tributaries support farming, ranching, rural communities, recreation, and a renowned trout fishery. However, during winter, water retained in headwater reservoirs contributes to acute low flows and ecological impacts in downstream reaches that do not meet minimum flow requirements for fish and wildlife. Over the past few years, TU's Colorado Water Program, together with other stakeholders, has pioneered a voluntary program to increase winter flow releases from reservoirs to maximize rearing and spawning benefits for fish.

By creating new partnerships and approaches that build collaboration and trust among ranchers, water districts, agencies and non-governmental organizations, the Program has reconfigured the timing of water delivery to maximize social and environmental benefits. By providing incentives to water rights holders and paying fees that allow water to be stored and delivered at different times of year, TU and partners are able to release water at critical, low flow periods to achieve significant instream winter flow benefits for the Upper Rio Grande, while also meeting existing water delivery obligations under the Rio Grande Compact.

In addition, stream channel degradation, loss of wetlands, and floodplain disconnection in Rio Grande tributary streams have contributed to adverse ecological impacts in the basin. In the Valle Vidal Unit of Carson National Forest, past grazing, mining, and logging activities have degraded Comanche Creek, downcutting the channel and disconnecting the creek from its historic floodplain. These impacts have also reduced the groundwater table and wetland water storage and caused drying of the surrounding wetlands.

The objectives of this project are to enhance flow in Rio Grande tributaries during critical winter low-flow periods, and to raise groundwater levels in the Comanche Creek watershed to reconnect the stream to the historic floodplain and wetlands, restore hydrologic function, and provide recreation and wildlife benefits.

Two activities funded by Intel are benefitting the water resources of the Rio Grande and tributaries in New Mexico:

- TU partners with a variety of stakeholders to facilitate and incentivize water releases from reservoirs during critical winter low-flow periods. Flow releases enhance flows in up to five upper Rio Grande tributaries in any given year, including the Conejos River, Beaver Creek, South Fork Rio Grande, North Clear Creek, and the Alamosa River. Flow releases also benefit the Upper Rio Grande in Colorado and northern New Mexico over a long-term period. This work is accomplished by managing the growing partnership, structuring agreements with agencies and water districts, and paying storage fees, incentives, and management costs required to store and release water at critical times of the year to maximize downstream benefits.

Comanche Creek after restoration

(Photo Credit: T. Mitchell, TU, 2019)

- TU and NFF completed instream and floodplain restoration activities to reconnect Comanche Creek to 52.4 acres of historic floodplain. This benefits Comanche Creek by enhancing water supply for wetlands, replenishing the depleted water table, and improving late season water availability to benefit fish, wildlife, and recreation in the Upper Rio Grande basin. Intel funding of the Comanche Creek floodplain reconnection project also leverages a 3:1 match from Pittman-Robertson funds to support complementary wildlife conservation activities in the area.

The restore benefit is calculated as the sum of the increased winter flow volume in the Rio Grande tributaries (97.8 million gallons)[8] and the increased storage volume within restored floodplain and wetland habitat along Comanche Creek (17.1 million gallons). Without the project, water is retained in Colorado reservoirs with minimal winter flow released and dewatered river conditions, and Comanche Creek remains disconnected from its floodplain with a depleted water table.

The project was initiated in 2018. 2021 was the fourth year of winter flow release and the third full year of wetland restoration.

[8] From January 1 – March 31, 2021, 52.8 million gallons were released from Platoro Reservoir; From March 1-31, 44.6 million gallons were released from Beaver Creek Reservoir; and on November 2, 2021, 0.33 million gallons were released from the Rio Grande Reservoir.

Dynamic Water Management for Wildlife Program

Location: Central Valley, California

Implementing partner: The Nature Conservancy (TNC)

2021 restore benefit: 209.5 million gallons

Project Timeline:

Project initiation: 2017

Year of initial restore benefit: 2017

Anticipated benefit end date: 2028

Birds camouflaged in flooded, post-harvest rice field

(Photo credit: Intel, 2019)

The expansive wetlands of the Central Valley once provided critical habitat for migratory birds traveling the Pacific Flyway that extends from Alaska to South America. While California still supports some of the world's largest concentrations of wintering waterfowl and shorebirds, more than 90 percent of California's wetlands have been drained for development and agricultural production, and bird populations are in significant decline. Water tables are also falling due to loss of critical recharge areas and pumping that exceeds renewable supply.

To restore some of this critical wetland habitat, TNC is implementing water management projects, such as BirdReturns, to create temporary wetland habitat on agricultural lands through "dynamic conservation" projects that achieve multiple social and environmental benefits. With BirdReturns, farmers receive income to apply water in the late spring and early fall to fields before and after the growing season. The water is applied precisely at the times and locations when migratory shorebirds frequently experience the greatest deficits in available habitat based on real-time bird sighting data and extensive monitoring of past project results. In this way, the project leverages citizen science and precision conservation to provide critical habitat. In addition, it is estimated that shallow flooding provides groundwater recharge benefits on up to 25% of Sacramento Valley farm fields. TNC monitors groundwater recharge on a subset of the project parcels.

This TNC program has been underway since 2014, and Intel initially committed to supporting this work for ten years (2017-2026). In 2019, Intel again supported this project to further expand social and environmental benefits for the period 2019-2028. The restore benefit is calculated as the volume of water provided annually to the fields that creates wildlife habitat. Other important benefits include aquifer recharge, support for migratory bird populations, and farmer income, with farmers receiving incentives for flooding their fallow fields. In 2021, 209.5 million gallons of water were applied to the fields, creating 388 acres of wetland habitat.

Middle Deschutes Instream Flow Restoration

Location: Deschutes River watershed, Oregon

Implementing partner: Deschutes River Conservancy (DRC)

2021 restore benefit: 93.5 million gallons

Project Timeline:

Project initiation: 2018

Year of initial restore benefit: 2019

Anticipated benefit end date: 2028

Deschutes River at Tumalo confluence

(Photo Credit: Deschutes River Conservancy)

The Deschutes River offers miles of camping, floating, hiking, and fishing in Central Oregon. Historically, the Middle Deschutes River in Bend flowed at approximately 1,000 cubic feet per second year-round. However, since the late 1800s/early 1900s, the Middle Deschutes has been heavily impacted by water withdrawals, including some of the state's largest irrigation diversions. As a result of these diversions, summer flows in this section of the river have been severely depleted, causing higher stream temperatures, inadequate habitat to support healthy native trout populations, and a decline in overall river health. From 1960-1990, the Middle Deschutes below Bend had an average May through September flow of 52 cubic feet per second (data accessed for DEBO station at: https://www.usbr.gov/pn/hydromet/arcread.html).

Water rights in Oregon, follow the prior appropriation doctrine which gives a water right to whomever first puts the water to a beneficial use. The date of the water right is referred to as the priority date. Older, more senior water rights have priority over more recent, or junior, water rights. In 1999, the DRC created the country's first large-scale water leasing program, working collaboratively with irrigation districts and farmers to voluntarily leave their water instream for an agreed-upon period, in return for an annual payment. This program leases water rights from water rights holders and protects the water to create and sustain instream habitat and water quality benefits. By working through the State of Oregon, this program assures that water is protected instream during critical low flow periods of the year to benefit portions of the river that suffer from chronic low flow. Leasing this water through the State of Oregon ensures that the water restored to the river qualifies as a "designated beneficial use" and ensures that water rights are not subject to loss or forfeiture. These efforts have been successful in helping increase flows during the dry summer season. The Middle Deschutes River's flow now regularly exceeds 125 cubic feet per second during the summer months, expanding and improving habitat for native fish and wildlife.

Intel's funding supports the DRC's program for 10 years to lease water rights from landowners to restore and protect instream flow through the Oregon Water Resources Department's (OWRD) instream leasing program. Each year, funding supports continued lease payments to irrigators, enrollment and protection of water rights for instream benefits, and administration and monitoring of the instream leasing program. The restore benefit is calculated as the reduced withdrawal, which is equal to the volume leased and protected within the Deschutes River each year, beginning in 2019 and continuing through 2028. The actual volume of restored streamflow each year is measured by DRC and OWRD using monitoring and lease verification. In 2021, DRC confirmed that Intel funding supported leasing of 93.5 million gallons of water to restore streamflow in the Middle Deschutes River.

Bowers Rock State Park Side Channel Restoration

Location: Willamette River Basin, Oregon

Implementing partner: Calapooia Watershed Council

2021 restore benefit: 376 million gallons

Project Timeline:

Project initiation: 2018

Year of initial restore benefit: 2020

Anticipated benefit end date: None – provides a permanent/long-term benefit

Bowers Rock

(Photo credit: River Design Group, 2021)

Side channels that meander through the Willamette River floodplain are critical to ecological health and provide diverse flow, temperature, and habitat benefits for several species of concern. Restoration of flow to these off-channel habitats is identified in state, federal, and local salmon recovery plans as a priority action to support winter rearing for endangered species of fish, to attenuate floods, and to support groundwater systems that can provide temperature benefits for fish and wildlife. Over the past century, nearly half of these valuable floodplain channels on the Willamette River main stem have been eliminated to improve main channel navigation.

The objective of this project is to restore natural river flow to a side channel complex within the 568-acre Bowers Rock State Park. The area includes several former side channels and floodplain wetlands that have been cut off from Willamette River flows by past gravel mining operations and levees. Specifically, this project restored flows to the Coon Creek side channel off the Willamette River, as well as an historic gravel pit that, prior to this project, was ponded and supported primarily non-native fish species.

A connector channel through the floodplain was excavated to reconnect the perennial portion of Coon Creek and the remnant gravel pit to the main stem of the Willamette River and reestablish flow and connectivity to several other disconnected channels (River Design Group, 2018).

As a result of these activities, typical high winter flows from the Willamette are anticipated to annually connect and flow through the approximately 1.4-mile-long complex for roughly 81 additional days per year at six inches depth or greater, providing over-wintering habitat for juvenile salmon (RDG, 2018). Improved flow and hydrologic function through this system now provides a diversity of off-channel habitats for fish and wildlife, as well as access to the restored, remnant gravel pit; facilitates fish passage; and provides overwinter rearing benefits to fish.

In addition to hydrologic reconnection, the project also involved habitat improvements in the pond (the remnant gravel pit) and revegetation of portions of the floodplain forest, providing significant benefits to wildlife.

The restore benefit is calculated as the average minimum necessary increased streamflow available to support fish passage into the restored to the side channel and pond. The 2021 restore benefit is 376 million gallons of water.

Horseshoe Lake Oxbow Restoration

Location: Willamette River Basin, Oregon

Implementing partner: Greenbelt Land Trust

2021 restore benefit: 41.0 million gallons

Project Timeline:

Project initiation: 2018

Year of initial restore benefit: 2020

Anticipated benefit end date: None – provides a permanent/long-term benefit

Horseshoe Lake

(Photo credit: Greenbelt Land Trust, 2020)

Horseshoe Lake is a historic oxbow located on the east bank of the Willamette River. It is located on a floodplain that supports wetlands, prairie, and riparian forests that are permanently protected through conservation easements and managed by Greenbelt Land Trust[9]. Due to a perched culvert that blocks river flow from accessing the site, the oxbow is disconnected from the nearby Willamette River except during peak flow periods. The objective of this project is to restore flow between the Willamette River and the oxbow to provide habitat for endangered salmonids during the critical winter rearing period. Additional benefits of this project include habitat for other fish and wildlife species, flood attenuation, and restored floodplain function. The site is part of a larger matrix of priority restoration sites and is linked to several restoration initiatives funded by state and federal agencies.

This project replaced a perched culvert with a low water crossing to allow flow exchange and fish passage to the oxbow during lower river flows. As a result of this project, the volume of water in the oxbow and the frequency of inundation increased. Riparian restoration and 44 acres of tree planting were also completed to create a contiguous floodplain forest of more than 400 acres.

The restore benefit is calculated as the increased inundation volume restored to the oxbow by reconnecting the oxbow to the Willamette River. The 2021 restore benefit is 41.0 million gallons of water.

Reestablishing the oxbow connection to the Willamette River (before and after)

(Photo Credit: Greenbelt Land Trust, 2019)

[9] http://greenbeltlandtrust.org/conserving-land/horseshoe-lake/

Lower South Fork McKenzie River Floodplain Enhancement

Location: Willamette River Basin, Oregon

Implementing partner: McKenzie Watershed Council (MWC)

2021 restore benefit: 198.7 million gallons

Project Timeline:

Project initiation: 2018

Year of initial restore benefit: 2020

Anticipated benefit end date: None – provides a permanent/long-term benefit

Project area following project completion

(Photo credit: MWC, 2019)

Historically, the South Fork McKenzie River (South Fork) provided habitat for Spring Chinook Salmon, Bulltrout, Pacific Lamprey, Western Pond Turtle, and other native species. The river has been significantly altered by logging, the construction of Cougar Dam, and straightening and channelization of the lower river with levees and riprap. Additionally, the floodplain and side channel have been dewatered and disconnected from the South Fork by the addition of fill materials that raised the floodplain elevation.

The project is a multi-phased effort designed to restore the physical, chemical, and biological processes that maintain a healthy, diverse, and resilient ecosystem within the lower portion of South Fork downstream of Cougar Dam. The objective of this project is to reconnect and restore flow to the floodplain at base river flows to provide critical habitat as well as improved water quality and hydrologic function to benefit a myriad of species. This project included the removal of levee, riprap, and fill material, aggradation of incised channels, rehabilitation of the historical channel network using relic channels where they exist, addition of roughly 800 pieces of large woody material, and riparian planting and noxious weed treatment. This project also included redistribution of sediment, reconnection of the floodplain to the main stem, and a dramatic increase to the quantity and quality of available spawning and rearing habitat for endangered salmon and other species. Spawning surveys conducted soon after project completion showed a dramatic increase in the number of fish residing in the project area, including Chinook salmon redds. [10]

The restore benefit is calculated as the increased volume of water inundating the floodplain as a result of this project. The 2021 restore benefit is 198.7 million gallons of water.

[10] Female Chinook salmon build and lay their eggs in a gravel nest called a redd. Redd counts provide fisheries managers with insight about Chinook salmon spawning activity and how many females survived the journey back and were able to complete their goal of putting eggs into the stream.

Deer Creek Floodplain Restoration

Location: Willamette River Basin, Oregon

Implementing partner: McKenzie Watershed Council

2021 restore benefit: 75 million gallons

Project Timeline:

Project initiation: 2020

Year of initial restore benefit: 2020

Anticipated benefit end date: None - provides a permanent/long-term benefit

Deer Creek

(Photo credit: McKenzie Watershed Council)

Deer Creek is an 8.2-mile long tributary of the McKenzie River, within the larger Willamette River Basin. Deer Creek enters the McKenzie River roughly 15 miles upstream of the Lower South Fork McKenzie River Floodplain Enhancement Project.

Historically, Deer Creek was a braided system with abundant gravels, complex pools and multiple channels providing high quality habitat for spring Chinook salmon, bull trout, rainbow trout, cutthroat trout, Harlequin duck, beaver and other native species. The creek was altered by historical logging and stream clean-out of wood, the placement of powerlines through the middle of the valley, a significant flood in 1964 that scoured the valley, and subsequent channel straightening and channelization with levees and berms to protect surrounding roads and powerlines.

As a result of these changes, stream velocity increased significantly, flushing gravels, sediment, large wood and other organic material from the creek, reducing habitat for native fishes and increasing stream downcutting.

The objective of this project is to restore the physical, chemical and biological processes that maintain a healthy, diverse and resilient ecosystem within Deer Creek. The project, which was completed in 2020, restored 28 acres of floodplain over 0.8 miles of Deer Creek by removing floodplain berms, filling incised channels with over 16,000 cubic yards of floodplain sediment and placement of over 700 pieces of large wood to restore braided channel networks across the valley bottom.

The restore benefit is calculated as the increased volume of water inundating the valley bottom as a result of this project, with a 2021 restore benefit of 75 million gallons of water. A broad range of habitat, water quality and water availability benefits are also realized by this work.

Wapato Lake Restoration and Management

Location: Tualatin River Basin, Oregon

Implementing partner: Clean Water Institute

2021 restore benefit: 118 million gallons

Project Timeline:

Project initiation: 2018

Year of initial restore benefit: 2021

Anticipated benefit end date: None - provides a permanent/long-term benefit

Wetland plant communities

(photo credit: TNC, 2021)

Wapato Lake is a historic lake and wetland area that has been actively managed for decades using levees and pumps to drain winter runoff from the site so it can be used for farming. The lake bed area, designated as the Wapato Lake National Wildlife Refuge, is managed by the U.S. Fish and Wildlife Service. Water level management in Wapato Lake benefits wildlife by providing aquatic and wetland habitat.

The U.S. Fish and Wildlife Service management plan for the Wapato Lake area requires major pumping from the lake to be completed by May 1 of each year to prevent adverse downstream impacts on the Tualatin River, including nuisance and toxic algal growth, high stream temperatures, and low dissolved oxygen. However, aging infrastructure such as unreliable and failing pump and pipe systems currently impedes the timely pumping of excess water. Failure to evacuate excess water early in the year directly contributes to human health and water quality risks for the Tualatin River basin because the quality of retained, shallow water declines in the warm spring and summer months. By replacing Wapato Lake piping and pumping infrastructure, pumping can be properly timed to minimize adverse impacts to downstream water quality, as well as to precisely manage water levels in Wapato Lake to benefit wetland habitat for migratory bird populations.

This project supported the infrastructure improvements to ensure that Wapato Lake water levels can be reliably managed and will facilitate controlled water releases prior to May 1 to avoid water quality impairment downstream. The 2021 restore benefit of 118 million gallons is calculated as the average annual volume of water pumped in March and April, to improve the flow regime and prevent downstream water quality impacts. Without the project, Wapato Lake could not be reliably managed for water quality benefits and for maximized wetland wildlife habitat.

Nanjapura Lake Restoration

Location: Ponnaiyar Watershed, Bengaluru, India

Implementing partner: CLEAN International

2021 restore benefit: 45.3 million gallons

Project Timeline:

Project initiation: 2020

Year of initial restore benefit: 2020

Anticipated benefit end date: None - provides a permanent/long-term benefit

Nanjapura Lake after bottom dredging

(Photo credit: SayTrees)

India has the second largest population in the world and is facing water scarcity across the country. Currently, over 600 million people are under high or extreme water stress across India. If no actions are taken to remediate the water crisis, it is estimated that over 30 of India's major cities, including Bangalore, will face grave water risk by 2050.

Bengaluru, the capital of the State of Karnataka, was once known as the "city of lakes" because of the region's rich green environment and famous lakes. The lakes were used to harvest rainwater and serve as a source of water for agriculture. These lakes have begun to disappear due to rapid economic and demographic growth and urbanization. Over the last few decades, dozens of lakes in the city have vanished and many of the lakes in Bengaluru are full of sediment or completely dried up. In addition, groundwater levels have dropped significantly in Bengaluru. Restoration of Nanjapura Lake, located in south Bengaluru, is helping capture monsoon and other rains and promote groundwater recharge.

The objective of this project is to increase the capacity of the lake and improve the region's water table and biodiversity. This was achieved by desilting 16 acres of Nanjapura Lake. The sediment dredged from the lake was used to build a walking path around the lake and any additional sediment was taken to nearby government land for disposal. Trees have been planted along the walking path.

The restore benefit is calculated as increased volume captured by desilting and increasing the capacity of Nanjapura Lake. The 2021 restore benefit is 45.3 million gallons of water.

Dyavasandra Lake Restoration

Location: Ponnaiyar Watershed, Bengaluru, India

Implementing partner: CLEAN International

2021 restore benefit: 54.3 million gallons

Project Timeline:

Project initiation: 2020

Year of initial restore benefit: 2021

Anticipated benefit end date: None - provides permanent/long-term benefit

Dyavasandra Lake Before Dredging (top) and **After Dredging** (bottom)

(Photo credit: SayTrees, Sept. 2020 and Jan. 2021)

Bengaluru, the capital of the State of Karnataka, was once known as the "City of Lakes" because of the region's rich green environment and famous lakes. The lakes were used for agricultural irrigation. These lakes have begun to disappear due to rapid economic and demographic growth and urbanization. Over the last few decades, dozens of lakes in the city have vanished and many of the lakes in Bengaluru are full of sediment. In addition, groundwater levels have dropped significantly in Bengaluru.

CLEAN International and their local implementation partner, SayTrees, are working to address water scarcity through restoration of lakes, such as Dyavasandra Lake, throughout the city. Lake rejuvenation will increase the ability to capture monsoon and other rains and promote groundwater recharge.

The objective of this project was to increase the capacity of the lake and improve the region's water table and biodiversity. This was achieved by desilting 20.9 acres of Dyavasandra Lake. This lake was initially overgrown and predominantly filled with silt and vegetation.

This project rejuvenated the lake, strengthened the main bund (e.g., a raised area of land surrounding a rice field, a reservoir, etc., that is designed to keep water in), and included the planting of 1,500 trees around the lake. These activities helped alleviate morphological stressors of blocked inlets and altered lake boundaries. The sediment dredged from the lakes was used to build the bunds and a walking path around the lake. The estimated restore benefit is calculated as increased volume captured as a result of the increased storage capacity.

Agua Tica Forest Protection

Location: San Jose, Costa Rica

Implementing partner: Fundecor

2021 restore benefit: 48.5 million gallons

Project Timeline:

Project initiation: 2020

Year of initial restore benefit: 2021

Anticipated benefit end date: 2030

Protected forest

(Photo credit: Manuel Guerrero, Fundecor, October 2020)

There are rising pressures on water resources near San Jose, Costa Rica due to high population growth, poor urban planning, and changing land uses. To protect water resources in the Grande and Virilla River subwatersheds, Fundecor has led the development of Agua Tica, the first public-private water fund established in Costa Rica. A technical program has been established to promote water replenishment in a groundwater recharge area, by protecting forest from conversion to grassland, agriculture and residential development. Although land use conversion is forbidden in Costa Rica, it still occurs.

This project protects 370 acres of mature forest from degradation for a 10-year period, through establishment of agreements between Fundecor and landowners. The forest will be monitored to ensure it remains protected.

The estimated restore benefit is calculated as avoided runoff volume as a result of protecting existing forest from conversion to a more degraded condition. The 2021 restore benefit was 48.5 million gallons.

Funded Projects Not Yet Achieving Restore Benefits

In addition to the projects described in the previous section, Intel has funded eight projects that are in various stages of implementation, but not restoring water as of December 31, 2021. Restore benefits will be reported when these projects are fully completed, and benefits are being achieved. Table 3 summarizes these projects and the estimated future restore benefits.

Table 3. Estimated Future Benefits of Projects Funded by Intel

Project Location	Project Name	Implementing Partner	Project Activity	Estimated Restore Benefit Upon Project Completion (MGY)
Arizona	Lower Salt River Invasive Species Removal	National Forest Foundation	Invasive species removal	79.0
Arizona	Colorado River Connectivity Channel	Trout Unlimited	Channel reconnection	64.4
California	King Fire Reforestation	American Forests	Reforestation	145.0
New Mexico	Rito Peña Negras Restoration	National Forest Foundation	Channel reconnection	18.5
Oregon	Chicken Creek Restoration	Friends of the Tualatin National Wildlife Refuge	Tree planting and floodplain/ side channel/ wetland restoration	20.0
Texas	Travis County Floodplain Reforestation	TreeFolks	Reforestation	0.2
Malaysia	Penang Schools Water Saving Program	CLEAN International	Water efficiency	42.7
Ireland	Blanket Bog Restoration Pilot	Ireland National Parks and Wildlife Service	Bog restoration	9.0
			Total Estimated Future Restore Benefit (MGY) =	**378.8**

Project-Specific Results

The locations of eight funded projects not yet achieving restore benefits as of December 31, 2021, are shown in Figure 2, and project-specific details are described in the remainder of this section.

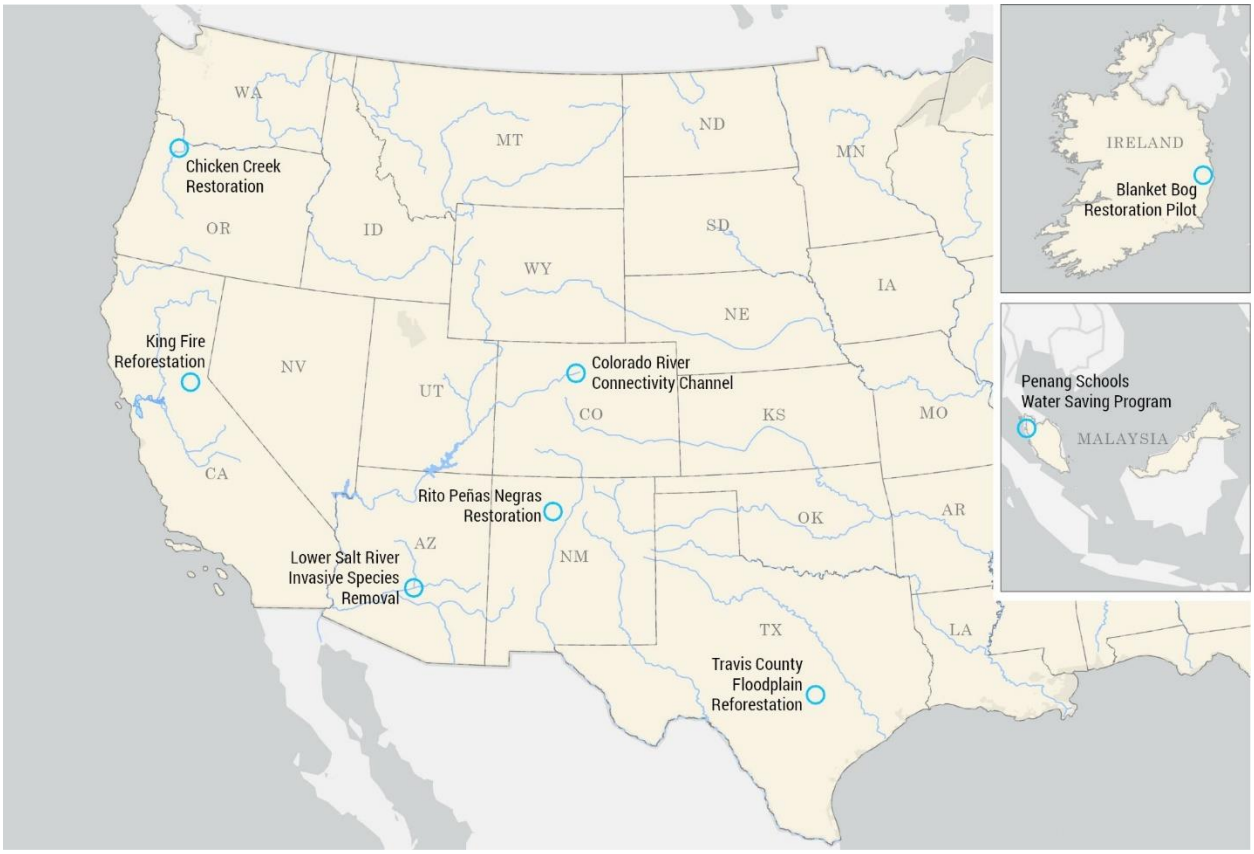


Figure 2. Locations of Funded Projects not Achieving Restore Benefits in 2021

Lower Salt River Invasive Species Removal

Location: Salt River Watershed, Arizona
Implementing partner: National Forest Foundation (NFF)
Estimated restore benefit upon completion: 79.0 million gallons per year
Project Status: Initiated in 2020; Expected completion in 2022

As mentioned in the Lower Salt River Restoration project summary, Tonto National Forest, located north of Phoenix, one of the most-visited National Forests in the U.S., is experiencing significant infestation of invasive and noxious weed species. In 2012, infestations were estimated to cover 514,361 acres of the forest. Most of these infestations (490,450 acres) have spread beyond the U.S. Forest Service's capability to eradicate. These invasions threaten native plant species by direct competition and limiting natural regeneration, reducing overall biodiversity and habitat for wildlife.

This project is removing invasive, non-native vegetation from a 70-acre area, which includes 20 acres of dense *Arundo* located in the riparian zone. *Arundo* is a non-native large grass that grows in dense stands up to 10 meters in height and thrives in riparian areas where the water table is at or near the soil surface. The *Arundo* will undergo removal and a series of three treatments to ensure it does not reestablish. In concert with these treatments, the entire project area will be treated to remove invasive species, including tamarisk, and will be replanted with native species that include willow, cottonwood, paloverde, and mesquite. These species are necessary to support ecological function at the site and create a vegetative community that can outcompete *Arundo* and prevent reestablishment. Reestablished native vegetation at the site will reduce evapotranspiration and provide critical habitat for birds, amphibians, and wildlife in vital desert riparian corridors.

Salt River (left) and Arundo Removal from a Nearby Riparian Location (right).

(Photo Credit: NFF, 2019)

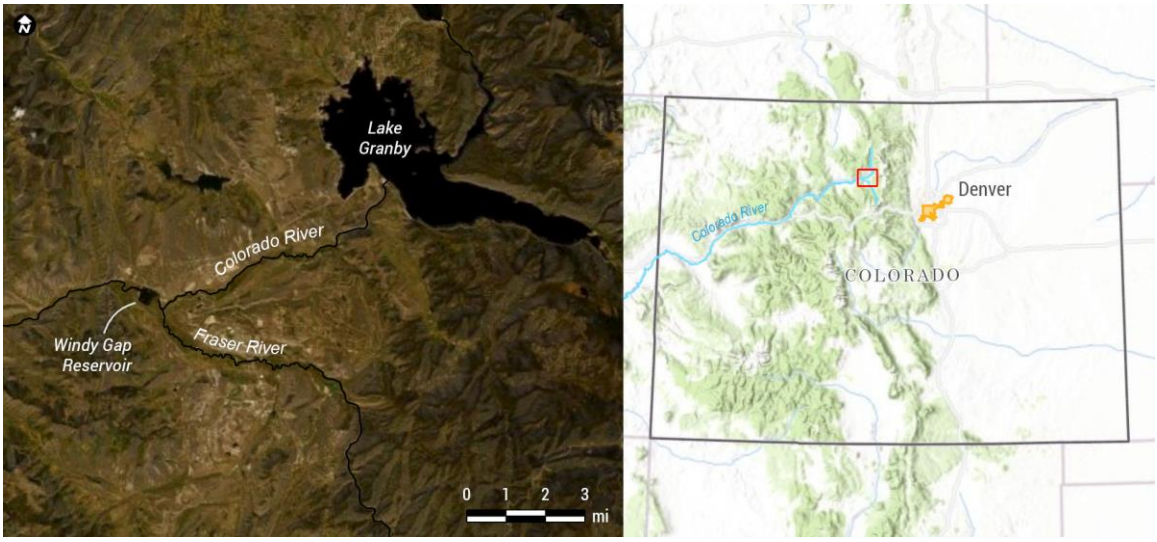
In total, 70 acres of riparian habitat will be restored along a section of the Salt River that is frequently used for swimming, floating, hiking and bird watching. The figure below shows the Salt River and another project area that is in the process of being cleared. In the photo (below, right), the river is less than 10 meters past the crew members but is not visible due to the dense *Arundo* stands.

The estimated restore benefit is calculated as the reduced evapotranspiration volume due to replacement of *Arundo* with native vegetation.

Colorado River Connectivity Channel

Location: Granby, Colorado
Implementing partner: Trout Unlimited
Estimated restore benefit upon completion: 64.4 million gallons per year
Project Status: Initiated in 2021; Expected completion in 2023

Windy Gap Reservoir is an impoundment of the Colorado River near Granby, Colorado that supplies water to the growing population on Colorado's Front Range. This reservoir and its dam were completed in 1985 and are owned and operated by the Northern Colorado Water Conservancy District. Due to its on-channel location, the dam and reservoir are a barrier to fish passage.



Project location (Map credit: LimnoTech)

The primary objective of this project is to create a flowing river channel and wetlands that reestablish connectivity between two segments of the Colorado River that are blocked by the Windy Gap Reservoir. Additional objectives are to restore the natural pulses of sediment and nutrients, improve water quality and provide fish passage, recreational access and amenities.

The estimated restore benefit is calculated as the increased instream flow in the new river channel.

King Fire Reforestation

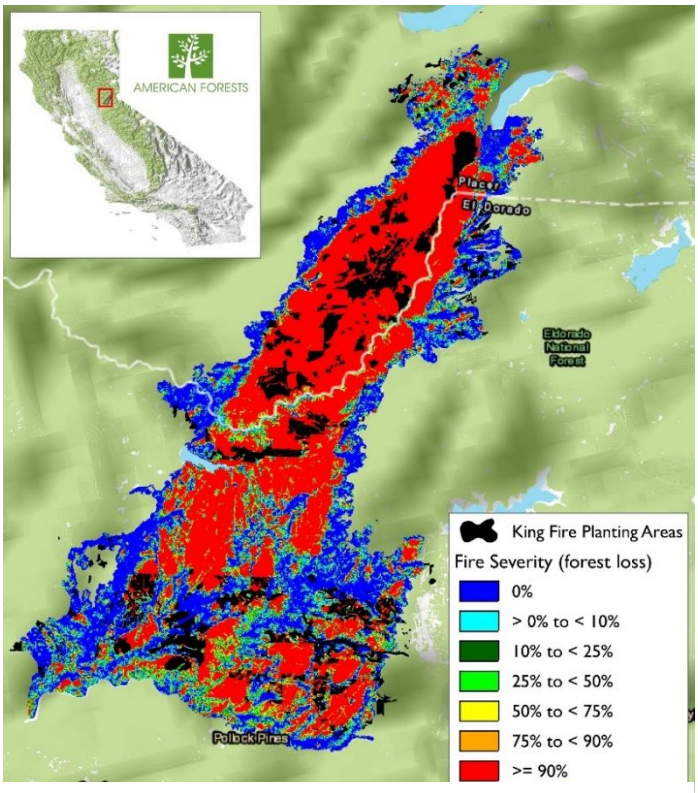
Location: American River Watershed, California
Implementing partner: American Forests
Estimated restore benefit upon completion: 145.0 million gallons per year
Project status: Initiated in 2019; Expected completion in 2022

In fall 2014, the King Fire scorched over 97,000 acres in El Dorado and Placer Counties in California within a month, including 30,000 acres within the El Dorado National Forest. Almost half of the area burned at a high severity, killing 90% of the plants and trees. A significant portion of the burned area is located within the American River watershed, which supplies water to Sacramento County as well as other water agencies and irrigation districts.

In 2016-2017, American Forests conducted the first large scale reforestation effort in partnership with the U.S. Forest Service. This work restored a mix of forest conditions that mimic natural and post-fire regeneration forest conditions to improve resilience to fire, pests and other stressors.

This project expands on the earlier effort by replanting 1,000 acres in the Middle and North Forks of the American River in Eldorado National Forest. Sites are being prepared to reduce fuel loads, and planted with a mixture of Sierra white fir, California incense-cedar, sugar cone pine, ponderosa pine, Douglas fir and giant redwood seedlings are being planted primarily in clusters to mimic natural seeding patterns and reduce future wildfire risk. The improved vegetative cover will reduce runoff and help restore the natural hydrology.

The estimated restore benefit is calculated as reduced runoff volume as a result of restoring forest on 1,000 acres of burned area.



King Fire Location, Extent and Severity

(Map credit: American Forests)

Rito Peña Negras Restoration

Location: Santa Fe National Forest, New Mexico
Implementing partner: National Forest Foundation
Estimated restore benefit upon completion: 18.5 million gallons per year
Project Status: Initiated in 2022; Expected completion in 2023

Rito Peña Negras is a headwater tributary of the Jemez River within the Upper Rio Grande Watershed on the Cuba Ranger District of the Santa Fe National Forest in New Mexico. Excessive fine sediment loads and high turbidity are found in Rito Peñas Negras, exacerbated by historic grazing practices and timber harvesting, an extensive road system, and dispersed recreation practices within the active floodplain (Santa Fe National Forest, 2005). These alterations have destabilized stream banks, widened the stream channel and reduced riparian vegetation and stream shading. The effect of these changes has increased water temperatures in the river, which is detrimental for Rio Grande Cutthroat Trout and other aquatic organisms.

Images showing examples of the planned Beaver Dam Analogs (BDAs) installed at another location. Image (left): Pooling water resulting from BDA installation, that has created wetland habitat along the San Antonio Creek; Image (right): A BDA along San Antonio Creek (photo credit: NFF, Oct. 2021)

The objective of this project is to restore Rito Peña Negras. Installation of beaver dam analogs (BDAs) is expected to decrease stream velocity, reduce channelization and sedimentation and improve coldwater habitat by reconnecting the stream with its floodplain and increasing groundwater infiltration and recharge. The BDAs may also help attract beavers back to this area after riparian vegetation has reestablished.

The Rito Peña Negras project will install 150 BDAs along three miles of stream in a very flat reach. Wherever possible BDAs will be constructed within existing exclosures (e.g., an area from which unwanted anmials are excluded) that are intact and functioning well, to prevent grazing impacts. The estimated restore benefit is calculated as the increase in groundwater recharge volume from construction of 150 BDAs.

Chicken Creek Restoration

Location: Tualatin River Basin, Oregon
Implementing partner: Friends of the Tualatin National Wildlife Refuge
Estimated restore benefit upon completion: 20.0 million gallons per year
Project Status: Initiated in 2020; Completed in 2021

Chicken Creek traverses the Tualatin River National Wildlife Refuge Complex on the Refuge's Atfalat'i Unit, prior to draining into the Tualatin River. Over 100 years ago, Chicken Creek was straightened into an agricultural ditch, allowing farmers to manage the land for crops and dairy cows, and reducing the length of the formerly meandering creek from 2.5 to 0.5 miles. This change impacted fish and wildlife habitat by impeding passage, altering hydrology, and eliminating habitat. Additionally, the higher flow velocity in the straightened channel has caused significant channel erosion, disconnecting the creek from its floodplain and depositing eroded sediment into the Tualatin River.

The Tualatin River National Wildlife Refuge Complex was established in 1992. Since then, water control structures and water delivery canals have been used to manage hydrologic function at the site. Currently, the water control structures are a barrier to aquatic organisms accessing habitat upstream of the National Wildlife Refuge Complex, and Chicken Creek remains in an altered, eroded channel which limits rearing opportunities for native species such as cutthroat trout and western brook lamprey.

Restoring the historic meandering flow of Chicken Creek (left) and placement of woody debris in restored Chicken Creek (right).

(Photo credit: B. Anderson, Friends of the Tualatin River National Wildlife Refuge Complex, 2020)

The objective of this project is to increase floodplain inundation within the National Wildlife Refuge Complex to provide stormwater and habitat benefits during the wetter winter months in the near term. This sets the stage for beaver to colonize the site and create habitat conditions that support biodiversity, improve water quality and promote water storage across an active floodplain. This project involved excavation of a new channel to restore meanders to Chicken Creek, the addition of large woody debris to the creek channel, removal of water control infrastructure and planting wetland and riparian vegetation for beaver. Additionally, the site is expected to provide habitat for Winter Steelhead and Pacific Lamprey, as well as other species in the Tualatin River that will have access to Chicken Creek after removal of a water control structure. The estimated restore benefit is calculated as the increased volume of water inundating the floodplain as a result of this project. Restore benefits are expected in 2022.

Travis County Floodplain Reforestation

Location: Colorado River Basin, Texas
Implementing partner: TreeFolks
Estimated restore benefit upon completion: 0.16 million gallons per year
Project Status: Initiated in 2020; Completed in 2021

Healthy riparian forests can improve water quality by filtering pollutants, shading streams and stabilizing streambanks. They also provide wildlife habitat and other benefits such as carbon sequestration. However, many of the historically forested riparian buffers in Travis County, Texas have been degraded due to pasture and grazing. These areas are often barren or overgrown with invasive species.

The Travis County Floodplain Reforestation Program was initiated in 2019 and is a collaborative effort between TreeFolks, the City of Austin's Watershed Protection Department, Travis County and City Forest Credits. This project provides free reforestation services, including free trees, planting services and consultations to landowner applicants. These applicants can choose to participate in the Carbon+ Credit pilot whereby carbon credits are sold to the City to help meet its 2020 carbon neutral goal. Proceeds from the sale of the carbon credits will be used by TreeFolks for program administration and future tree planting in Central Texas. For properties participating in the Carbon+ Credits program, there is a 25-year easement protecting the trees from cutting or removal.

Superior Forestry crew members sorting trees to ensure maximum diversity in planting area. (photo credit: TreeFolks, 2021)

The objective of this project is to restore healthy forest buffers in eastern Travis County floodplains, by replanting large, contiguous sites within or very near the 100-year floodplain, reducing water runnoff. Deforested areas with little-to-no canopy cover are targeted for planting. The average floodplain width planted is 50 meters or more, but varies by site. Several additional objectives include: promoting stewardship through volunteer involvement; providing education through workshops for participants focused on land stewardship, reforestation, and carbon sequestration to aid in creating a network of landowners preserving floodplains; improving water quality through riparian planting; and improving air quality through tree planting.

The estimated restore benefit is calculated as reduced runoff volume as a result of replanting four acres of degraded riparian buffers with trees. Restore benefits are expected in 2022.

Penang Schools Water Saving Program

Location: Malaysia
Implementing partner: CLEAN International
Estimated restore benefit upon completion: 42.7 million gallons per year
Project Status: Initiated in 2021; Expected completion in 2024

Malaysia is rich in history and beauty and although it has an abundance of water in terms of high annual rainfall, some states such as Penang are considered water stressed. Penang presently draws 80% of its water from Muda River, which it shares with Kedah state. The remaining supply is from the Mengkuang Dam, the Air Itam Dam and the Teluk Bahang Dam.

Water stress in Penang is due to population growth, increased development, increased agriculture and industry and low water tariffs. Sustainable infrastructure to help conserve water as well as education on the importance and value of water are crucial to making a lasting difference in reducing water stress in this region.

The objectives of the project are to conserve water and educate students and residents on the importance and value of water. This will be achieved through installation of water saving features in schools in Penang, along with development of an educational program for schools and communities.

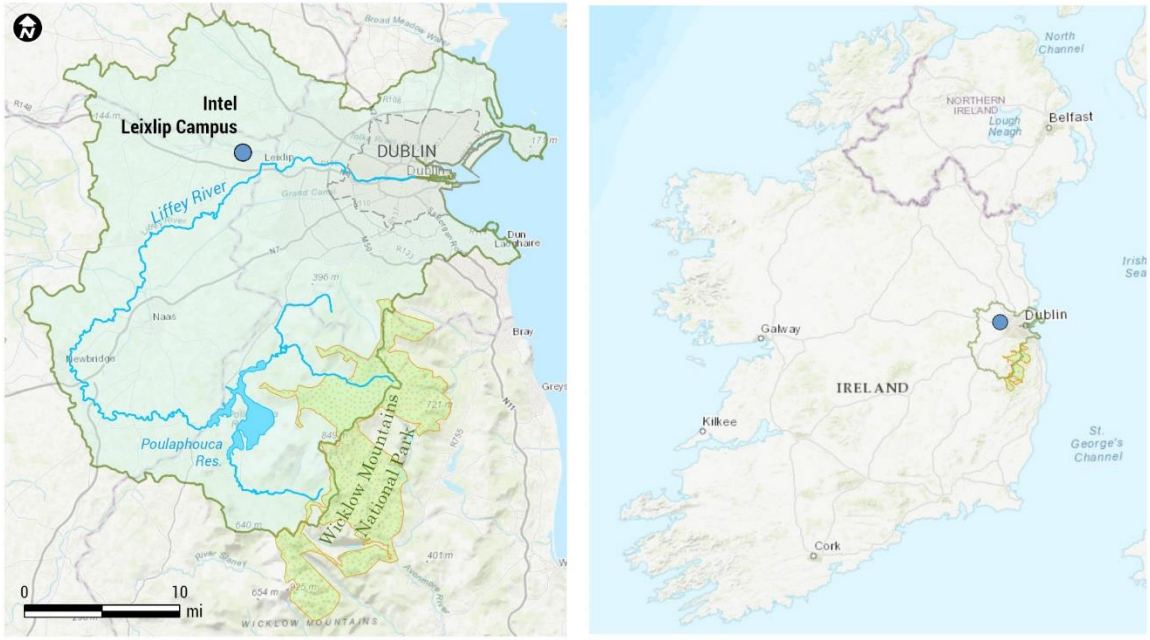
Tentative school locations for project implementation

CLEAN International will install water saving features at 100 schools in Penang and equipment will include automatic push taps on faucets and urinals throughout the schools, as well as pressure reduction washers in taps to reduce overall water use. Throughout the program, students at the schools will play a key role in the establishment of the water conservation and education program. This engagement in schools has a ripple effect as students share their knowledge with families, take action to help reduce water consumption and help incorporate their learnings into everyday life. The estimated restore benefit is calculated as the reduced withdrawal resulting from water saving feature installation.

Blanket Bog Restoration Pilot

Location: Wicklow Mountains National Park
Implementing partner: Ireland National Parks and Wildlife Service
Estimated restore benefit upon completion: 9.0 million gallons per year
Project Status: Initiated in 2021; Expected completion in 2022

Wicklow Mountains National Park (WMNP) was established in 1991 and is designated as a Special Area of Conservation and Special Protection Area under the European Union Habitats and Birds Directives, respectively. WMNP encompasses 20,000 hectares of upland habitats including blanket bog, heath, woodlands, lakes and exposed rocky habitats. The majority of the area of WMNP is covered by varying depths of peat or peaty soils. Steeper, drier slopes with thin peat tend to support upland heath vegetation; blanket bog develops in wetter areas, where peat depth is greater. Located just south of Dublin, WMNP attracts large numbers of visitors.



Location Map, highlighting the Liffey River watershed (Map credit: LimnoTech)

This project will restore 60 hectares of degraded blanket bog within the WMNP. The exact restoration approach will be determined as part of the restoration design plan but is expected to primarily involve drain blocking.

The objective of bog restoration is to enhance the water storage capacity of the bog, protect the existing carbon storage and increase the carbon sequestration potential of these peatland habitats. Improvements in water quality are also expected to occur on a longer time frame, after vegetation cover has been restored, and peat erosion and runoff is improved; however, water quality improvements are not guaranteed, and would require pre- and post-project monitoring to quantify. The estimated restore benefit is calculated as the average potential increased storage volume after bog restoration.

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