Columbia River Basin

Basin Overview

The Columbia River is the fourth largest river in North America and the largest river in the Pacific Northwest. It drains roughly 260,000 square miles and travels more than 1,240 miles from its headwaters in the Rocky Mountains to its confluence with the Pacific Ocean. The river is the lifeblood of the region, supplying water for municipal, industrial, and agricultural sectors; producing renewable, reliable, and low-cost hydropower; supporting a large recreation and tourism industry; and providing crucial habitat for fish and wildlife, including Endangered Species Act-listed salmon and steelhead.

Future Changes in Climate and Hydrology

Temperature

According to the recent River Management Joint Operating Committee's (RMJOC) RMJOC-II Climate Change Study, temperatures have risen 1.5°F (degrees Fahrenheit) since the 1970s and are projected to increase another 1 to 4°F by the 2030s. If current emission trends continue, projections indicate warming of 4 to 10°F by the 2070s.

Precipitation

The RMJOC-II Climate Change Study results suggest a trend towards increased annual precipitation into the future. The Upper Deschutes River Basin Study found that in the Upper Deschutes River subbasin, median changes in precipitation amount to an increase of approximately 5 percent by the 2060s. In terms of seasonal changes to precipitation, studies suggest that the increase in precipitation will occur primarily during the already-wet winter months, while the dry summer months are projected to become drier.

Snowpack

Rising temperatures in the basin are projected to cause an increase in the proportion of precipitation that falls as rain, rather than snow. This will result in a trend towards declining snowpack in the mountainous regions of the basin into the future.

Summary of Studies in the Columbia River Basin

- River Management Joint Operating Committee (RMJOC) RMJOC-II Climate Change Study
- Upper Deschutes River Basin Study
- Crooked River Reservoir Operations Pilot Study

Runoff

By the 2030s, the RMJOC-II Study anticipates fall and winter flows to be higher, spring peak runoff to likely occur earlier, and low summer flow periods to likely last longer.

Water Management Impacts

Several studies have evaluated the impacts from the potential changes to temperature, precipitation, snowpack, and runoff on water deliveries, hydropower, flood risk management, fish and wildlife, and the occurrence of extreme events. Below are some of the potential impacts for the basin:

- Lower summer snowmelt runoff may increase the reliance on stored water for irrigation in many parts of the basin.
- Warming temperatures, a shift to earlier runoff, and lower summer flows may reduce hydropower operational flexibility and the ability of the hydropower system to meet increasing demands.
- The increased potential for rain-on-snow events could result in more frequent large runoff events during the winter months.

Adaptation Strategies

In recent years, Reclamation collaborated with stakeholders on the completion of several investigations of climate change adaptation strategies.

Developing Better Stakeholder Relations Using Science

The Upper Deschutes River Basin Study was a collaboration between Reclamation and Deschutes Basin Board of Control with funding from the Oregon Department of Water Resources. The study brought together a wide range of stakeholders and created relationships between stakeholders that has been beneficial in subsequent studies and has led to successful discussions about solutions to complex and often competing needs.

Adapting to Changing Conditions in Real-Time

The Crooked River Reservoir Operations Pilot Study investigated a range of possible improvements to reservoir operations under five different climate change scenarios. The study developed a new dynamic rule curve that could meet flood protection requirements under the wetter 2080s climate change scenario and an additional dynamic rule curve for managing total dissolved gas concentrations downstream.

Building Resilience to Drought

Over the last 5 years, Reclamation provided funding towards three drought contingency plans in the basin through its WaterSMART Drought Response Program. These plans include the Washington State Drought Contingency Plan; Public Utility District No. 1 of Whatcom County, Washington Drought Contingency Plan; and North Santiam Watershed Drought Contingency Plan. These plans identified investigations or improvements that could begin now to improve future drought resiliency, as well as actions that can be taken during a drought to lessen the impacts.

The novel helix fish passage design developed by Reclamation's Hydraulics Lab in Denver, Colorado is being constructed at Cle Elum Dam near Yakima, Washington.

Innovations

A variety of innovative projects and research have occurred within Reclamation's Columbia-Pacific Northwest Region since the 2016 SECURE Report. An example is presented below:

Helix Fish Passage

An innovative helix fish passage design that likens the spiral ramp in a parking garage was developed through a collaborative research effort with Reclamation's Hydraulics Lab. The helix configuration emerged as the most effective design out of more than 15 computer-generated designs, while also minimizing turbidity during downstream passage, which can hurt fish. The results of this project will inform the design of other Reclamation fish passage projects of this type.

Next Steps

A need has been identified for updated and refined modeling tools to address long-term planning needs, along with real-time operational needs.

To see the full basin report and other components of the 2021 SECURE Water Act Report, please visit: https://www.usbr.gov/climate/secure