

### 3. Executive Summary

*The Problem:* In a constantly changing river, how can engineering certainty be established?

The **Sandy River Log Jams project** will help the Portland Water Bureau (PWB) water supply operations comply with the Endangered Species Act and the Clean Water Act. The project restored and enhanced stream, floodplain, and riparian habitats at two sites located within Oxbow Regional Park (Oxbow) and Dabney State Recreation Area (Dabney). To protect fish species and comply with federal law, the Portland Water Bureau (PWB) developed a Habitat Conservation Plan (HCP) to mitigate and offset impacts caused by the operation of the water supply system. This project was identified in the HCP with specific mitigation criteria.

The Sandy River originates on the slopes of Mount Hood and drains 330,000 acres. As a result, most of the channel bed and banks are composed of very fine lahar sediments from ancient volcanic eruptions. The river is confined by steep valley walls, with a combination of variable high flows and extremely erodible soils, creating dynamic river conditions. Meeting the specific mitigation criteria within the dynamic river context, posed distinct design challenges. For example, the most challenging aspects of the Oxbow part of the project were that the consistency of subsurface riverbed substrates was unknown and existing habitat features (salmon spawning beds and a perennial side channel) had to be protected and maintained. The most challenging aspects at the Dabney site included avoiding reactivating a landslide and difficult equipment access across a wetland.

*The Solution:* "Perfectly ordered disorder designed with helter-skelter magnificence." -Emily Carr

Emily Carr's quote sums up the team's solution beautifully: using perfectly ordered disorder. The solution is to design as nature would. Inherent to the solution was (1) understanding the river (a very dynamic one) could not be permanently "fixed" and the design must allow the river to maintain natural processes and natural channel change while (2) also creating certainty of project outcomes for the client and stakeholders. In turn we developed a solution that united these disparate objectives by:

1. Minimizing impacts to mature floodplain forest and engaging existing channel processes to **work with nature**. For example, the Dabney design maintained and provided fish passage to exceptional wetland habitat that was formed by the slide. Juvenile coho were found swimming in the channel shortly after construction.
2. Developing an innovative log jam design: A hybrid design combining internal ballasting with anchoring, a self-settling "box of rocks" with rootwad piles to resist scour and engage at high flows. This design was developed specifically for construction in a remote site.
3. A collaborative construction approach between designers and construction staff on site along with specialized construction techniques so that impacts were extremely limited and habitat in many areas was in place immediately following construction.

The design and construction team worked closely with our client to develop an approach that worked with nature to adapt and engage dynamic processes, and preserve and connect existing habitat while providing certainty in meeting mitigation criteria. The construction was witnessed by hundreds of river visitors and the project benefits both the visitors and fish.