

# FUNDING CULVERT REPLACEMENT

LEVERAGING FEMA TO SUPPORT SALMON, PROPERTY, AND PUBLIC SAFETY



## MODERNIZATION AND ECONOMIC BENEFITS

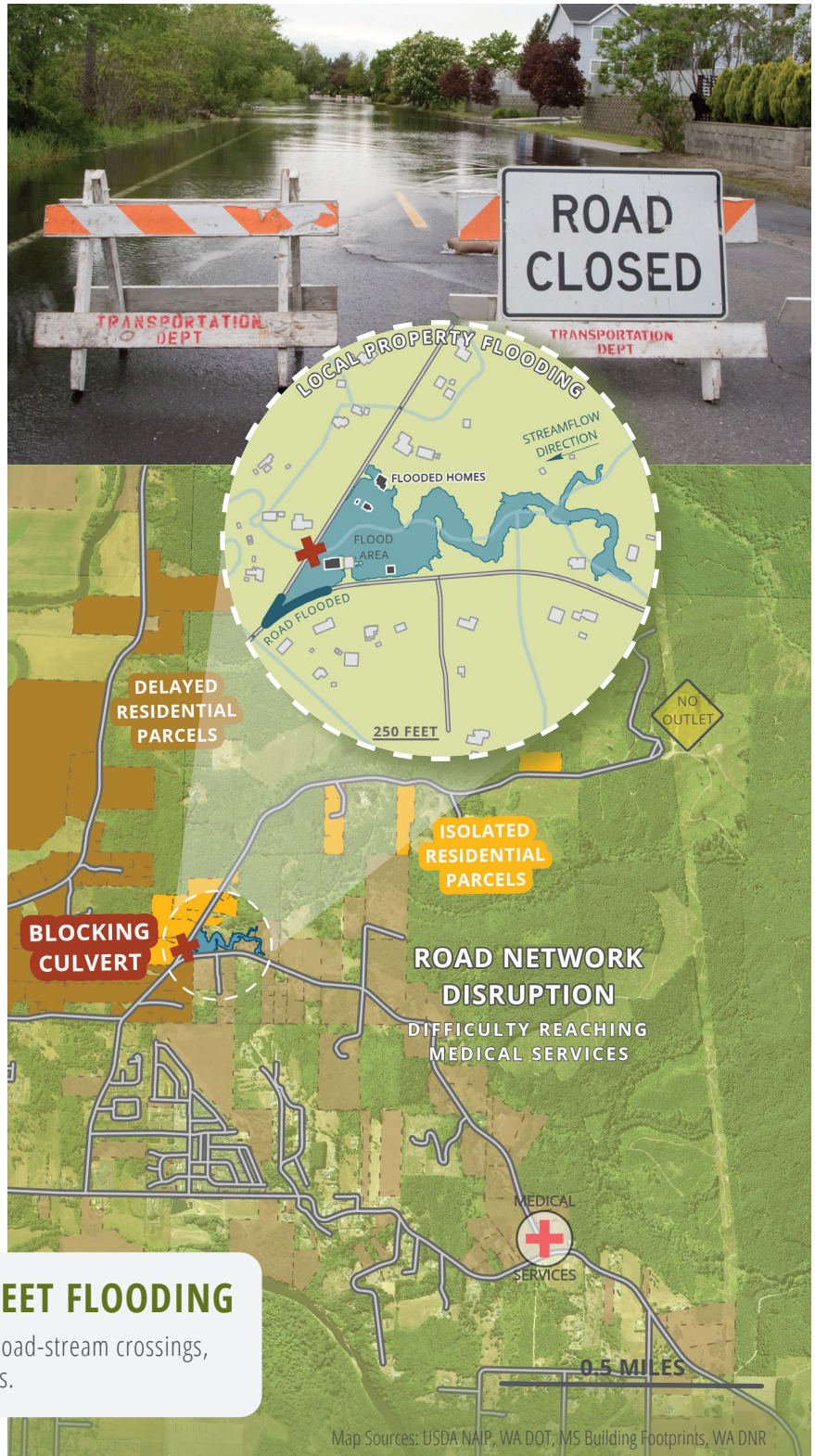
The built environment can significantly impact ecosystem services, especially where infrastructure is designed without full consideration of stream ecology and aquatic migratory species. By expanding our understanding of the value of improved stream crossings to include not only ecological costs, but also conventional risks (e.g., localized flooding, transportation disruptions), we can build a modernized transportation infrastructure that supports both human needs and larger ecological and hydrological processes. Our team has developed innovative, scalable geospatial techniques for identifying conventional risks associated with blocked and degraded stream crossings that can be applied to watersheds and regional basins where recent, high-quality geospatial data are available.

## FEMA FUNDING FOR CULVERT REPLACEMENTS

One potential source of funding for culvert replacement is FEMA's new Building Resilient Infrastructure and Communities (BRIC) program (replacing FEMA's Pre-Disaster Mitigation Grants), which will be launched in the Autumn of 2020 with expanded funding. Proposals where overall project benefits outweigh implementation and operating costs are eligible for this competitive funding pool. To help applicants develop strong culvert replacement proposals, Earth Economics has developed geospatial tools to project flood-related costs of impaired road-stream crossings in terms of both local property flooding, and road network disruptions. Localized flooding is modeled as the maximum level at which water would accumulate before overtopping adjacent roadways (which act as levees when water passage is blocked), and the estimated water depth for buildings within those flood zones. Road network disruptions are modeled based on the sections of roadways where the flooding model predicts overtopping, which may also result in washouts.

## CULVERT FAILURE CAN LEAD TO STREET FLOODING

Our geospatial tools model flood-related costs of impaired road-stream crossings, in both local property flooding and road network disruptions.



## IN THE CHELAHIS BASIN, A **BLOCKED CULVERT...**

- PREVENTS SALMON FROM ACCESSING THEIR INLAND BREEDING HABITAT
- RAISES RISKS TO PROPERTY AND PUBLIC SAFETY FROM FLOODING AND ROAD DISRUPTIONS
- MAY GENERATE DAILY COSTS FROM \$18,000 TO \$100,000
- ONE HIGH-IMPACT FAILURE COULD COST AS MUCH AS \$2.4 MILLION

## RESTORING ACCESS TO **SALMON HABITAT**

In the Pacific Northwest, salmon are keystone species of immense ecological and cultural importance, which also support large tribal, commercial, and recreational fishing industries. Correcting stream-crossing infrastructure to restore access to inland habitat is a major (albeit expensive) priority throughout the region—due to treaty obligations, the economic importance of fisheries, and the potential that declining salmonid populations could be listed under the Endangered Species Act. Because tens of thousands of culverts throughout Washington state currently block access to critical inland habitat, further progress requires both more diverse funding options and a broadening of stakeholder support.

## EARTH ECONOMICS CULVERT **STUDIES AND APPLICATIONS**

Earth Economics' study of 930 road crossings of salmon-bearing streams in the upper and lower Chehalis basins identified potential public safety and economic costs for nearly 90 percent of those crossings, averaging \$18,000 for each day a blocked culvert floods nearby structures or disrupts roadways. Such costs would be expected to increase as flooding or disruptions persist. Failure of the highest-impact crossing could result in daily flooding and road disruptions costs of up to \$2.4 million, while more than thirty culverts have estimated daily costs greater than \$100,000.

This project is part of Earth Economics' broader efforts to help local agencies apply for FEMA disaster mitigation funding. In 2018, we worked with the Venture Land trust to submit a FEMA application to acquire 2,200 acres next to a high-fire risk neighborhood in California, with the goal of actively managing that land to reduce fire risk. We are currently working with The Nature Conservancy California to assess FEMA's newest Benefit-Cost Analysis Toolkit (released in late 2019), which is designed to make it easier to submit nature-based project solutions.



Photo Credit: Wild Salmon Center, Washington Program

## ABOUT **EARTH ECONOMICS**

Established in 1998, Earth Economics is a 501(c)3 nonprofit organization based in Tacoma, Washington. As a global leader in science-based economics, we provide a range of consulting services, groundbreaking economic research, and technology innovations to help organizations, investors, tribes, policy makers, and foundations make better decisions. Through our services we are able to better take communities, nature, and economic vitality into account.

## CONTACT US FOR **MORE INFORMATION**

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