SPR RESEARCH PROGRAM
SECOND-STAGE PROPOSAL SUMMARY

PROBLEM NUMBER AND TITLE

26-24: Updating Streamflow Statistics for Central and Eastern Oregon to Reduce Flooding Risk

PROBLEM SUMMARY

Regional flood frequency equations are needed to plan, maintain, and protect critical infrastructure against flood risks across Oregon. When designing and maintaining hydraulic infrastructure in central and eastern Oregon, ODOT professionals face persistent challenges of sparse streamflow data, highly variable precipitation, diverse geologic and topographic features, and irregularities due to large water withdrawals for agriculture. While reliable streamflow statistics can be obtained for western Oregon locations using the ODOT funded USGS StreamStats tool, the current accuracy of the underlying regression equations for locations in central and eastern Oregon are much less reliable, and in some cases not available. Further, though the StreamStats tool may be helpful for some central and eastern Oregon locations, these regression equations—now more than 20 years old—may not accurately reflect present-day conditions, particularly where basins have experienced significant shifts in long-term precipitation and temperature patterns, land use, or water withdrawals. Accurate streamflow statistics are essential for sizing bridges, culverts, and roadside drainage, ensuring infrastructure longevity through variable flow conditions and extreme weather events.

ODOT OBJECTIVES

The objective of this research is to update Oregon streamflow statistics and the heavily used StreamStats tool so that this tool can be relied upon for ODOT hydraulic design in central and eastern Oregon. This update process will employ new machine-learning and refined statistical approaches, together with more expansive data from states that share central and eastern Oregon's hydraulic and hydrologic characteristics. Specifically, this research aims to: 1) enhance design accuracy, 2) support infrastructure longevity under future conditions, 3) optimize resource allocation, 4) improve planning and reduce maintenance, and 5) facilitate regulatory compliance and environmental stewardship with effective fish passage design and habitat protection.

BENEFITS

This research will enable ODOT to more reliably design, maintain, and assess design performance of ODOT hydraulic infrastructure in more rural central and eastern Oregon which routinely experiences high intensity flooding events and flooding post-wildfire. A statewide, updated, automated, widely-used, and accessible tool incorporating newer data and modern predictive methods will substantially improve design flow estimates, improving both design safety and functionality during highly variable flow conditions. Further, accurate streamflow predictions may assist with ensuring cost-effective yet safe designs or identify underperforming infrastructure for future planned and prioritized countermeasures, enabling better decisions for resource allocation, risk mitigation, and environmental stewardship across the diverse landscapes of Oregon.

SCHEDULE, BUDGET AND AGENCY SUPPORT

Estimated Project Length: 30 months.
Estimated Project Budget: $275,000
ODOT Support: Paul Wirfs (State Hydraulic Engineer)

FOR MORE INFORMATION

For additional detail, please see the complete STAGE 2 RESEARCH PROBLEM STATEMENT online at:
https://www.oregon.gov/odot/Programs/ResearchDocuments/26-24

SPR RESEARCH PROGRAM
SECOND-STAGE PROBLEM STATEMENT
FY 2026

PROBLEM NUMBER AND TITLE

<u>26-24:</u> Updating Streamflow Statistics for Central and Eastern Oregon to Reduce Flooding Risk

RESEARCH PROBLEM STATEMENT

Regional flood frequency equations are needed to plan, maintain, and protect critical infrastructure against flood risks across Oregon. When designing and maintaining hydraulic infrastructure in central and eastern Oregon, ODOT professionals face persistent challenges of sparse streamflow data, highly variable precipitation, diverse geologic and topographic features, and irregularities due to large seasonal water withdrawals for agriculture [(1)]. While reliable streamflow statistics can be obtained for western Oregon locations using the ODOT funded USGS StreamStats tool (Figure 1), the current accuracy of the regression equations for locations in central and eastern Oregon are much less reliable, and in some cases not available. When StreamStats cannot delineate a basin for a chosen site, designers lose the benefit of the fast, automated approach that normally yields watershed characteristics on-demand, often resulting in the need for manual analysis to define the drainage area and compute the corresponding design flow. Manual processes can often be more labor-intensive, less cost-effective, variable between practitioners, and error-prone [(2)].

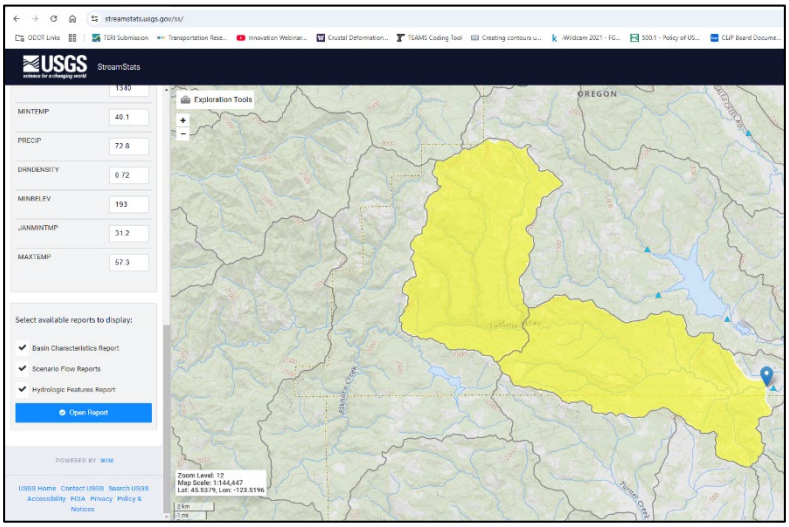

Figure 1: Example automated, user-friendly StreamStats run delineating basin on Tualatin River. Clicking on the Blue button on the left provides report with a variety of parameters including basin characteristics, peak-flow and low-flow statistics, etc.

Further, though the StreamStats tool may be helpful for some central and eastern Oregon locations, the underlying regression equations—now more than 20 years old—may not accurately reflect present-day conditions, particularly where basins have experienced significant shifts in long-term precipitation and temperature patterns, population change, land use, or water withdrawals.

With regards to anticipated potential future conditions in central and eastern Oregon, shifting precipitation patterns and warmer conditions present greater flood hazards for highways, bridges, and culverts. Increased rainfall instead of snowfall in winter can

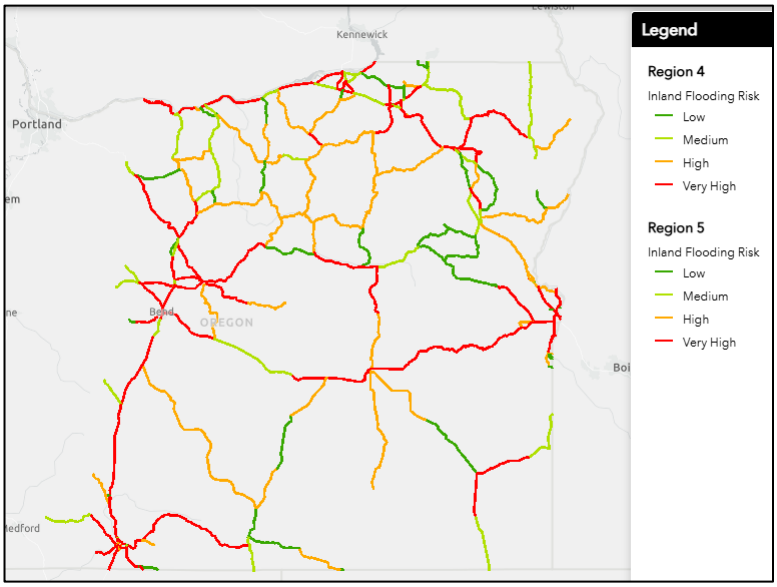

Figure 2: Inland flooding risk for central and eastern OR (Regions 4 and 5). Red indicates very high, Orange High.

cause runoff to peak earlier in the year, raising the potential for mid-winter flooding (Figure 2) [3-5]. High intensity storms bring short duration, high volume flows that may further strain infrastructure, further strain maintenance crews, negatively impact the economic vitality of communities, disrupt travel, and present additional safety hazards for the traveling public, especially during evacuation events. These extreme weather events are expected to increase in severity and frequency into the future. ODOT recently assessed high water and flood related delays (2013-2021) for the state including central and eastern Oregon (Figure 3) to highlight high-impact delay locations. The results depict the large number of multi-day travel disruption associated with high water and flood events already occurring in typically arid regions of the state. Ameliorating this flooding impact to highway infrastructure through design with accurate streamflow statistics is essential for sizing bridges, culverts, and roadside drainage, ensuring infrastructure longevity through variable flow conditions and extreme weather events.

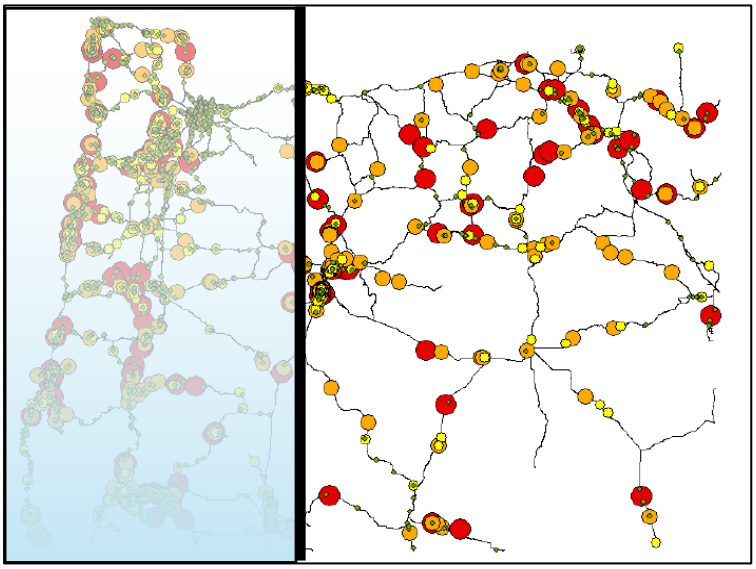

Figure 3: High water & flood related delays, focus on central and eastern OR. Red highest delay (25-36 hours)

RESEARCH OBJECTIVES

The objective of this research is to update Oregon streamflow statistics and the heavily used StreamStats tool so that this tool can be relied upon for ODOT hydraulic design in central and eastern Oregon. This effort will also update western Oregon if needed. The update process will employ new machine-learning and refined statistical approaches, together with more expansive data from states that share central and eastern Oregon's hydraulic and hydrologic characteristics. Specifically, this research aims to: 1) enhance design accuracy, 2) support infrastructure longevity under future conditions, 3) optimize resource allocation, 4) improve planning and reduce maintenance, and 5) facilitate regulatory compliance and environmental stewardship with effective fish passage design and habitat protection.

WORK TASKS, COST ESTIMATE AND DURATION

Task 1: Technical Advisory Committee formation. In addition to the ODOT Hydraulic Engineering representatives, the TAC may include a Nevada StreamStats USGS representative as Nevada very recently updated their statewide StreamStats tool. collaborative is envisioned for this research work as well as an academic representative.

Task 2: Catalog of data compilation, QA/QC of data, and outlier assessment. All peak streamflow data from the USGS, OWRD, and neighboring states with similar characteristics to central and eastern Oregon (California, Idaho, Nevada, and Washington), cataloged with explanatory variables.

Task 3: Evaluate finalized dataset from Task 2 trends such as non-stationarity.

Task 4: Evaluate regional skew coefficient to ensure the latest streamflow measurements and statistical techniques are factored in for more accurate flood-frequency calculations.

Task 5: Define flood regions and update statewide if needed, potentially incorporating Machine Learning approach.

Task 6: Develop regional regression equations and calculate statistics for several annual exceedance probabilities.

Task 7: Communication and Final Deliverables. Workshop will be developed and delivered. Dataset and USGS Scientific Investigations Report (SIR) will be delivered including methodology, equations, and statistics.

StreamStats tool for Oregon will also be updated.

Key Deliverables: *Workshop for updated StreamStats tool, updated peak annual streamflow dataset and regional regression equations, SIR.*
Estimated Project Length: 30 months.
Estimated Project Budget: $275,000

IMPLEMENTATION

Updated StreamStats tool will be accessible for use during hydraulic design when needed as indicated in ODOT's Hydraulic Design Manual (HDM, Section 6.3.1). The Research Coordinator will facilitate a project Workshop for roll-out of the updated StreamStats tool as well as advocate for editorial update of HDM section 6.3.1.

POTENTIAL BENEFITS

This research will enable ODOT to more reliably design, maintain, and assess design performance of ODOT hydraulic infrastructure in more rural central and eastern Oregon which routinely experiences high intensity flooding events and flooding post-wildfire. This effort will also include an update to western Oregon if needed. A state-wide updated tool incorporating newer data and modern predictive methods will substantially improve flow estimates, improving both design safety and functionality during highly variable flow conditions. Further, accurate streamflow predictions may assist with ensuring cost-effective yet safe designs or identify underperforming infrastructure for future planned and prioritized countermeasures, enabling better decisions for resource allocation, risk mitigation, and environmental stewardship across the diverse landscapes of Oregon.

PEOPLE

ODOT champion(s): Paul Wirfs (State Hydraulic Engineer)

Problem Statement Contributors: Kira Glover-Cutter (in consultation with Stage 1 submitter, USGS)

REFERENCES

1) Risley, J., Stonewall, A., & Haluska, T. (2008).
2) Ries, K. G., & Atkins, J. B. (2007).
3) Dalton, M. (2020).
4) https://geo.maps.arcgis.com/apps/webappviewer/index.html?id=bf44dcc302574212b535e1ac22497e5a
5) Fleishman, E., editor. 2025.

STAFF REVIEW PAGE

LITERATURE CHECK

TRID&RIP

☐ X A review of TRID & RIP databases found no existing research that answers the research question

ODOT DECISION LENSES

Climate: The proposed research will provide more updated regional flood frequency estimations that have been lacking for central and eastern Oregon which will assist in design of high-longevity infrastructure that can better withstand future precipitation, flooding, and high-water events. Correctly designed hydraulic infrastructure supports fish passage even under these anticipated future conditions.

Equity: This research will provide economically disadvantaged rural communities and eastern and central Oregon tribal partners an updated USGS tool for estimating design flow to ensure design of more reliable infrastructure and assured emergency planning along safe routes.

Safety: Correctly designed hydraulic infrastructure that can withstand current and future flooding scenarios provides safety for the travelling public and ensures public investment in safety. If successful, this research will improve hydraulic engineering design for the traditionally underserved geographic areas of central and eastern Oregon and thus improve safety for these rural and tribal partner communities. Correctly designed hydraulic infrastructure also helps ensure healthy and livable communities under the community value of environmental stewardship through viable fish passage design and habitat protection.

TECHNOLOGY & DATA ASSESSMENT

☐ XNo Identified T&D output

☐ At the end of this project, the implementing unit(s) within ODOT will need to coordinate the adoption of new technology or data in order to realize the full potential of this research.

CROSS-AGENCY IMPACTS

- List ODOT partners or impacted units. ODOT Hydraulic Engineering Section