CASE STUDY

ENHANCING FLOOD RESILIENCE AND WATER QUALITY IN THE ALA WAI WATERSHED

Client: Hawaii Green Growth & The National Wildlife Foundation

Challenge

The Ala Wai Watershed, Honolulu's most densely populated drainage area, faces significant flood and water quality challenges due to urbanization, increasing storm events, and rising sea levels. These risks threaten infrastructure, public safety, and natural habitats, disproportionately impacting vulnerable communities.

Solution

Mērak Labs worked with 3Rwater to apply advanced stormwater analysis and identify priority areas for green stormwater infrastructure (GSI) retrofits, integrating flood risk, water quality concerns, and socioeconomic factors.
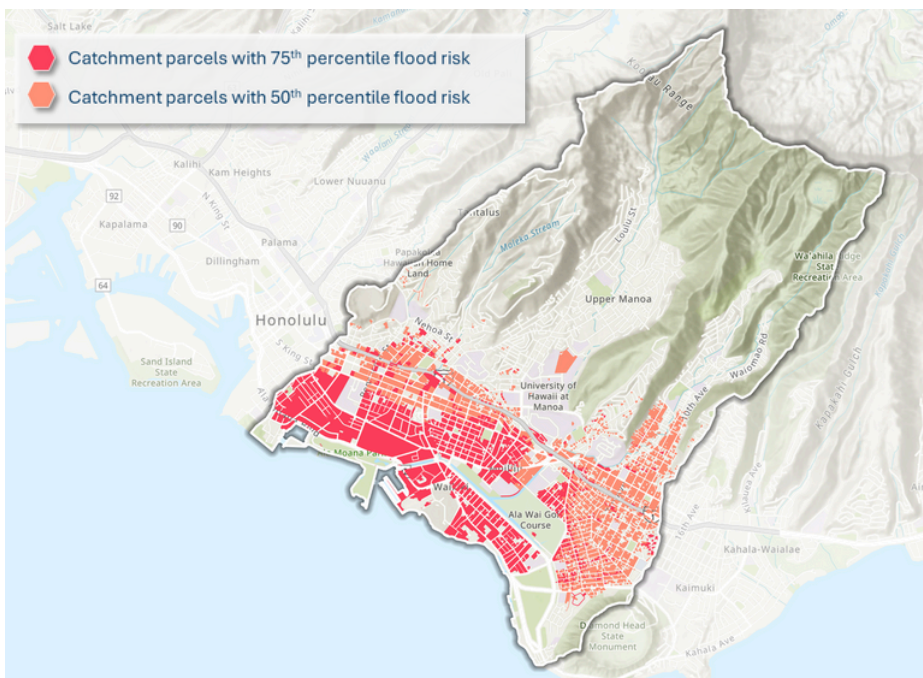

Figure 1. GSI catchment areas were evaluated based on flood risk, rainfall (25-50 inches/year), and impervious cover (>75%). High-risk parcels were further designated within the top 50th and 75th percentiles of overall risk.

Key Challenges

• Flood Risk: Increased storm intensity and sea level rise exacerbate flooding, particularly in highly developed areas with limited permeability.

• Water Quality: High levels of nitrogen (N), phosphorus (P), and total suspended solids (TSS) degrade water quality, contributing to ecosystem decline.

• Urbanization: Impervious surfaces accelerate runoff, reducing natural infiltration and increasing pollutant loads.

• Equity Considerations: Vulnerable communities within the watershed are disproportionately affected by flood and water quality risks, requiring targeted solutions.

Mērak Labs

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Follow the Drop

Our results pinpoint priority areas where GSI could have the most impact. The City and County of Honolulu has made 3Rwater's Follow the Drop app publicly available where local nonprofits are supporting community engagement, especially in these targeted areas.

The Follow the Drop app identifies and sizes green stormwater infrastructure specific to the property and collects valuable metrics including near-real time stormwater capture data. The data collected also supports a trial GSI incentive program.
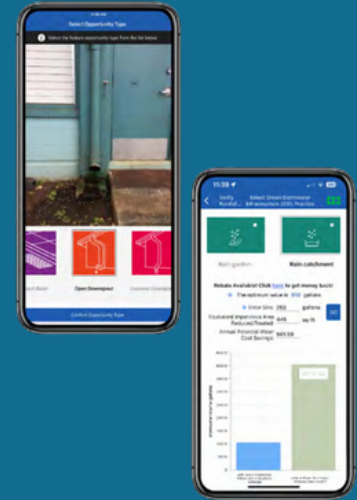
Approach

This project leveraged data-driven methodologies to identify priority areas for intervention, using:

The Simple Method: Estimated nitrogen, phosphorus, and TSS loads per parcel for a 1-inch storm event.

Flood Risk Analysis: Highlighted high-risk parcels using sea level rise projections and parcel-specific characteristics, such as imperviousness, slope, and tree canopy coverage.

Socioeconomic Integration: Applied ALICE data and the CDC's Social Vulnerability Index to ensure equitable prioritization.

Catchment vs. Recharge Strategies: Differentiated clustered high-risk catchment parcels from dispersed recharge areas to optimize GSI implementation.
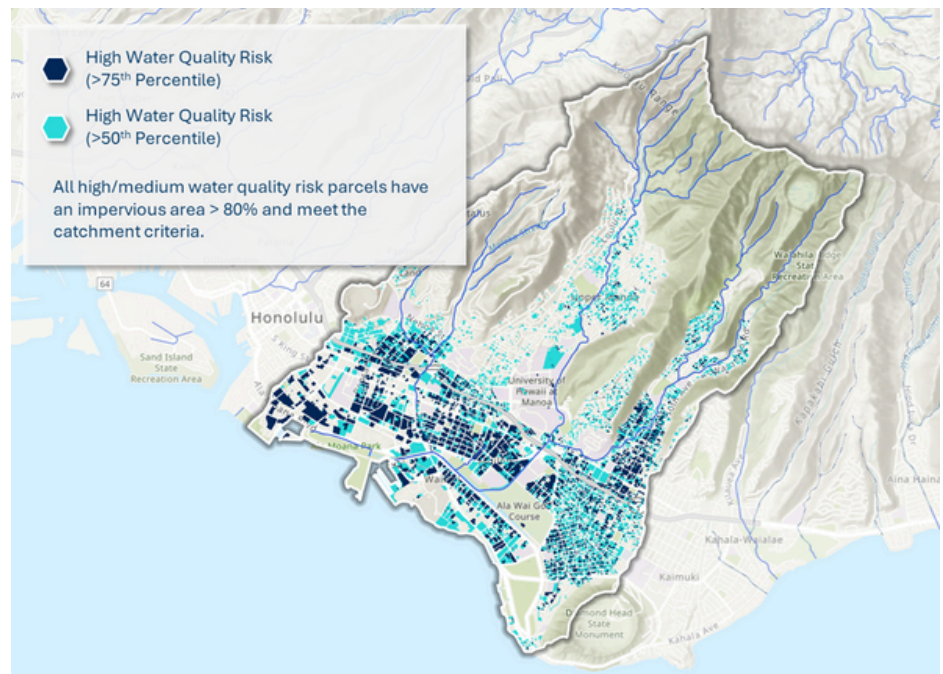

Figure 2: GSI catchment areas were evaluated based on flood risk, rainfall (25-50 inches/year), and impervious cover (>75%). High water quality risk parcels were further designated within the top 50th and 75th percentiles of overall risk.

Findings & Insights

High-Priority Parcels

724 commercial properties and 4,057 residential properties were identified as high water quality risk areas.

Similarly, 1,048 acres, or 3,500 parcels were flagged as high-risk flood areas. Many of these parcels overlapped and were identified for high-impact interventions.

Pollutant Hotspots

Maps of nitrogen, phosphorus, and TSS loading per parcel highlighted areas where runoff contributes the most significant pollutant loads.

Public & Private Collaboration

Findings support the need for a stormwater utility model that enables public-private partnerships for retrofits.
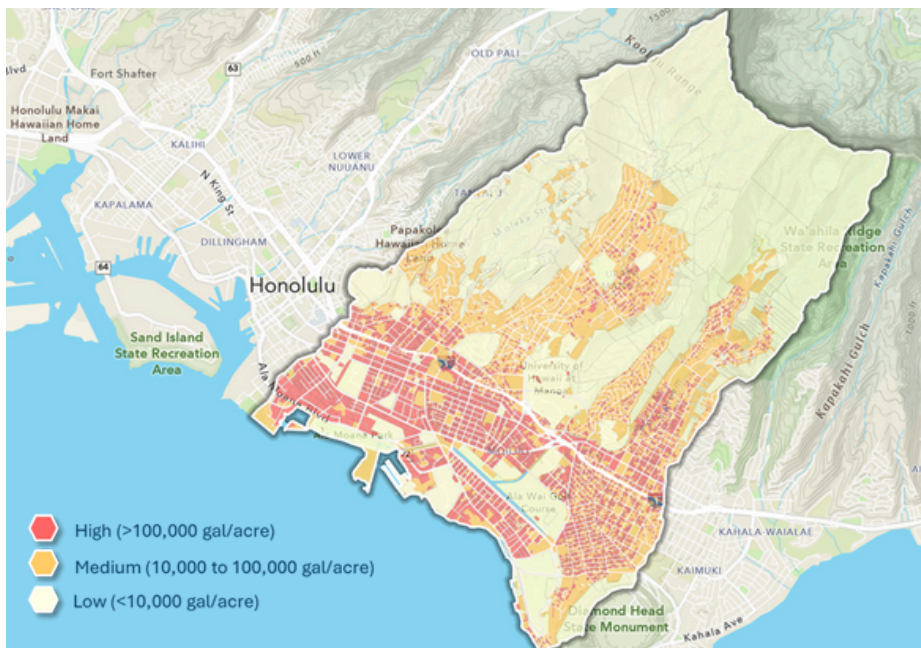
Proposed Solutions

Legend:
- High (>100,000 gal/acre)
- Medium (10,000 to 100,000 gal/acre)
- Low (<10,000 gal/acre)

Figure 3: *Total runoff generated per acre during a 1-inch storm event provides a consistent baseline for comparison in areas with variable rainfall, highlighting potential volumes for capture, reuse, or recharge opportunities.*

• **Green Stormwater Infrastructure (GSI):** Implementation of rain gardens, bioswales, and permeable pavement to reduce runoff and improve infiltration.

• **Stormwater Utility Development:** Expanding a program to support private property retrofits through public-private collaboration.

• **Policy & Community Engagement:** Enhancing outreach using 3Rwater's "Follow the Drop" app to engage property owners and stakeholders in stormwater solutions.

Next Steps

Future steps include:

• **Pilot Projects**: Target high-impact sites for GSI retrofits based on identified priorities.

• **Funding Strategies**: Explore incentives and grant programs to support stormwater management efforts.

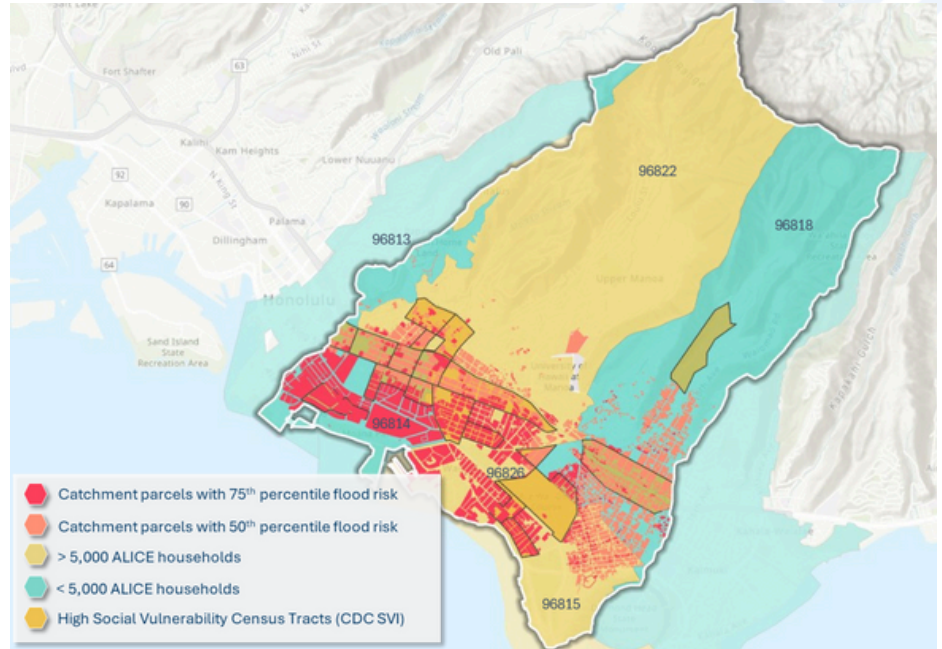• **Scalability**: Apply lessons learned to other urban watersheds facing similar challenges.

Figure 4: Combining ALICE data (based on zip codes) with parcels and CDC's Social Vulnerability Index (SVI) data (based on census tracts) identified as high flood risk and meeting catchment criteria highlights areas most likely to benefit from targeted interventions.

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