From the Bottom Up: Groundwater Engineering and Citizen Collaboration for Stormwater Solutions in Falls City, OR

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Groundwater Flooding In Falls City

Neighborhoods in south Falls City, OR battle heavy stormwater discharge during wet Coast Range winters. Most mitigation efforts have focused on individual surface runoff diversions leading to disagreements between upstream and downstream landowners. This study aims to investigate the contribution of groundwater to the surface flooding in south Falls City and to determine the feasibility of various dewatering schemes to mitigate stormwater flooding.

RESEARCH QUESTIONS:

1.) Is groundwater a primary driver of surface flooding in high precipitation alluvial basins?

2.) What combination of engineering solutions for flood mitigation is most feasible for small rural communities?

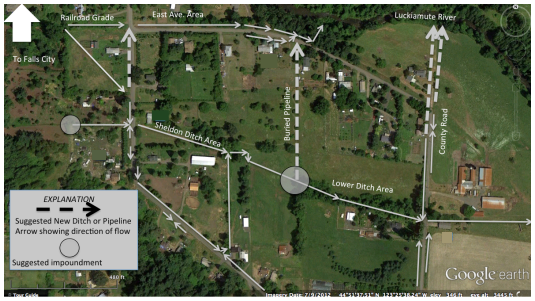

Figure 1. South Falls City Flooding Situation Location Map. *This map was produced by Falls City residents during Community Watershed Forum Meetings and refined later by Professor Todd Jarvis. The Figure features potential solutions generated by Falls City residents in Meetings.*

Groundwater Flooding

- Occurs when water table intersects ground surface.
- Long seasonal onset as water table rises from dry to wet season.
- Often accompanies and exacerbates surface/fluvial flooding.
- Longer subsidence time than surface flooding.
- Recently recognized as source of surface ponding in many locations:
  - Lincoln, ND, Denver, CO, Twin Cities, MN, Alberta, Canada, Karst regions of UK

Methods

- Geologic characterization of setting: mapping, geotechnical boring, seismic refraction survey.
- Characterization of hydraulic properties of subsurface: pump and slug testing.
- Gathering local knowledge about watershed change and hydrology.
- Conduct interviews with landowners in south Falls City to characterize flooding variation across flooding zone.

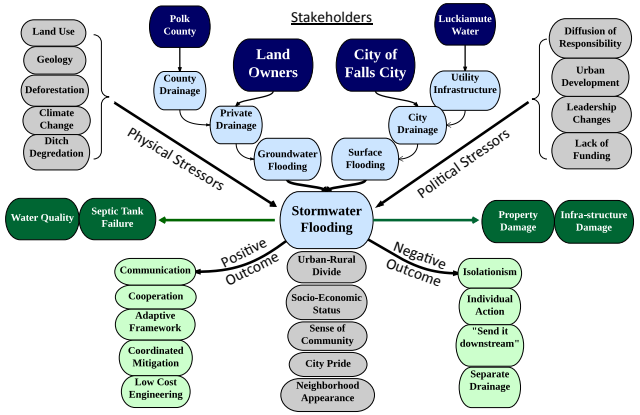

Figure 2. Conflict Map of Falls City Stormwater Dispute. Outlines stakeholders, infrastructure, influences (physical, political, and interpersonal), results, and actions.

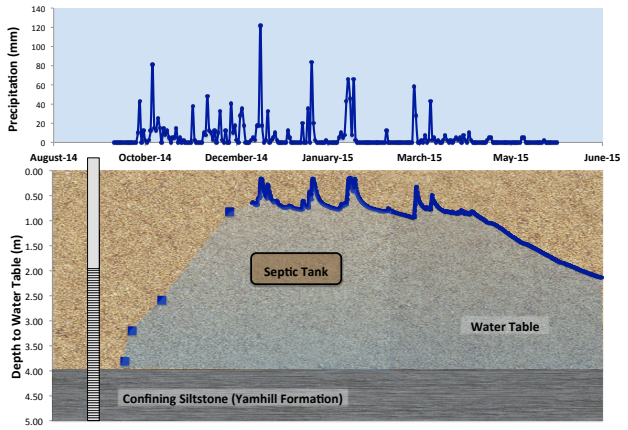

Figure 3. Seasonal Water Table Fluctuation. Precipitation recorded at NOAA gage #352800 in Falls City, OR. Water table measurements recorded at monitoring well (Fig 1.) with a hand operated well sounder until pressure transducers were installed on 12/15/2014..

Community Collaboration

In addition to aquifer characterization and mitigation evaluation, this study also aims to facilitate collaboration between stakeholders. Historically, landowners have constructed simple drainage measures individually without consulting neighbors, which increases discharge to downstream stakeholders. Beginning in 2013, IWW has sponsored Community Watershed Forum meetings that bring stakeholders together to explore solutions. This study's dewatering analysis will aim to supplement stakeholder generated solutions in future meetings to arrive at consensus on a mitigation plan. Lastly, the study aims to put in place an adaptive framework for stakeholders to maneuver through future disputes.

Dewatering Methods

Footprint and Maintenance ↑ / Expense ↓	Proposed Solution	Pros	Cons	Estimated Cost
	Ditch Maintenance	Low Cost, Cooperative, Uses Existing Infrastructure	Shallow Dewatering Potential, Frequent Maintenance	$0 to $500
	Reforestation	Neighborhood Aesthetics, Retards Flooding	Long Lead Time, Finite Dewatering Potential	Local: $50 to $500; Basin: $1,000 to $5,000
	Ditch Excavation	High Drainage Potential, Large Capture Area	Deep Ditch Required, Sediment Discharge, Frequent Maintenance	1 ft depth: $1,500; 3 ft depth: $10,000 to $25,000
	Drain Tiles	High Drainage Potential, Limited Surface Disruption	Many Lines Needed, Excavation Installation, Limited by Topography	$2,500 to $10,000 per parcel
	Dewatering Wells	Small Surface Footprint, Deepest Dewatering Potential	Requires Power, Vulnerable to Mechanical Failure, Many Wells Required	$10,000 per well

Next Steps

- Seismic refraction to determine depth of alluvium for entire flooding zone.
- Measurement of volumetric flow in ditches at various groundwater levels.
- Infiltration data from region's septic tanks to evaluate subsurface heterogeneity.
- Tracer test to evaluate connectivity of subsurface to ditches.
- LiDAR data to determine possible drainage diversion and paleo-river channels.
- Pre-engineering, modeling and pricing of proposed mitigation measures.
- Continue sponsoring stakeholder meetings to coordinate solutions.

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