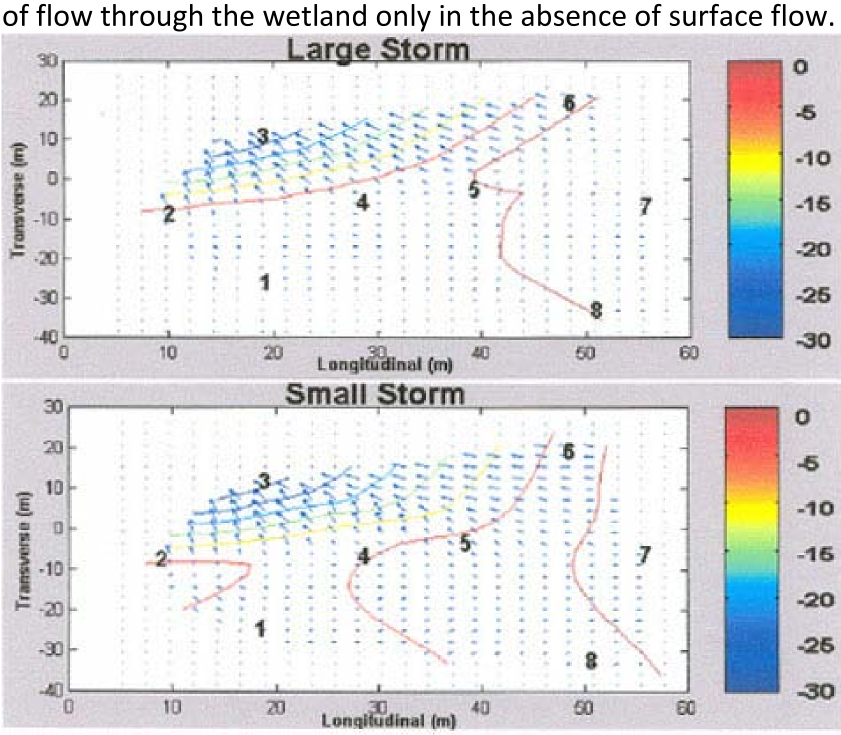
WASHINGTON STATE DEPARTMENT OF
Natural Resources
Peter Goldmark - Commissioner of Public Lands

State Trust Lands Habitat Conservation Plan

HYDROLOGY OF SMALL WETLANDS

Small wetlands form a significant portion of headwater channels where the topography is influenced by previous mass wasting and sediment deposition. This project sought to determine the need for wetland protection by indirectly estimating the hydrologic effects of forest harvesting and the resulting rise in the water table level for a small forested wetland in western Washington fed by several headwater streams. Differences between large and small storm wetland response will provide insight into what may happen after clear cutting of the basin feeding this wetland.

Hourly precipitation and water level changes were recorded from eight wells.
Quiver plots indicated that direction of flow in the wetland after large storms was only slightly different than after small storms, suggesting that topography is the dominant factor in determining hydraulic gradients. Travel times of five preferential flow paths of water through the wetland were quantified to estimate the residence time of water after large and small storms by a cross correlation analysis of the timing of water level changes. Velocities were determined by dividing distances between wells by travel times. Only one of the five flow paths indicated a significant difference in velocity following large and small storms, each of the estimated velocities an order of magnitude larger than saturated hydraulic conductivities of similar substrate of other studies. The presence of several inundated wells served to skew the predicted groundwater direction and velocities allowing for an accurate portrayal of flow through the wetland only in the absence of surface flow.



Quiver plots for typical large and small storms with well locations. Contours indicate water levels, and vectors indicate magnitude and direction of flow. Longer vectors indicate larger flux. Because groundwater gradients and their corresponding velocities are not significantly different after large and small storm events, the rate of flow through the wetland does not change with different storm sizes.

This quick, coordinated groundwater response throughout the wetland further supports the fact that gravitational flow, dictated by elevational gradients, is the energy gradient for water movement in areas of high relief like the Pacific Northwest.

Relation to HCP: Effectiveness of buffers around headwater streams and small wetlands is a priority of Habitat Conservation Plan research. This work links the wetland components of the riparian conservation strategy to the conservation objective of maintaining and restoring high quality aquatic habitat. Riparian restoration efforts aid in federally-listed salmon recovery efforts, and contribute to the conservation of other aquatic and riparian obligate species.

Project Status: Initiated in 1998, concluded in 2000.

Principal Investigator: Dan Berlin, Duke University.
More Information:
Berlin, D. J. 2000. A Hydrologic Perspective of the Implications of Clearcutting on a Forested Slope Wetland. Master's Thesis. Duke University, Durham, NC.