Effect of discharge on residence time distribution in a small headwater wetland

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http://ecosystems.mbl.edu/pimo/projects.html
• Wetlands remove nutrients and contaminants from a water system as it flows downstream.
• Removal of nutrients is dependent on the amount of time water remains in contact with wetland substrate.
Water Budget

$$\Delta S = Q_{in} - Q_{out} + Q_{GW} + Q_{overland} + Q_{P} - Q_{ET} \pm \text{Residual}$$

- Precipitation, $Q_p$
- Evapotranspiration, $Q_{ET}$
- Change in storage, $\Delta S$
- Stream, in $Q_{stream\_in}$
- Stream, out $Q_{stream\_out}$
- Groundwater $Q_{GW}$
- Overland $Q_{overland}$
Discharge

Flow

50 meters
Estimate of overland discharge:

Velocity ~10cm/s
Water Budget

- Change in Storage
- Qin
- Qout
- Qgw
- Precipitation
- Evapotranspiration
- Residual

Average Daily Fluxes (m^3/d)
Residence Time Distribution

- Multiple pathways through a wetland will result in different portions of flow exiting the wetland at different times.
Tracer Studies

http://www.turnerdesigns.com/products/submersible/c3-submersible
Rhodamine WT injection site

Long-term point measurement

Continuous measurements across pond

Transect point measurements across wetland

Long-term point measurement
C,in
Q,total

WETLAND PLATFORM
V,platform Q,platform

CHANNEL V,channel Q,channel

C,out
Q,total