

# **Surface Water and Groundwater Interactions in the Okanagan Basin**

## **Implications for Water Resources and Aquatic Habitats**



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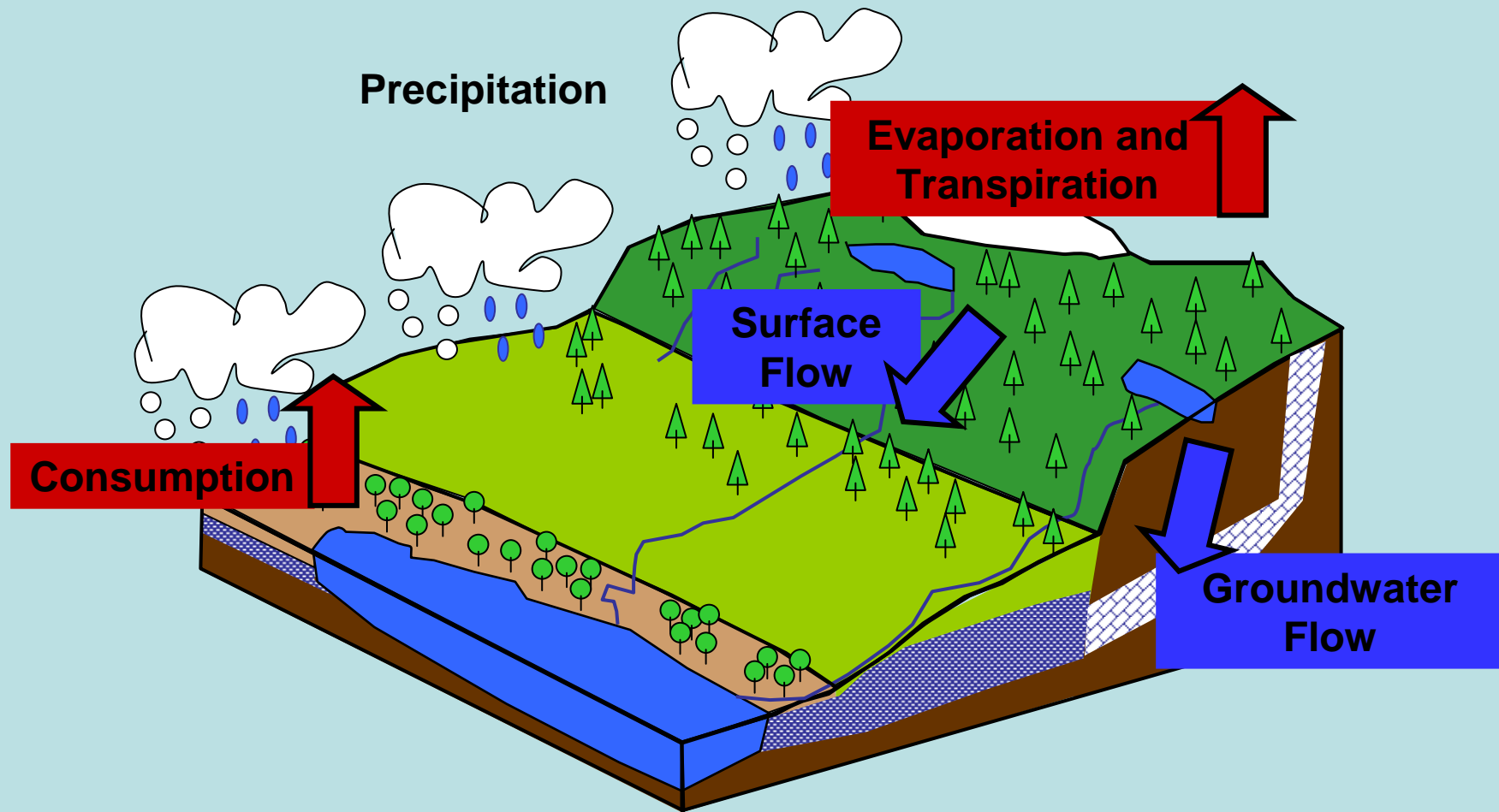




***What role does groundwater play in the Okanagan Basin?***



# Water Budget for Okanagan Valley Aquifers



## **Groundwater in the Okanagan Basin**

**Groundwater and surface water are a single resource.**

**1974 Okanagan Basin Study:**

*“... it becomes apparent that groundwater resources are not a feasible alternative to large scale development of surface water resources.”*

**Groundwater is a reservoir that extends water availability.**

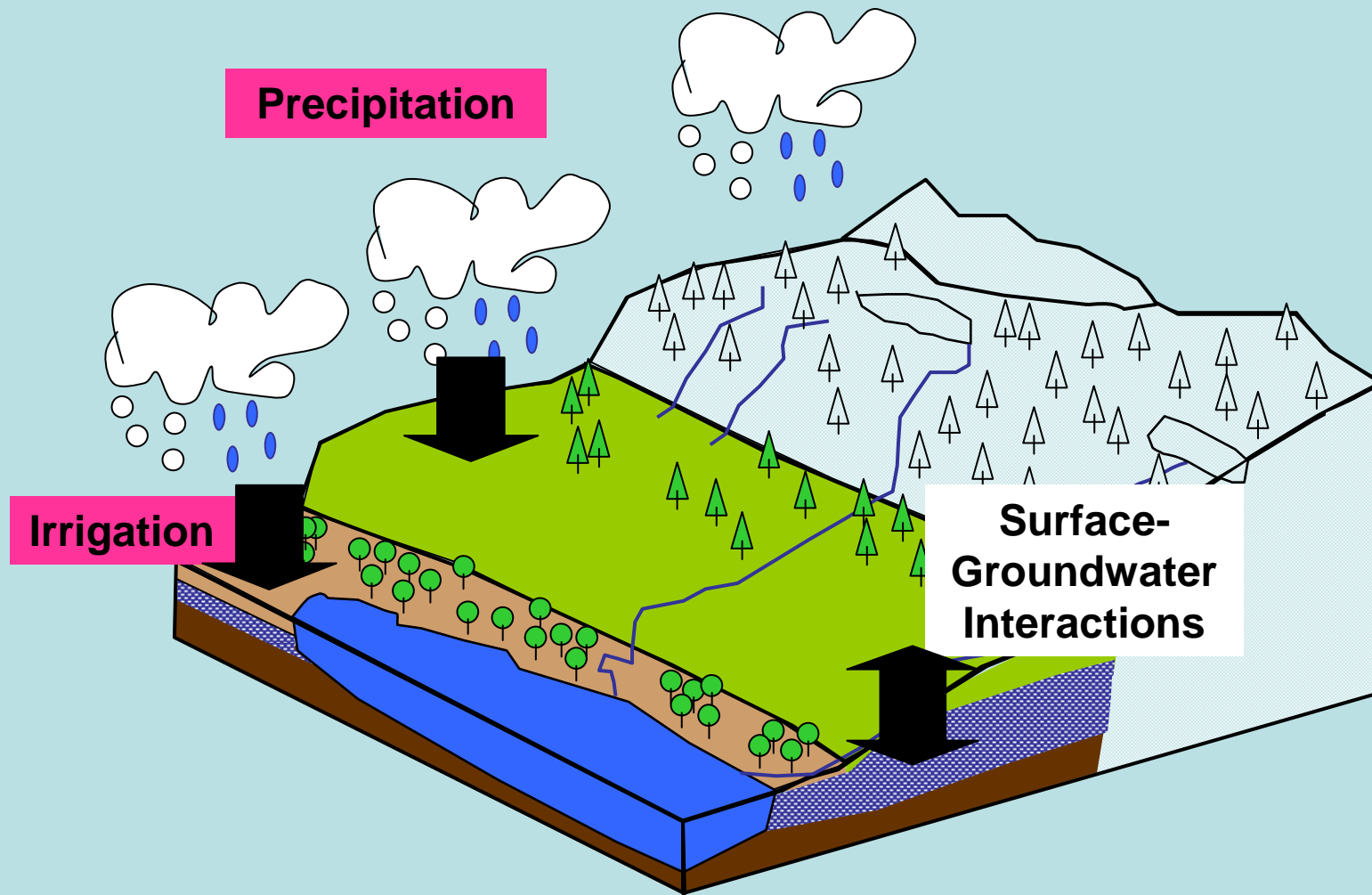
*Aquifers are a natural reservoir when surface water is inaccessible (frozen in the winter) or unavailable (low flows during the summer).*



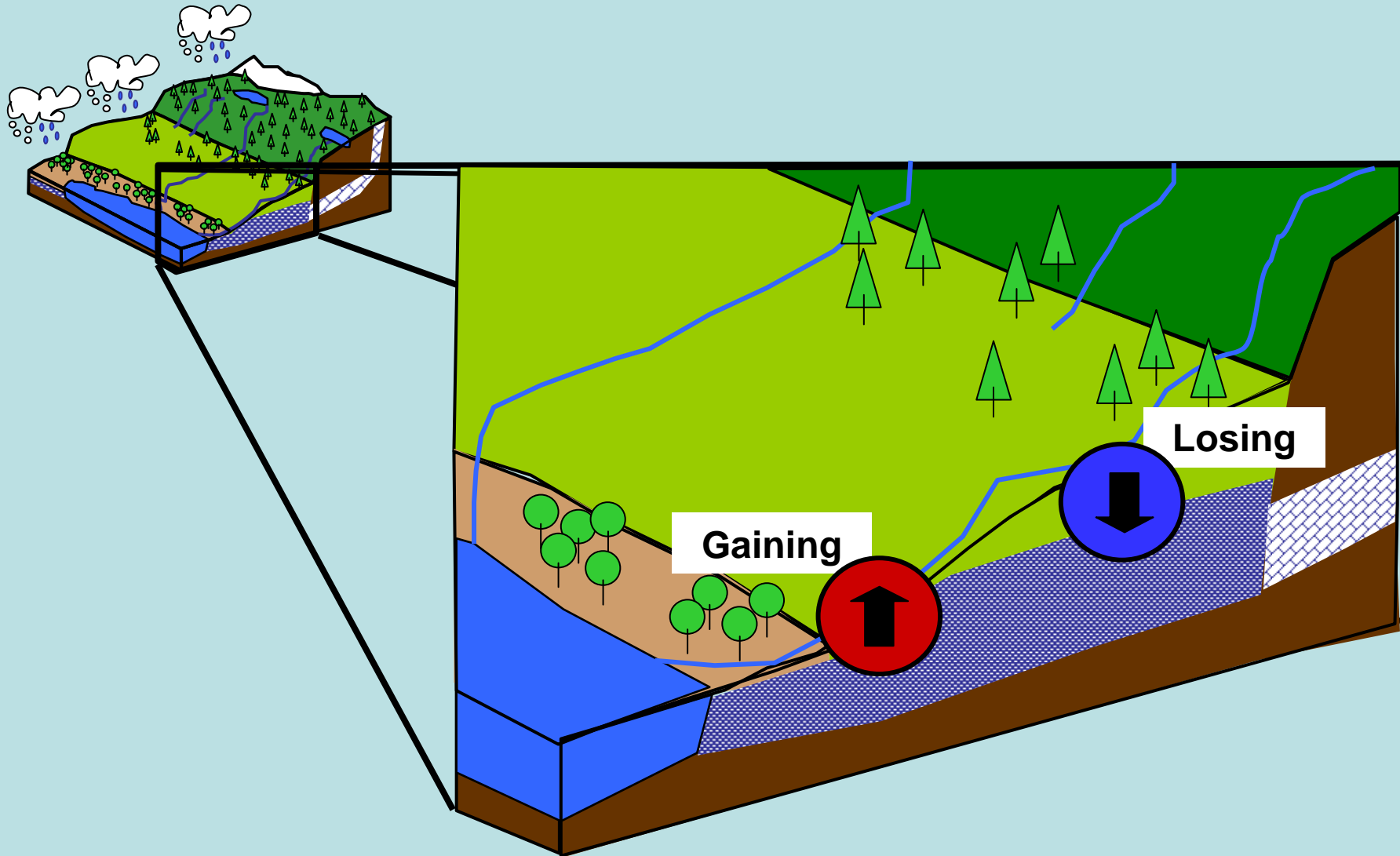
# ***How does groundwater interact with surface water?***

***(Lakes, Wetlands and Streams)***

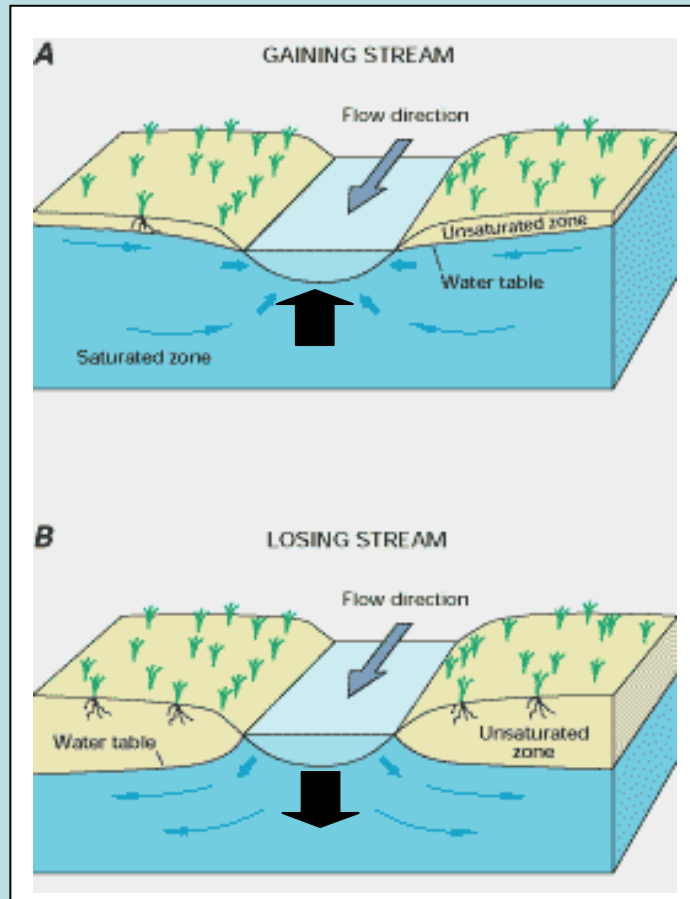
# Recharge of Valley Aquifers



# How Does Groundwater Interact with Surface Water?



# Types of Interactions:



From Alley et al., USGS Circular 1186, 1999

**A. Gaining – groundwater contributes to stream**

**B. Losing – surface water contributes to groundwater**

***Streams may gain groundwater in some reaches and lose in others.***

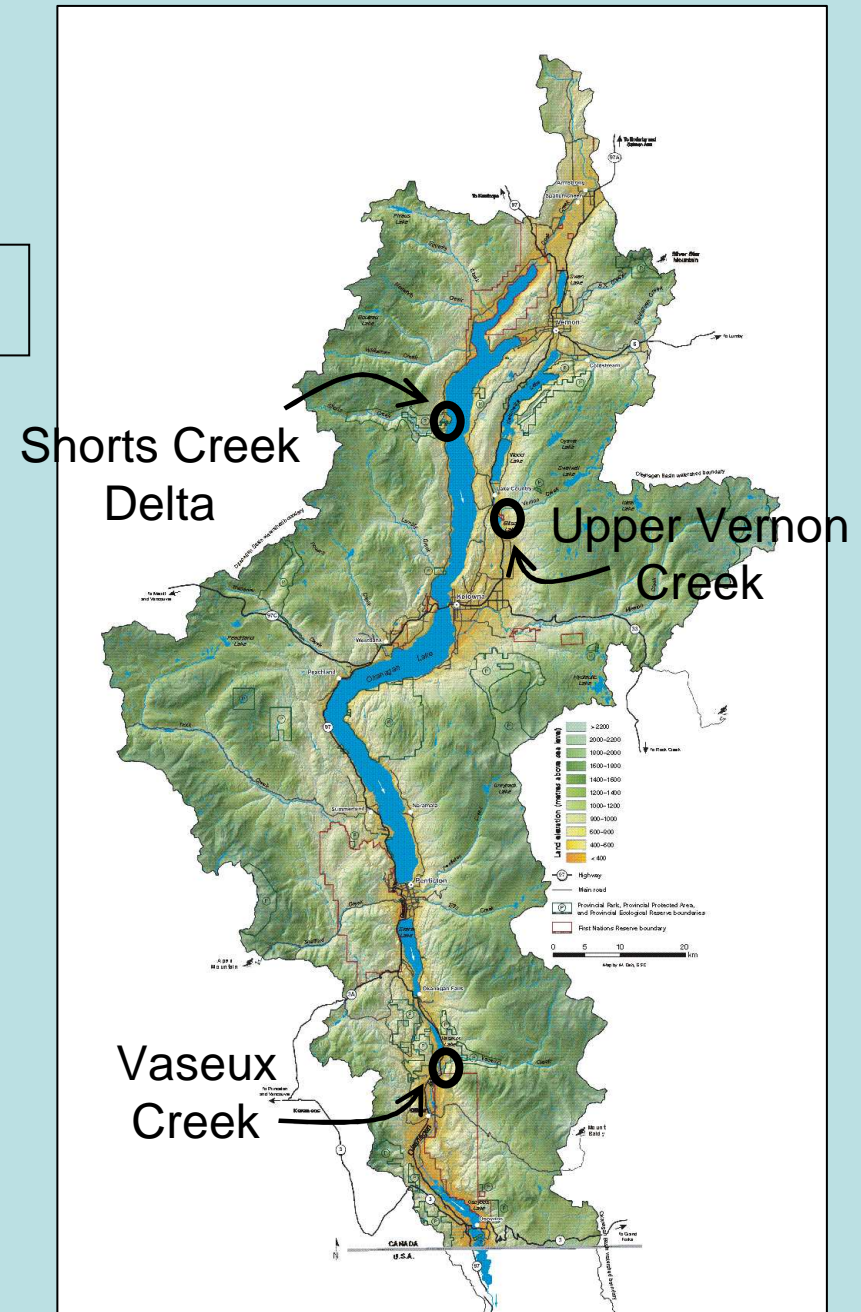




***What surface water – groundwater interactions did we find?***

## Sites:

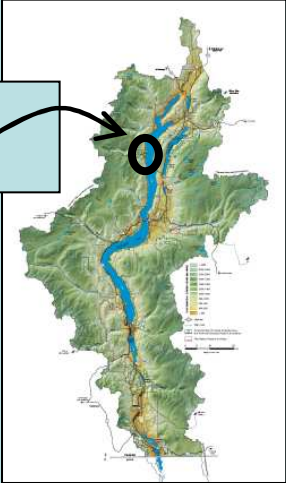
Where creeks flow  
over sand and gravel  
deposits on their way  
to the valley floor.







# Shorts Creek Delta

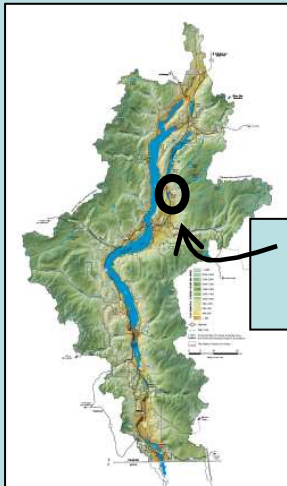


- Losing stream
- 20 to 85% of low flow goes to groundwater





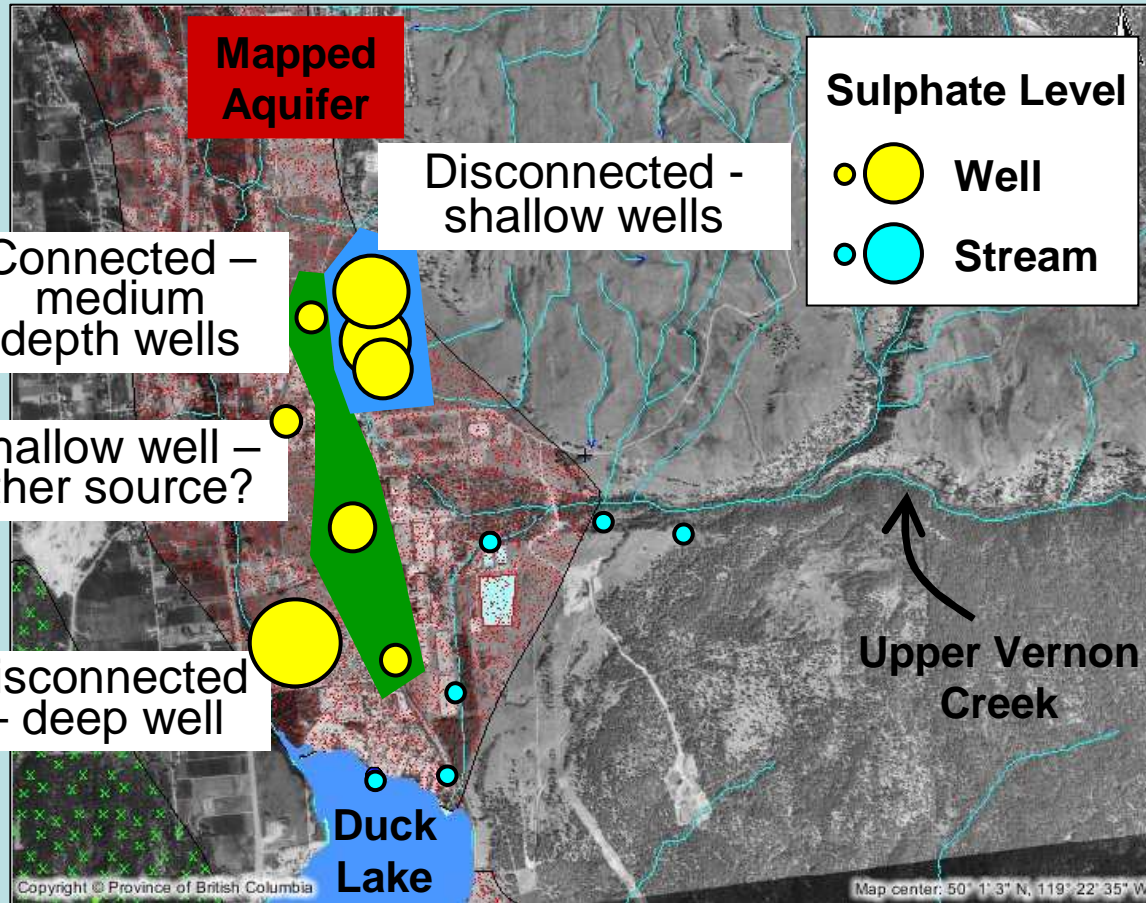
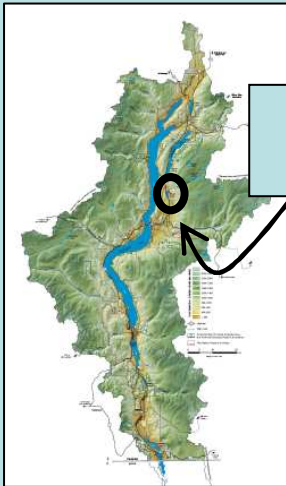
- Both gaining (upper) and losing (lower)
- Seasonal differences
- Kokanee spawn in lower reach



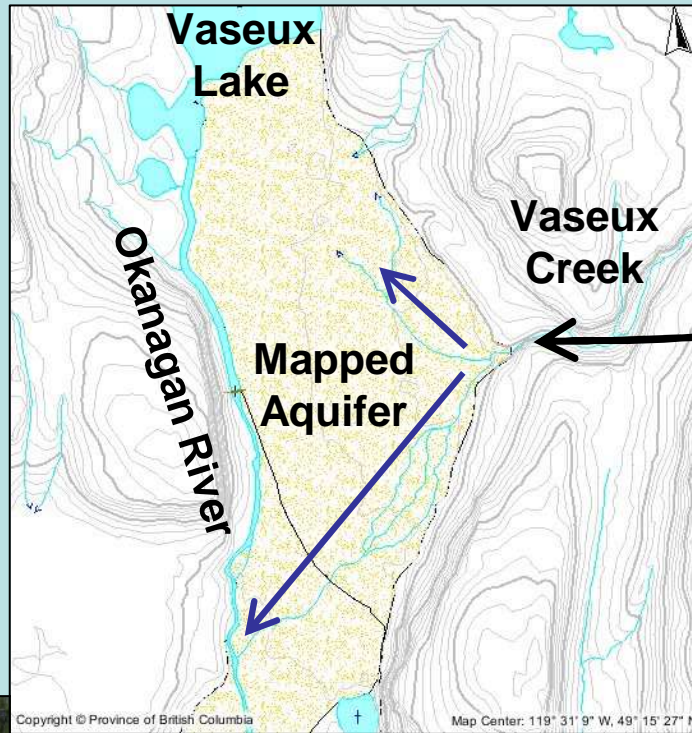
## Upper Vernon Creek



# Upper Vernon Creek

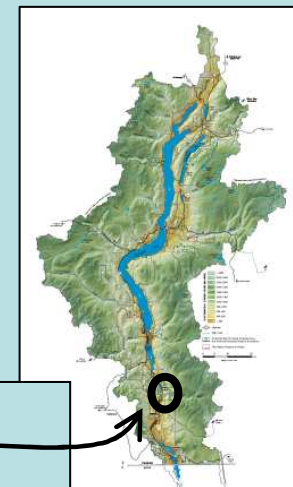


Recharge occurs further upstream



- Always losing
- 24 to 100% of flow goes to groundwater
- avg 14 million litres per day

# Vaseux Creek



## **Groundwater – Surface Water Interactions in the Okanagan Valley**

**Along the valley margins, creeks will lose water until they flow over a shallow, low permeability layer that forces water back up to the surface.**

**e.g. Upper Vernon Creek**

**Some creeks only lose water, supplying potentially large volumes of water to the valley aquifers.**

**e.g. Vaseux and Shorts Creeks**

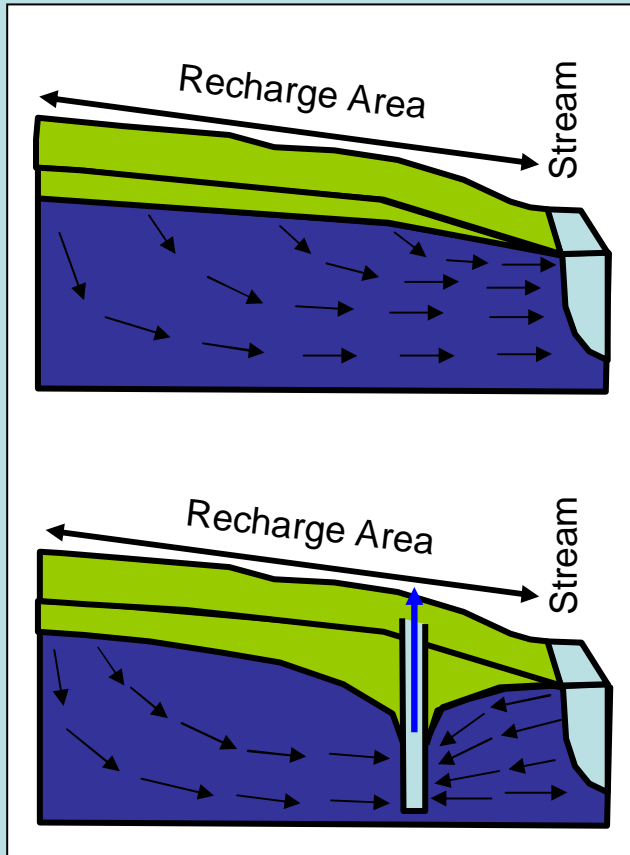




***How might water management practices impact these interactions?***

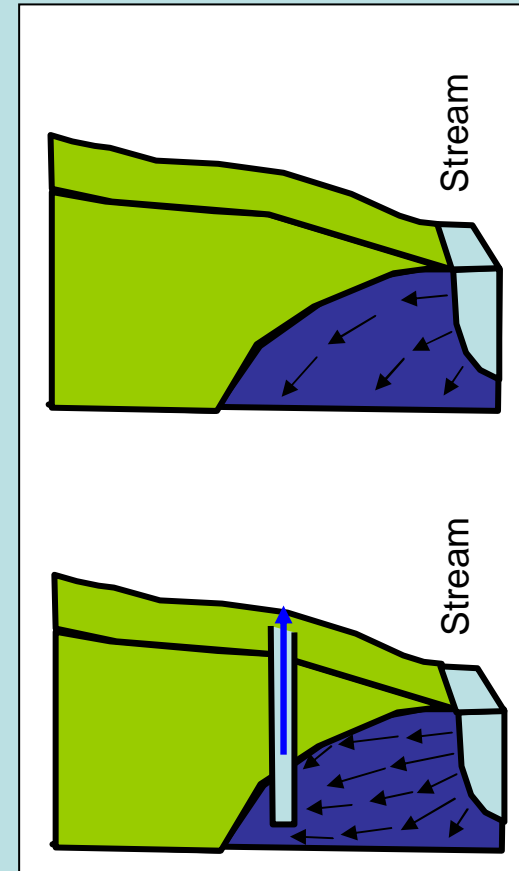


# Water Resources Issues



## Gaining Stream:

Pumping can reverse direction  
of water movement.  
Becomes a losing stream.



## Losing Stream:

Pumping enhances loss.



***How do surface water –  
groundwater interactions affect  
aquatic habitat?***

# Aquatic Habitat Issues



## Gaining streams:

- Upwelling water is tempered and contains nutrients from underground, but is lower in oxygen

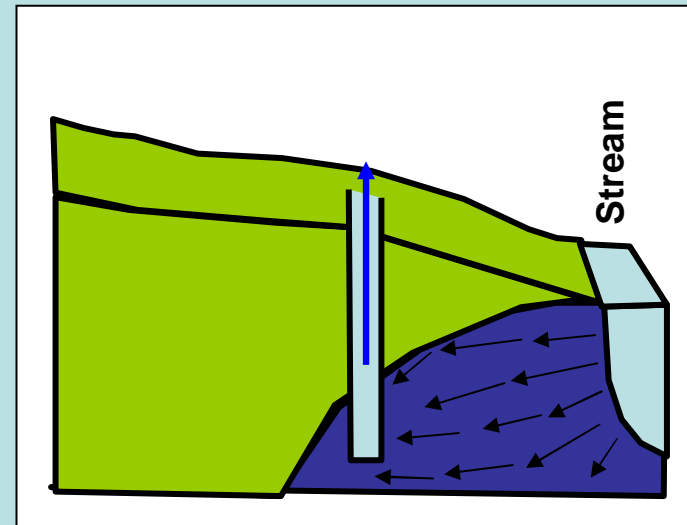
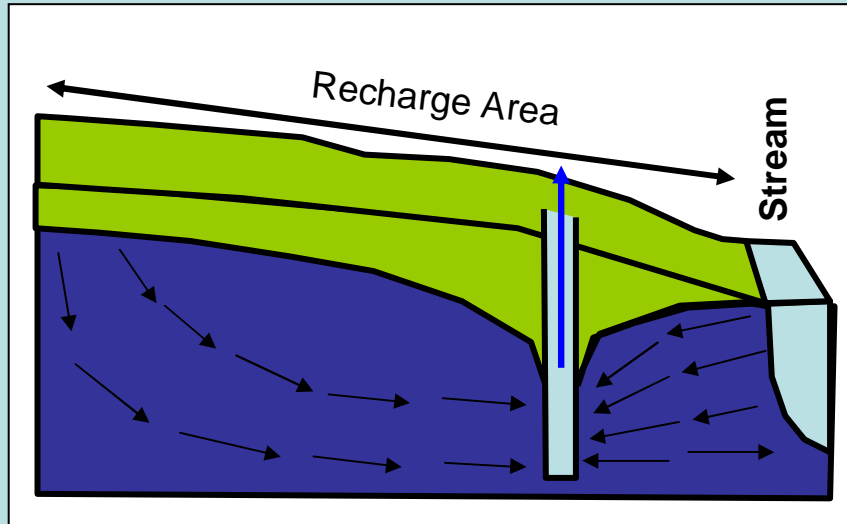
## Losing streams:

- Downwelling water is high in dissolved oxygen but temperature varies over day and seasonally

Species use conditions that maximise egg survival.



# Aquatic Habitat Issues

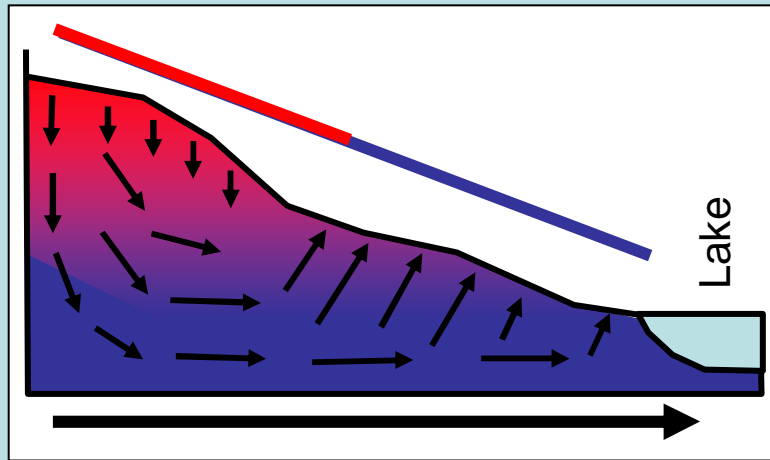


## Well Pumping

Can disrupt flow patterns (changing direction or enhancing flow) that affect egg survival

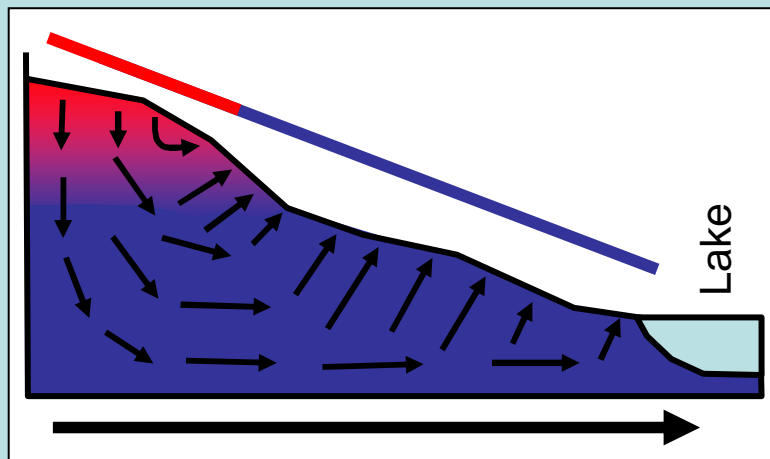


# Aquatic Habitat Issues



## Groundwater Pumping

- Greater proportion of surface water
- Water is cooled (winter) or heated (summer)



## Natural State / No Pumping

- Greater proportion of groundwater
- Water is moderated throughout the year

Streamflow Direction

## Take-Home Messages



- **Groundwater and Surface Water are a single resource**
- **Well placement and pumping rate affects surface water resources**
- **Groundwater – surface water interactions affect aquatic habitat**



## Thank you:



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