



Potential Peak Flow Management within the Clark Fork Basin, Montana

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Issues

- Clark Fork Basin needs water for future users
- Providing for the long-term sustainable use by the various competing existing users
- Existing storage is, or will soon be, fully utilized
- Mitigation potential of existing supplies may be limited – can Flathead water mitigate new uses in the Upper Clark Fork?

An aquifer is an underground reservoir of water contained by rock or unconsolidated materials (gravel, sand, silt or clay), from which groundwater can be extracted. In 'managed aquifer recharge' a water source, such as recycled water (eg derived from urban stormwater or treated sewage) or natural water (eg from a lake or river), is used to 'recharge' an aquifer with water under controlled conditions. The aquifer is used to store surplus water for later use or for environmental benefit.

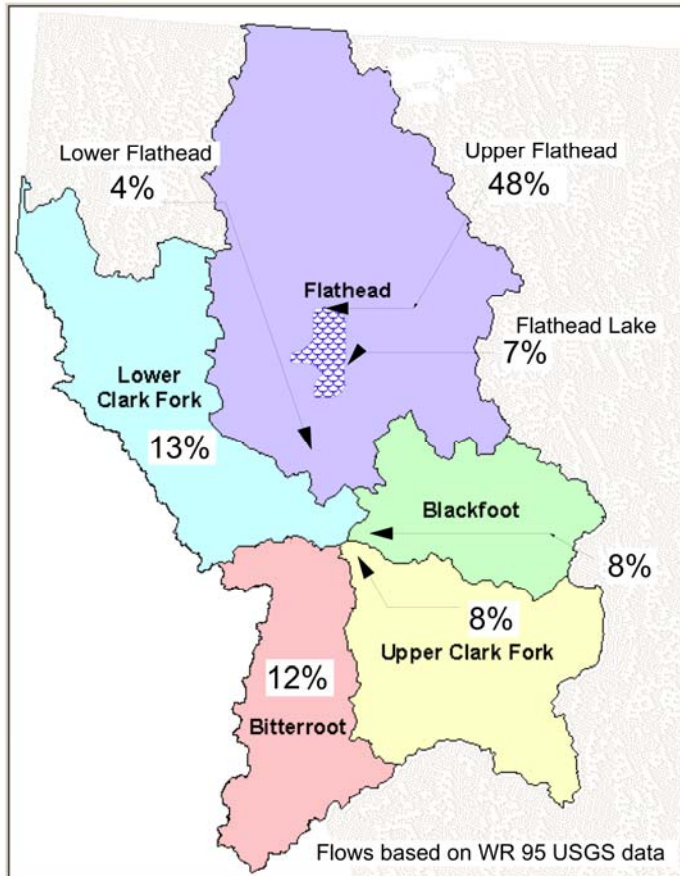
NRMMC,2009, Australian Guidelines for Water Recycling Managed Aquifer Recharge, National Water Quality Management Strategy Document No 24, Natural Resource Management Ministerial Council, Environment Protection and Heritage Council, and the National Health and Medical Research Council, Canberra, AU

In Montana we have “Accidentally Managed the Recharge” since irrigation began. With Managed Recharge we are suggesting Intentional Aquifer Management.

Potential “New” Sources

- Conservation – use less, frequently viewed as reduced diversions
- Increase surface storage – expand existing dams, build new ones.
- Increase groundwater storage – manage recharge (Aquifer Storage & Recovery)

Project Area



Annual Runoff	-	14,040,000 AF
Average Annual Q	-	19,390 cfs
Lowest Daily Mean Q	-	3,200 cfs
Highest Daily Mean Q	-	133,000 cfs

59% of Annual Clark Fork Basin
Discharge from Flathead River

Benefits of ASR

May reduce the need to construct large and expensive surface reservoirs.

ASR systems can store very large volumes of storage at a fraction of the economic and environmental costs of surface storage systems.

ASR systems are considered to be more environmentally friendly than surface reservoirs.

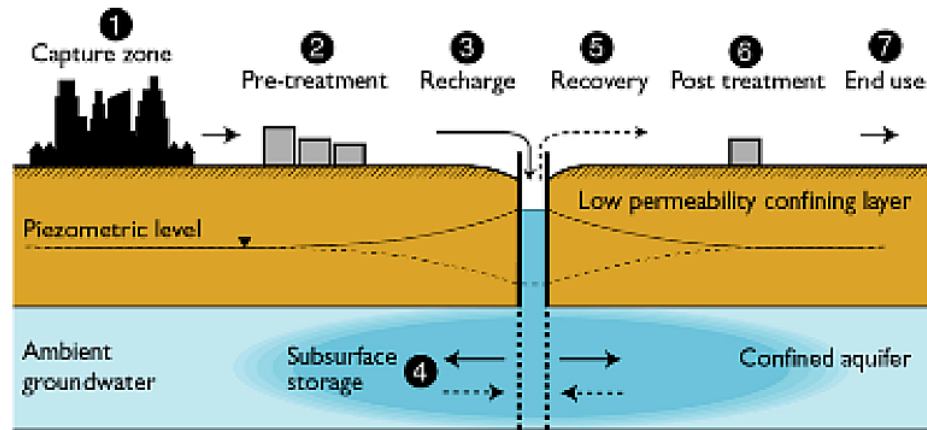
Offer more protection from tampering.

ASR may restore and expand the function of an aquifer that has experienced long-term declines in water levels due to heavy pumping necessary to meet growing urban and agricultural water needs.

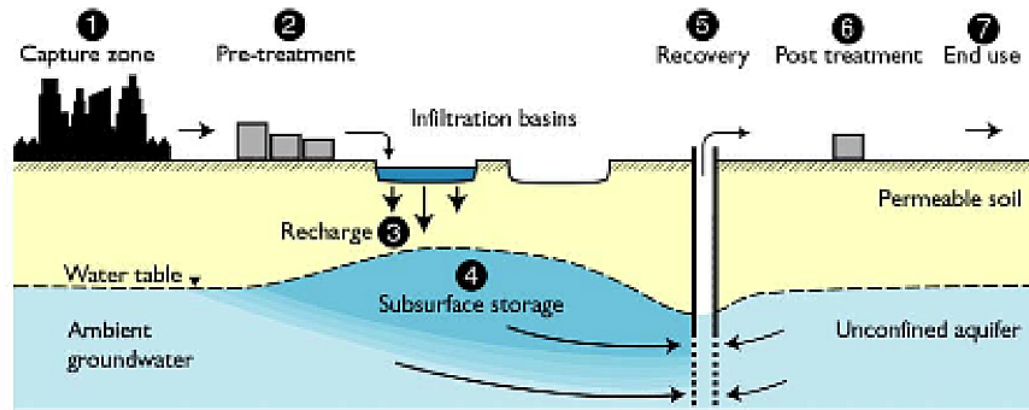
Can be geographically dispersed.

ASR systems also avoid the evaporative losses associated with surface reservoirs and are less vulnerable to contamination.

Typical ASR Installations



(a)



(b)

- (a) Aquifer storage and recovery system storing water in a confined aquifer.
(b) Soil aquifer treatment system infiltrating water to an unconfined aquifer.

Types of ASR Installations

Aquifer storage and recovery (ASR) – same wells

Aquifer storage, transport and recovery (ASTR) – different wells

Vadose zone wells - recharge unconfined aquifers

Percolation tanks and recharge weirs – dams on ephemeral streams
(channels that only contain water after rainfall or snowmelt)

Rainwater harvesting

Bank filtration – induced infiltration from surface source

Infiltration galleries – recharge method,

Dune filtration – infiltration ponds built on dunes unconfined aquifer recharge

Infiltration ponds – unconfined aquifer recharge

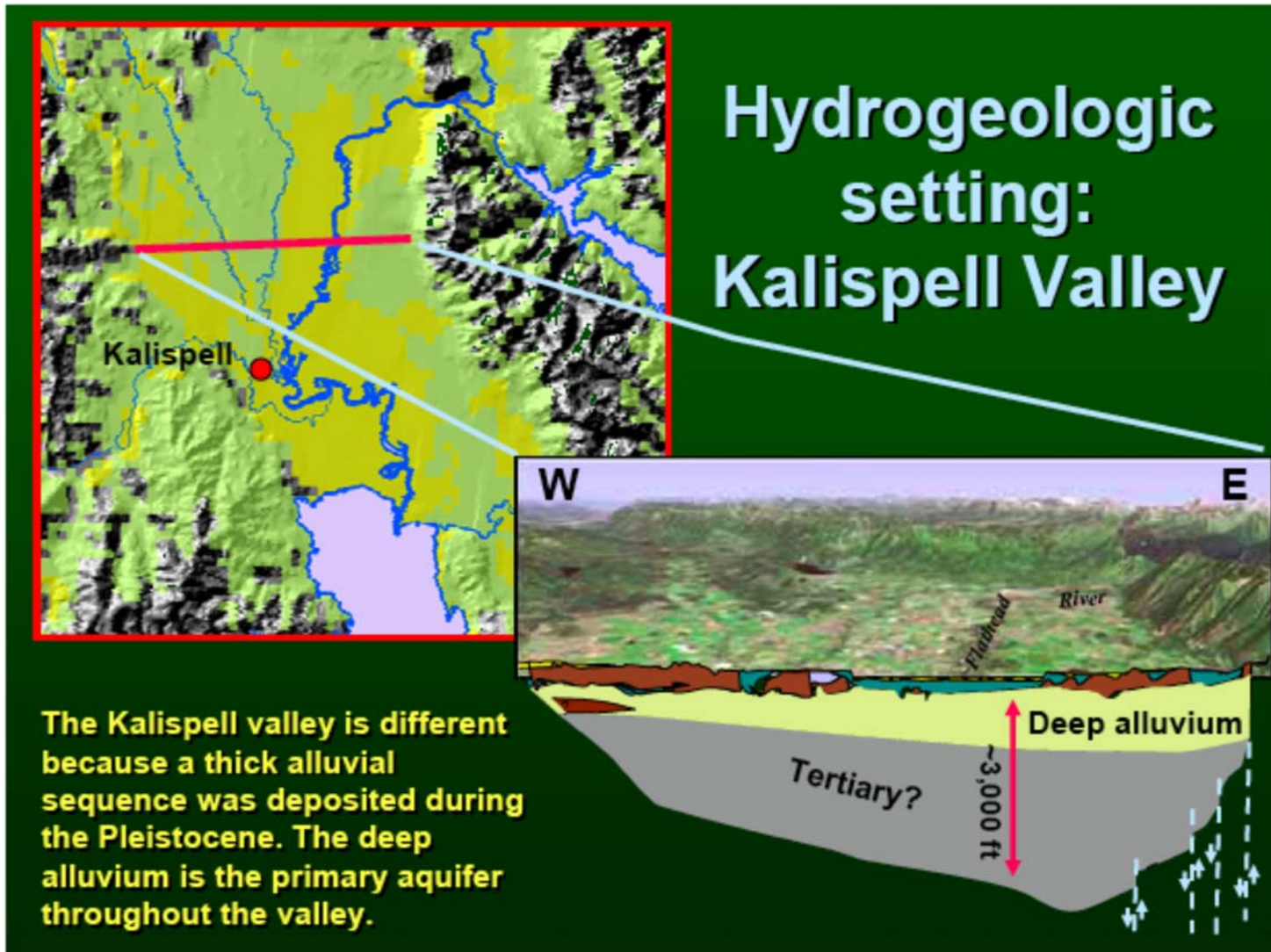
Soil aquifer treatment – treated sewage effluent recharge

Underground dams – cutoff trench in ephemeral channel subsurface

Sand dams – ephemeral stream beds

Recharge releases – controlled recharge on ephemeral streams

Upper Flathead Cross-Section



Project Goals

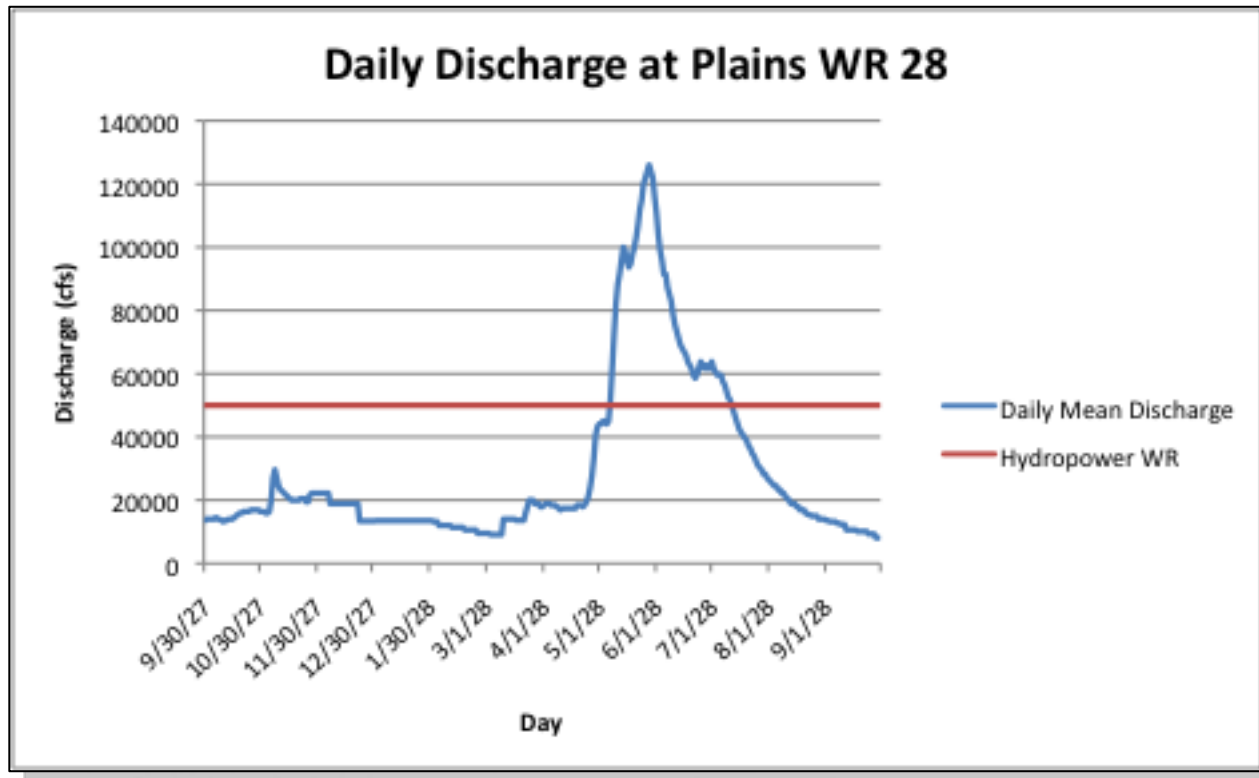
Provide Flood control through headwaters storage

Reduce flow during periods of oversupply of wind power

Reduce spill at hydropower facilities

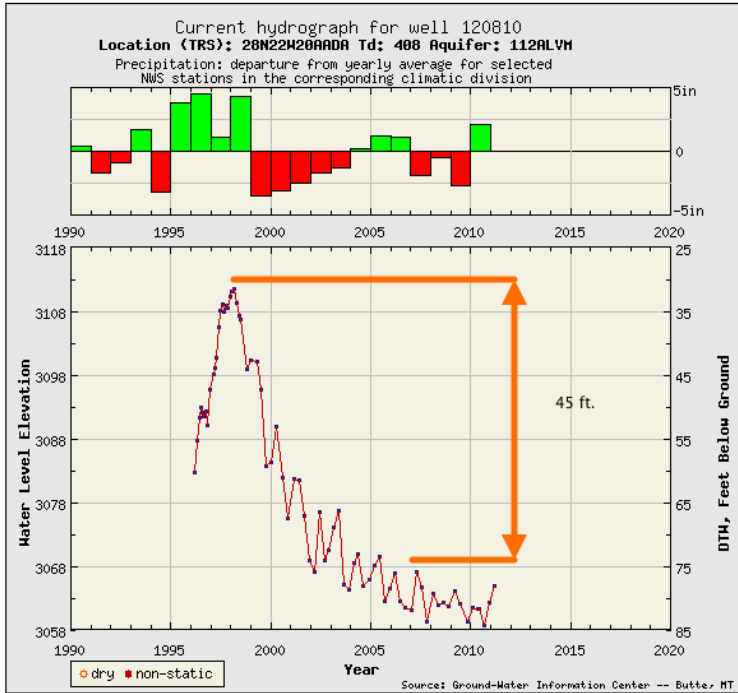
Increase storage for potential appropriation, and mitigation

Water Availability



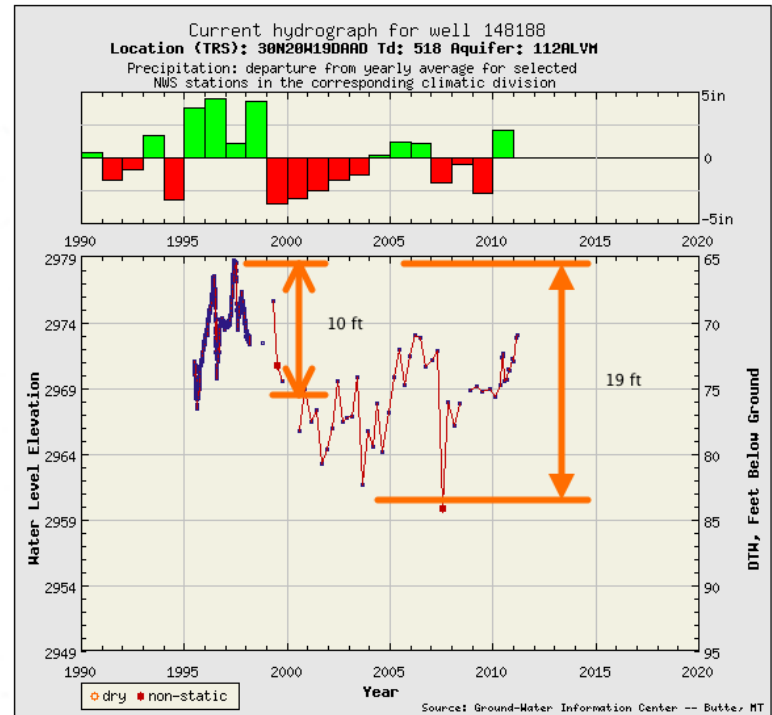
Spill = 4.1 million ac-ft in WR1928

Potential Storage

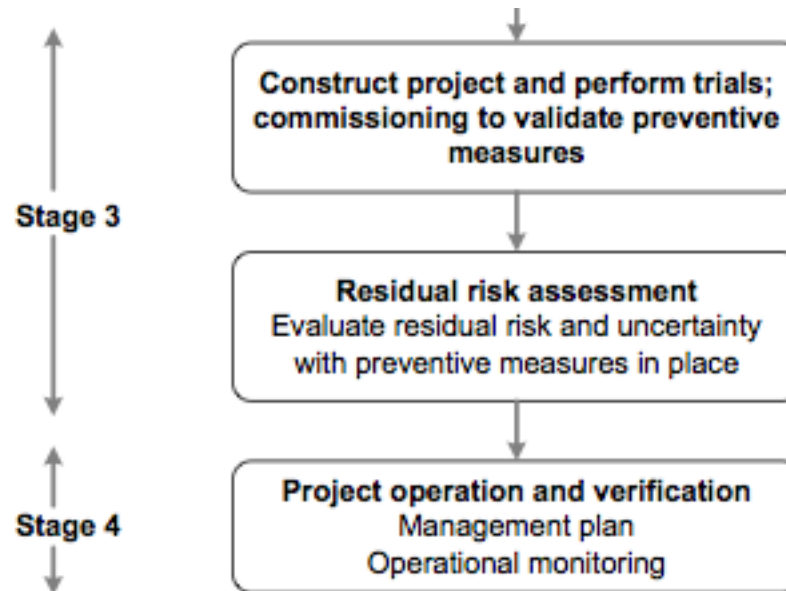


Outer edge of aquifer

Centrally located in aquifer



Project Plan



Project Plan

Phase I will:

Assess where flood control relief is needed within the basin.

Identify potential locations for water storage, either surface or groundwater.

Estimate the rate at which water might be stored.

Prepare a preliminary assessment of hydrologic feasibility:

Can sufficient water be diverted to affect surface water flows?

Can water be “injected” through any means at a sufficient rate to capture surplus flows?

Coordinate with various permitting & water resource management agencies.