

Groundwater in Flood Based Farming Systems



TWO STRATEGIES

1. OPTIMIZING RECHARGE
2. DEVELOPING GROUNDWATER RESOURCES
 - SAND DAMS AND SUBSURFACE DAMS
 - FLOOD WELLS

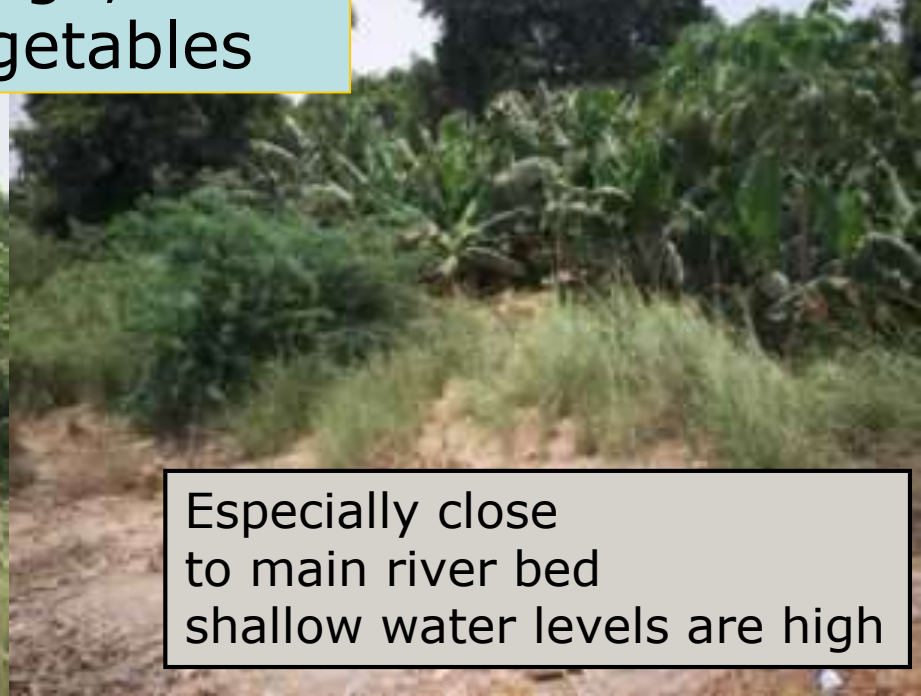
Ground water use

- Source of drinking water, locally and regionally
- Source of agricultural water : cultivate high value horticultural crops
- Buffer





High value crops
For instance:
Papaya, Mango,
Banana, Vegetables



Especially close
to main river bed
shallow water levels are high

Yet overuse occurs

Banana plantation (Yemen) failed because of ingression of saline water



Statement:

Because groundwater is very valuable, need to optimize recharge in spate irrigation areas

How to optimize recharge from spate flows?

- Recharge mainly from main riverbed – far less from main wadi flood channels or fields
- Recharge most effective from gravelly sections of the river bed
- Recharge most effective, if spate flows slow
- Recharge from flat sections of the river bed
- Recharge from water ponded at bunds and weirs
- Recharge from (subsurface) base flow
- Spread spate over large area to optimize recharge

What to do to optimize recharge from spate flows?

- Keep 'rough' gravel bed intact with floods flow (more roughness bed)– be careful not to remove too much gravel
- Consider low weirs/ bed stabilizers to slow down the flow
- Avoid excessive siltation in main recharge section of the river bed
- Do not block the subsurface flow through cut-off weirs or bed stabilizers!!

Not a good idea:

Wadi Siham weir
in Yemen
completely
blocked
subsurface flow
and caused
a dramatic drop in
water
levels in
downstream wells



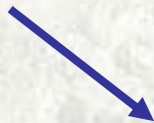
Not a good idea:

The same happened with this bed-stabilizer: it blocked the subsurface flow – causing the recharge of downstream wells to stop



Good idea:

Farmers in this downstream area argued for a change in the traditional water distribution – with more chance of a flood going downstream



It was not so much the irrigation from the state they were looking – instead they were interested in having their wells recharged

Good idea:

**LOW RECHARGE WEIR
TO SLOW DOWN AND SPREAD FLOODS**

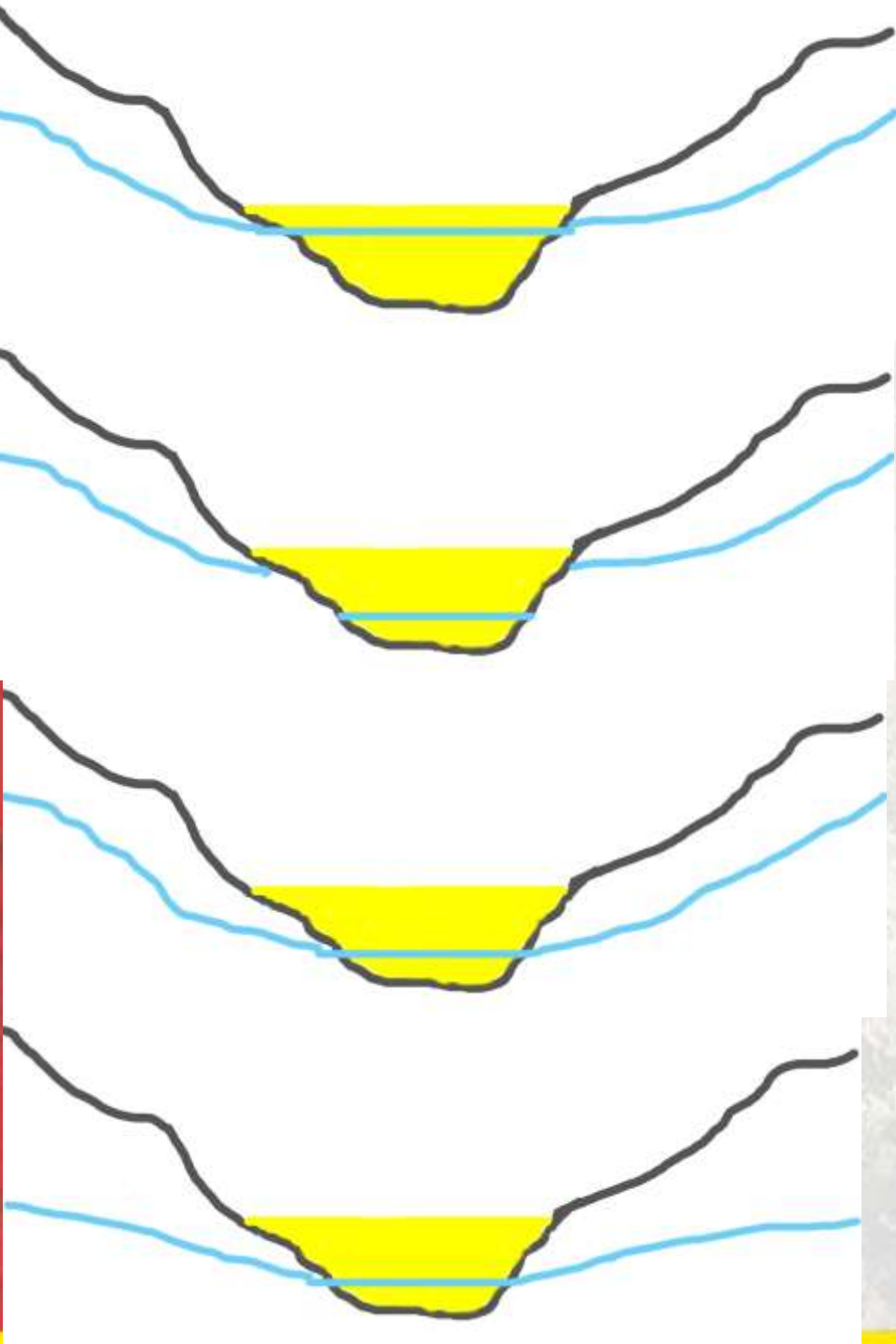


Developing groundwater resources

- Sand dams and subsurface dams
- Flood wells

Making use of shallow aquifers in sandy riverbeds





Lateral flow

Delayed discharge into the bed due to different hydraulic conductivity of sand and clay or loam

Base flow

The shallow aquifer that carries water at the base (bottom) of the streambed

KENYA – ADVANTAGES OF NON VENTED DRIFTS

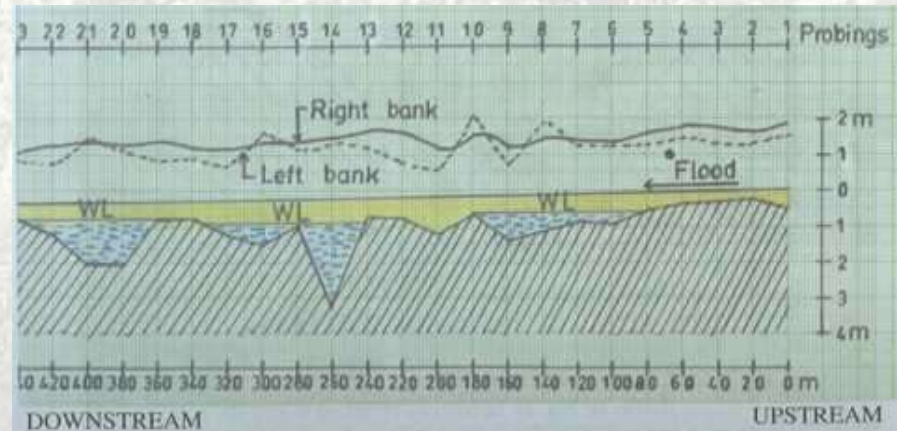
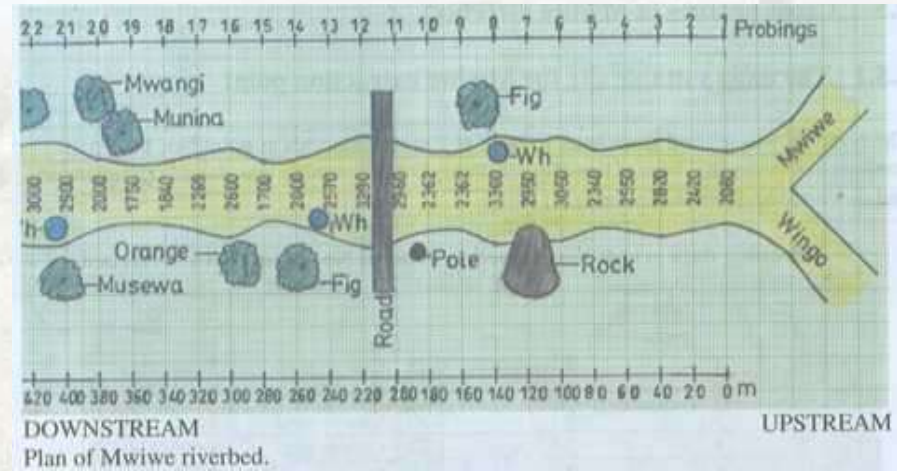


KENYA: INFILTRATION GALLERY UNDER CONSTRUCTION FROM ROAD SAND DAM



Profile of riverbed

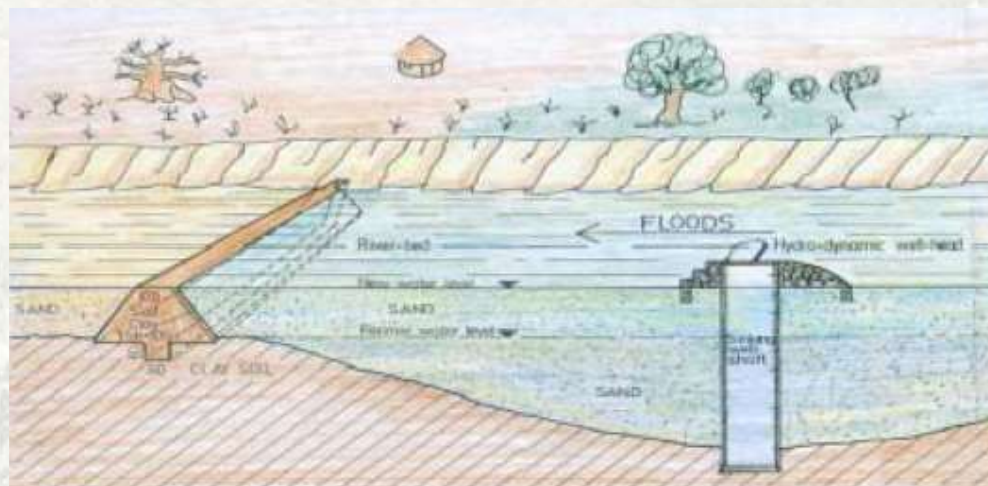
- After probing a longitudinal profile was drawn
- From different profiles it can be seen that the underground at point 18 is the most suitable for the sand dam



Subsurface dams of soil

A subsurface dam will:

- Block underground flow of water
- Raise water level in the sand to 30 cm below surface of riverbed



Construction guidelines

Step 1)

- Build subsurface dams (weirs, and sand dams) preferably on underground dykes situated downstream or underground water reservoirs to get maximum water volume
- Use the most clayey soil for construction of the dam (To find out which soil is best use bottles with soil samples, pour water on top and place them up side down to see which soil has the slowest infiltration rate)



Construction guidelines (continued)

Step 2:

- After identifying suitable soil, remove all sand in riverbed in a 3 meter wide stretch
- To prevent seepage, make a key (trench) of 100 cm wide and 60 cm into solid soil
- Transport clayey soil
- Fill key with 20 cm moisturized clay
- Repeat laying out layers of 20 cm until dam wall has reached 30 cm below surface of sand
- Walls have a slope of 45 degrees, smoothed with shovels and wooden floats
- Sand is back-filled on both sides and on top

Flood wells

In riveraine areas there is constant recharge of water

This in principle constitutes a good source of water

Accessing it depends on soil conditions in the river bed:

- clay: dugwells
- Sandy strata: shallow tubewells

Advantage of shallow tubewells is:

- Secure
- Can be used soon after floods

Dugwell in flood plain

