Roads as Instruments for Resilience: Opportunities in Zambia

Stakeholder Meeting, Radisson Blu Hotel, Lusaka, Zambia

July 26, 2017

Outline

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3. Current Practices: Road Water Management
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1. Introduction

- Road development is one of the major investments in Zambia.
- Climate change affects infrastructures: during construction, and over their life time.
- Infrastructure development changes runoff patterns of landscapes;
  - ➢ Roads as conveyance systems.
- ***How best could we use roads to harvest/manage water for multiple use and livelihood improvement?***

2. Roads in Zambia: Status and Water related Challenges

2.1 Approaches Used

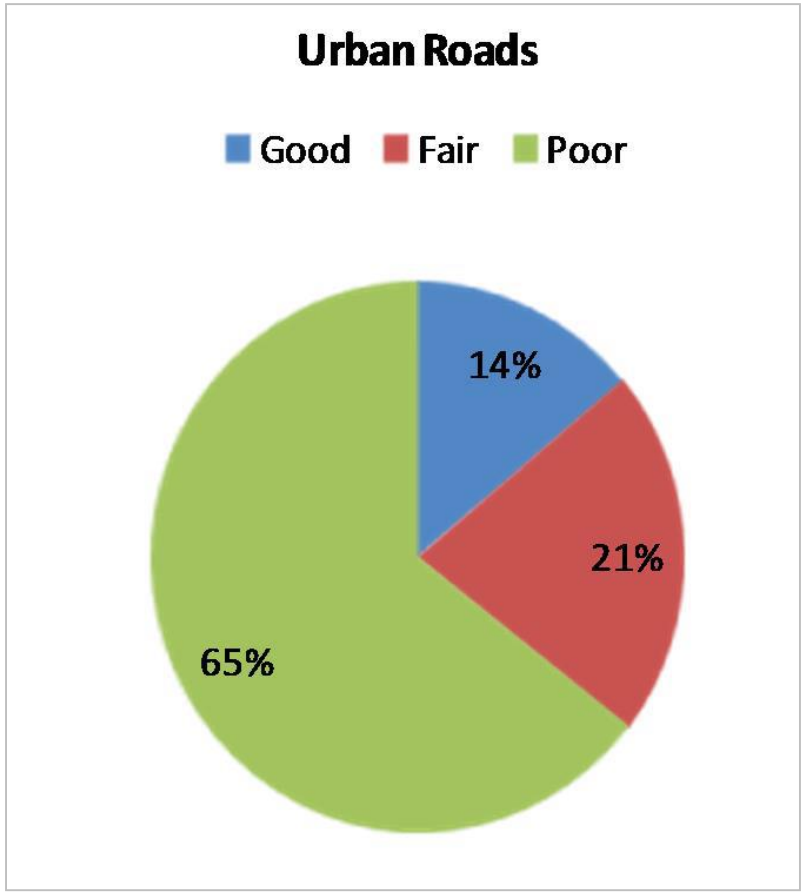
- Review of strategy documents on road, water, agriculture and environment.
- Transect survey of representative roads.
- Discussions with various government organizations.
- Discussions with farmers: both male and female headed.
- Discussions with private sectors (contractors).

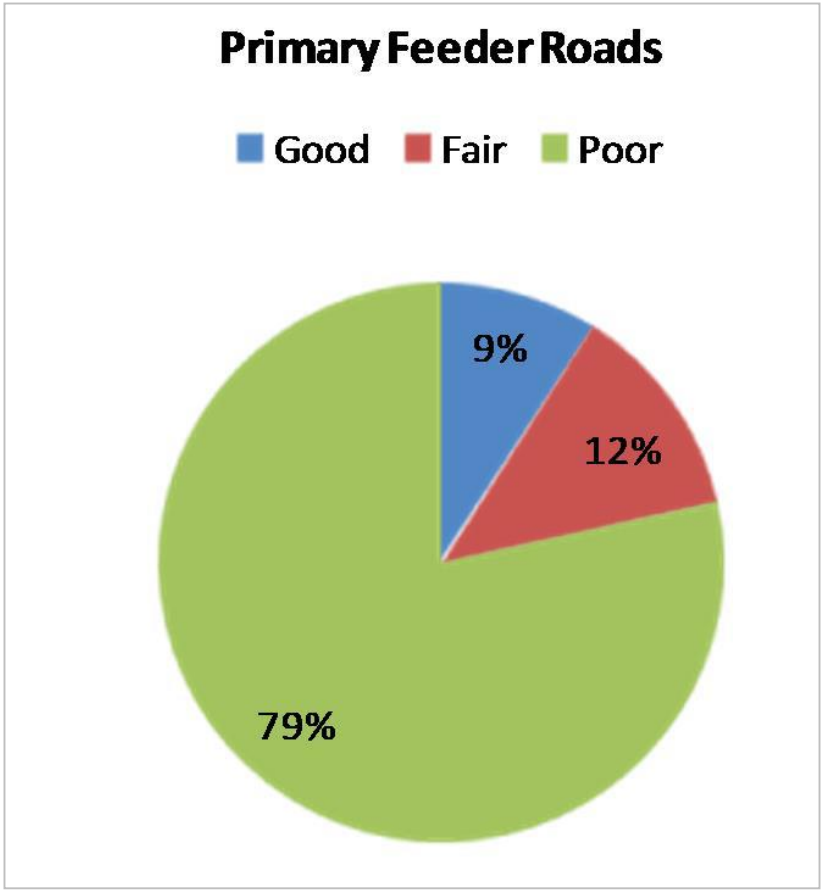
2.2 Roads in Zambia

- Zambia has a total classified road network of 67,671Km:
  - 37, 000km: gazetted roads.
  - 30,671km: un-gazetted roads classified as feeder, national park and estate roads.
- Core Road Network: 40,445Km.

(Source: RDA, 2012) (2012-2016 strategic Plan)

Condition of both urban and primary feeder roads in Zambia (RDA, 2012)





2.3 Road Transect Survey

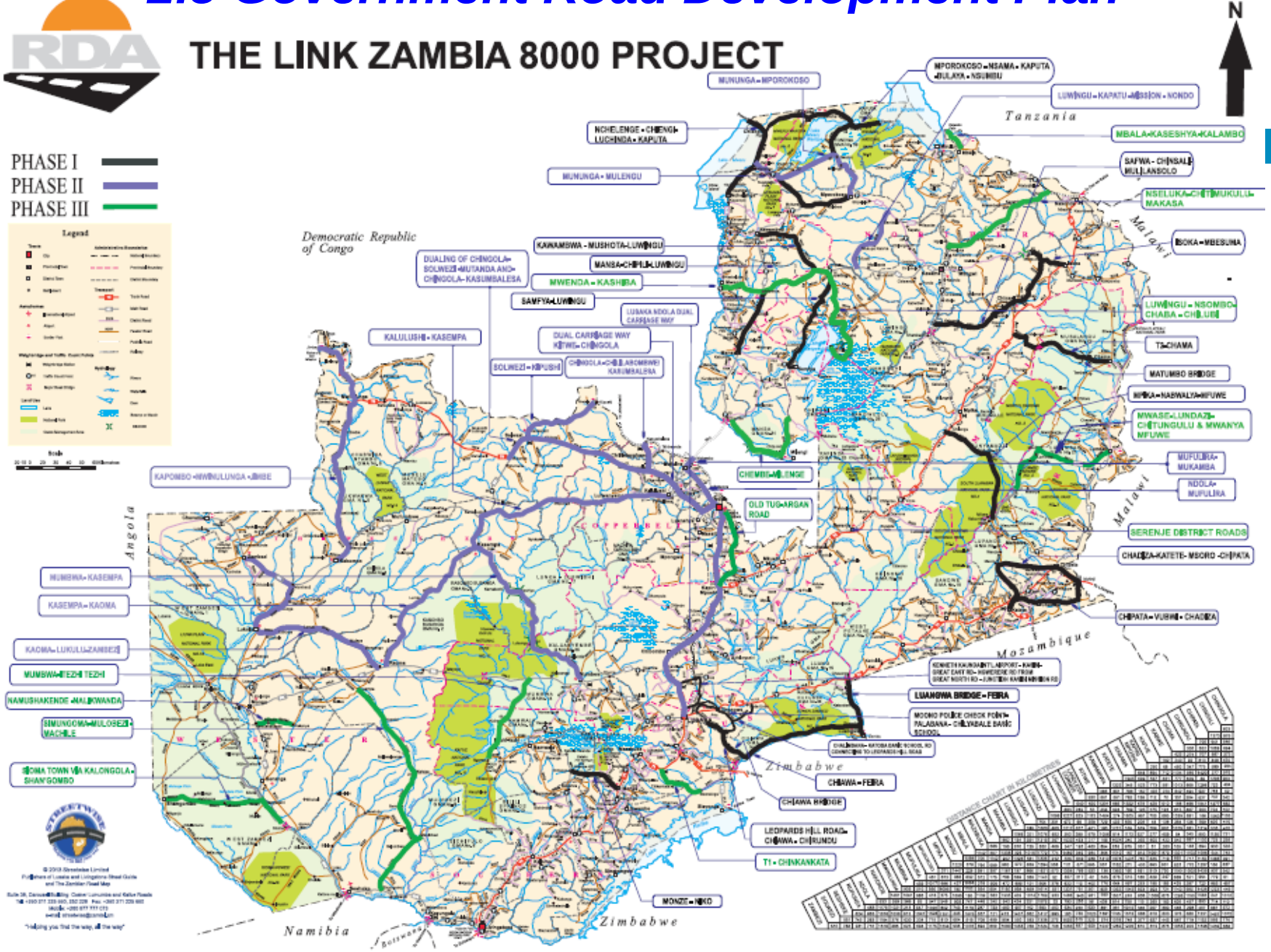
2.4 Some of the water related challenges

- Siltation of road hydraulic structures
- Erosion
- Flooding
- Water logging
- Landslides
- etc.

Water logging due to raised road embankments

Erosion: damage on retaining structures and scouring of pier foundations

2.5 Government Road Development Plan



2.6 Government Water Resources Development Plan: Dam Construction

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ZAMBIA DAILY MAIL, Saturday, July 22, 2017

State to build $8m dams

Eastern, Luapula, Copperbelt and Southern provinces to improve water storage facilities

PRISCILLA MWILA
Lusaka

THE Ministry of Water Development, Sanitation and Environmental Protection has embarked on a project to build dams in four provinces at a cost of US$8 million.

Permanent secretary Edward Chomba said the dams will be built in Eastern, Luapula, Copperbelt and Southern provinces to improve water storage facilities.

He said in an interview that Government is scaling-up the construction of dams countrywide, including areas where there is enough rain, to ensure sustainable management of the water resource.

"The ministry has embarked on a dam construction project with support from various stakeholders who include the World Bank and African Development Bank (ADB). We want to improve storage facilities so that we do not experience water deficit in future," he said.

Bishop Chomba said the dams are aimed at harvesting water for sanitation, irrigation, wildlife and keeping the environment clean.

He said investing in dams is good for the country as it is intended to also increase agriculture production and contribute to the nation's diversification agenda.

Bishop Chomba said the water will also be used for irrigation, domestic purposes and fish farming.

He said the ministry is mobilising resources from the ADB to construct 16 more dams countrywide.

And Bishop Chomba said the construction of Chikowa Dam in Mfuwe, at a cost of US$1.4 million, was completed and is operational.

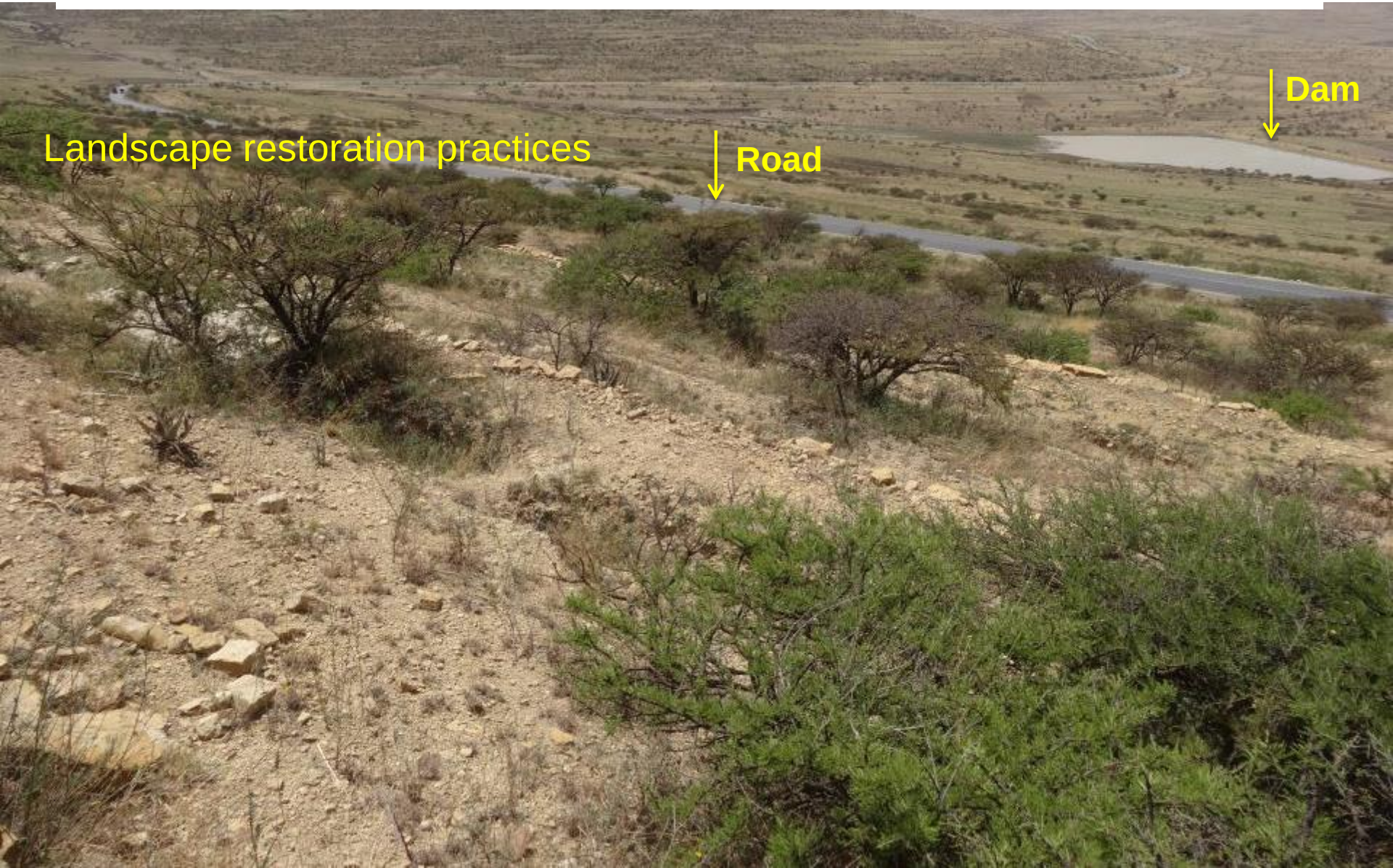
He said Chibalashi Dam in Mansa is also completed and 3.9 cubic litres of water has been harvested.

Bishop Chomba said communities in the two districts are already benefitting from the harvested water which is expected to last up to the start of the next rainy season.

Linking Road Development with land management and dam construction:

- *Reduce siltation from roads and road catchments.*
- *Connect road hydraulic systems with water storage structures including dams.*
- *Promote conjunctive use of surface and groundwater.*

Unmanaged water from roads could be the main source of sediment; leading to siltation of reservoirs (example from Ethiopia)

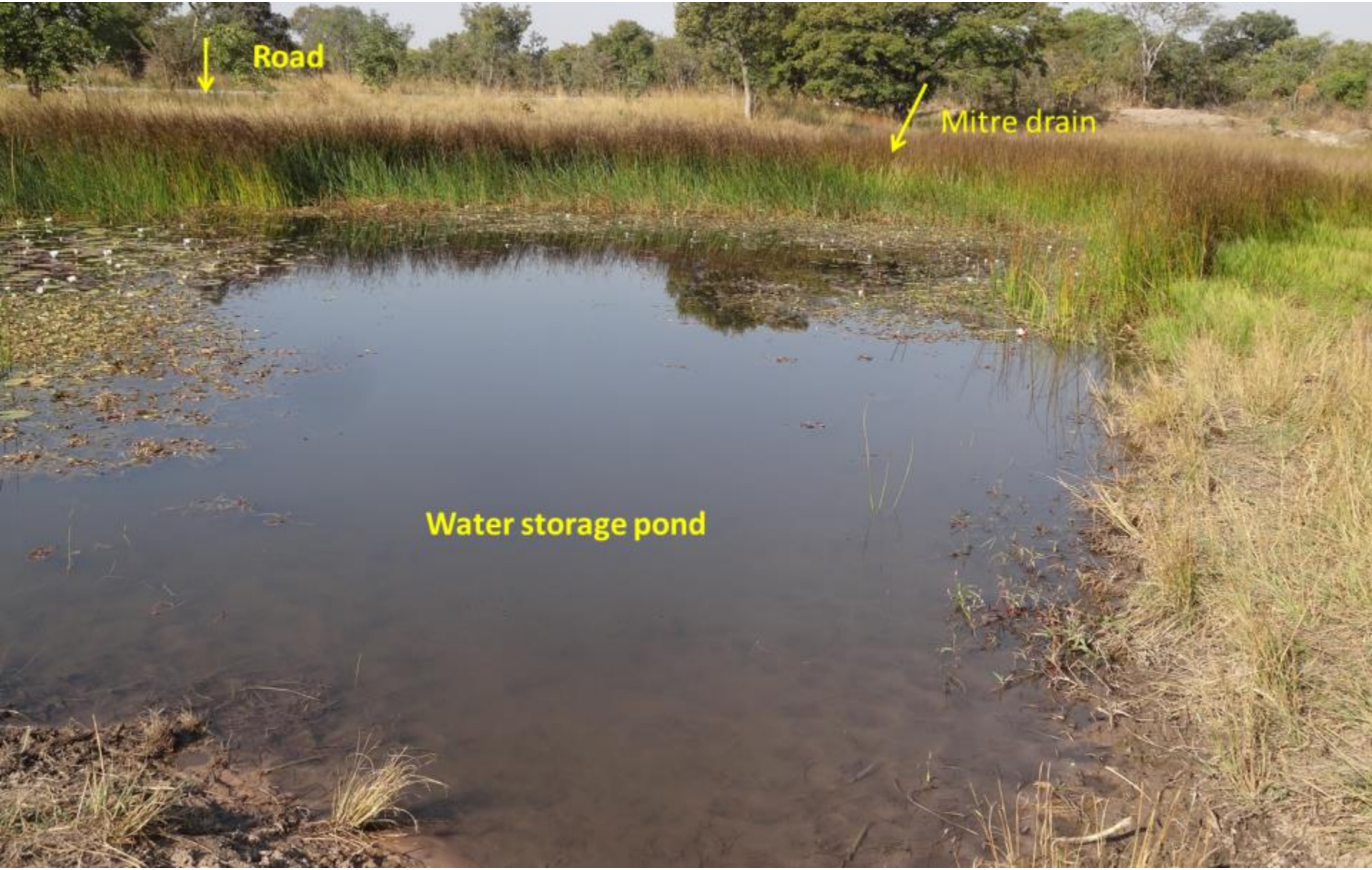


3. Practices: Road Water Management in Zambia

Water from culvert is stored in borrow pit for livestock

Water from roadside is channeled into a borrow pit through Mitre drains

Water from roadside is channeled into a borrow pit through Mitre drains for livestock




Road
Tree plantation
Roadside runoff channeled into a tree plantation
Farm level moisture conservation

Water from roadside is channeled into a borrow pit through Mitre drains for wildlife

Series of borrow pits used for water storage for wildlife

4. Opportunities: Road Water Management for Resilience

- Extensive road development plan that could incorporate water management options.
- Climate change/rainfall variability is challenging rainfed agriculture:
  - Need for Water Harvesting including from road catchments.
- Increase in water demand during off-season for small-scale irrigation.
- Dam construction is in progress:
  - Need to link road development with land management and water harvesting using surface storages.

- Land degradation is increasing (deforestation, expansion of agricultural land, etc.)
  - ➢ *Need to link land management with road development.*
- The topography of most part of Zambia is relatively flat: a suitable scenario for water management using roads.
- Geohydrology of Zambia is shallow GW aquifer system: suitable for GW recharge using water from roads and reduce risks of GW depletion, etc.
- Great interest by all partners: government, private, communities, and financers, etc

Opportunities with new road upgrading: An example

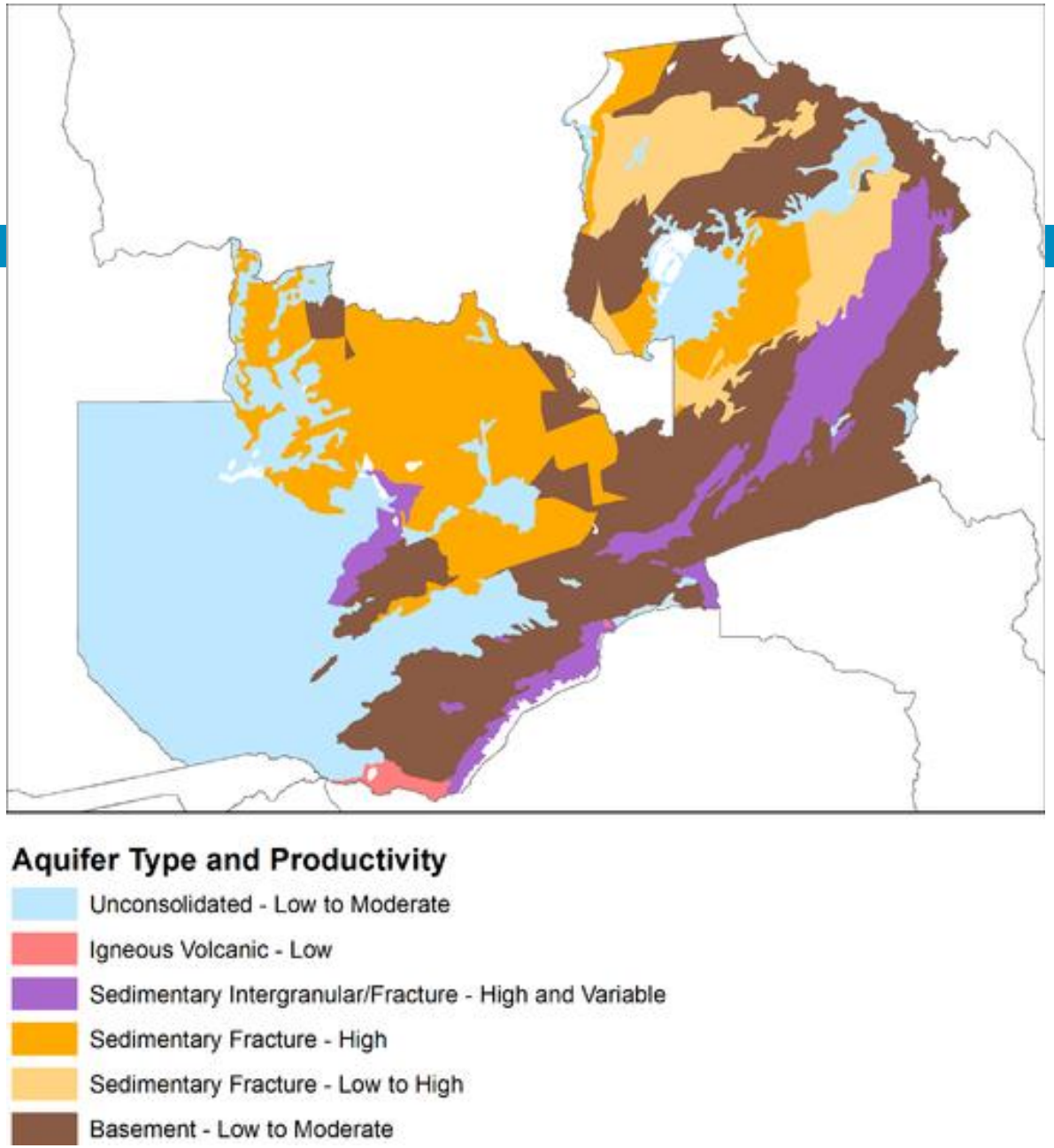
Potentials: Water from roads for surface water storage and GW Recharge

Potentials for sand dam construction to enhance water availability along sandy rivers

Can we use bridges to buffer moisture along stream/rivers?

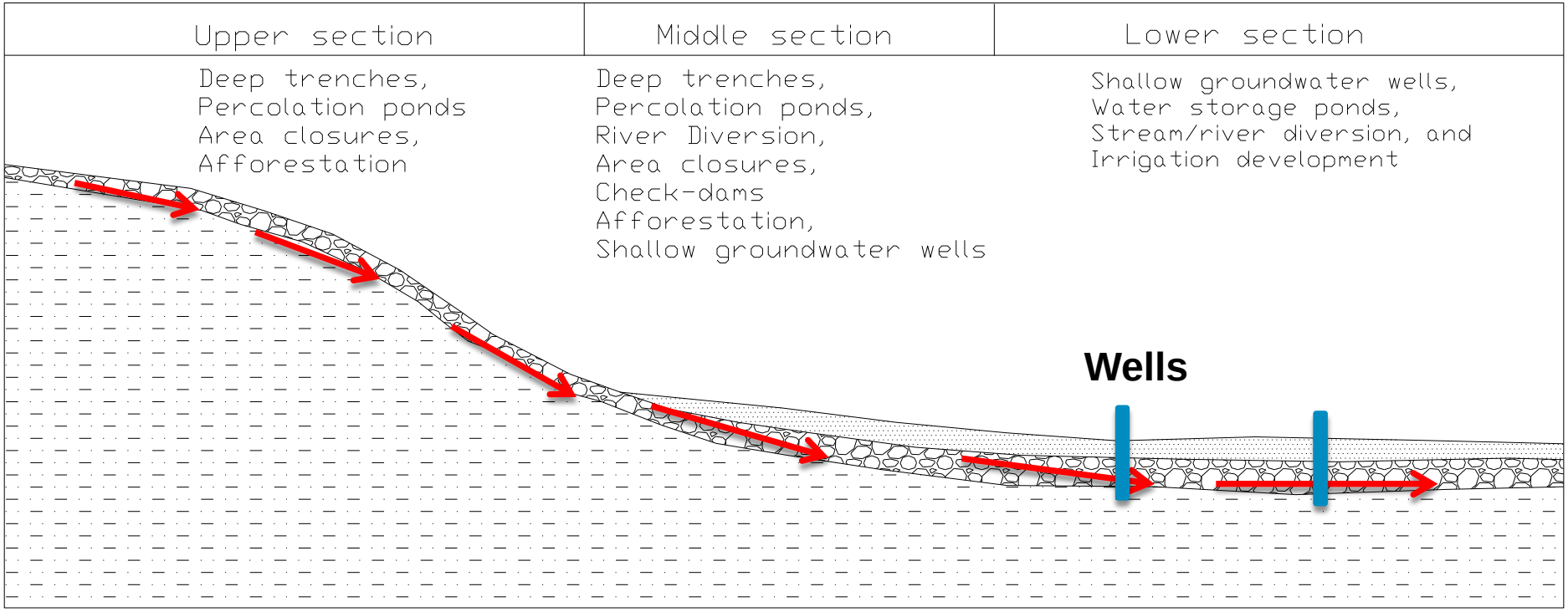
Diesel versus electric pumps for small-scale irrigation

Geohydrology of Zambia



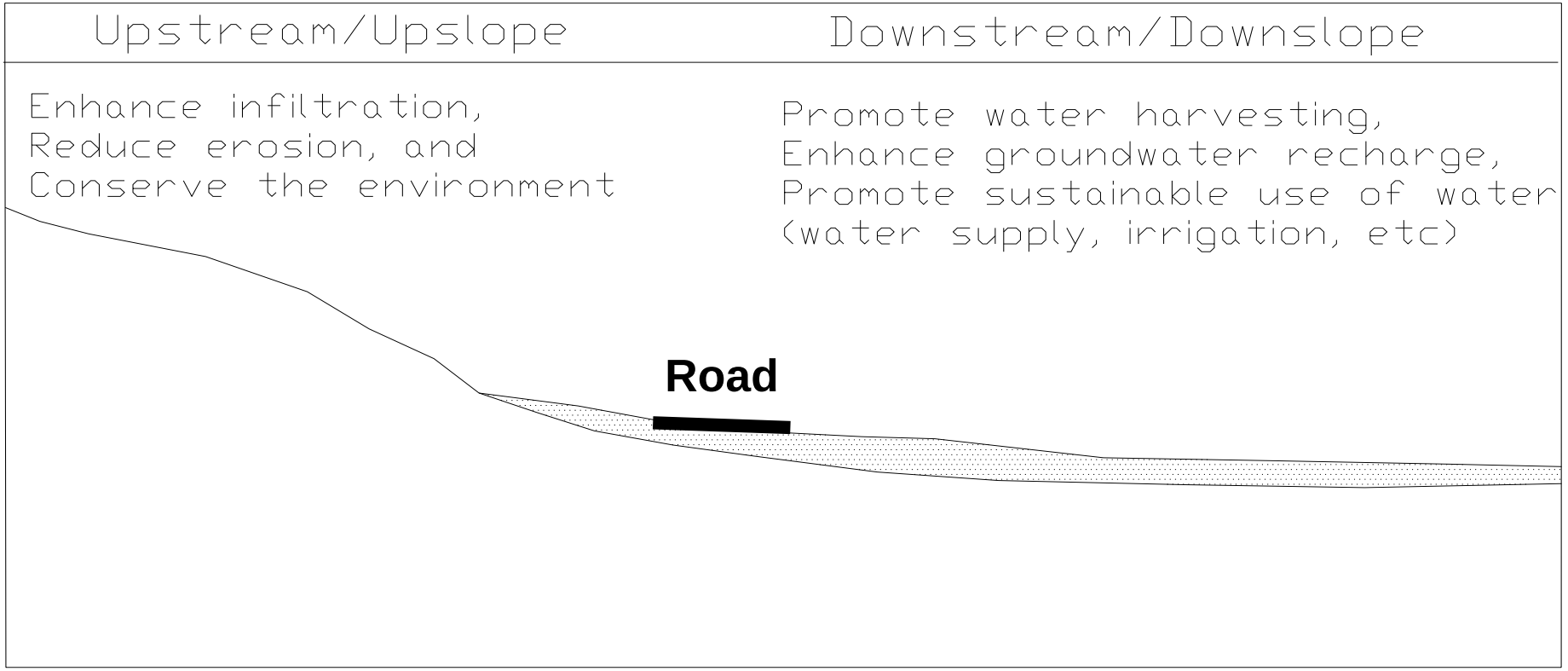
http://earthwise.bgs.ac.uk/index.php?title=File:Zambia_Hydrogeology2.png&filetimestamp=20150610124455&

Typical Geohydrological Model: Most Parts of Zambia



Symbol			
Rock/Soil type	Metamorphic rock	Weathered Metamorphic rock	Soil (Sand, silt, and clay)
Permeability	Moderate	Moderate to high	Moderat to low

5. Promoting Climate Resilient Infrastructure



- *Infrastructure development: based on landscape continuum water management model.*
- *Different techniques along the landscape: upstream, integrated with infrastructure, and downstream.*

5.1 Technologies at Upstream/upslope

Technologies that:

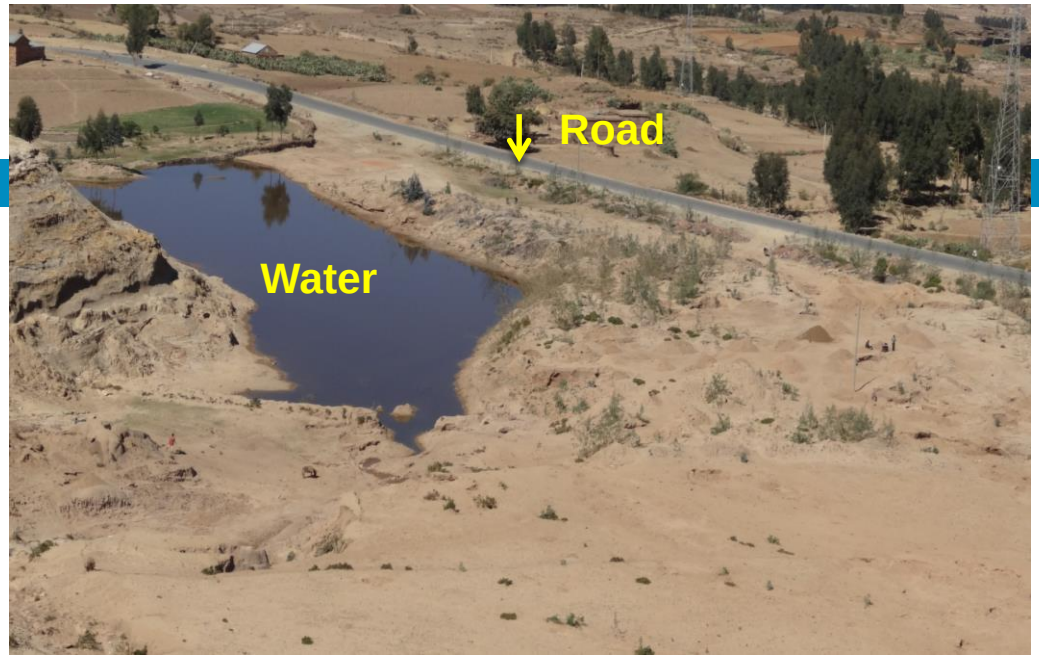
- *Enhance infiltration,*
- *Reduce erosion, flooding and siltation,*
- *Enhance soil moisture and groundwater recharge.*

Example: Surface runoff has reduced by 80% as a result of the upstream intervention.

5.2 Technologies integrated with infrastructures

Roads: as water storages and diversions.

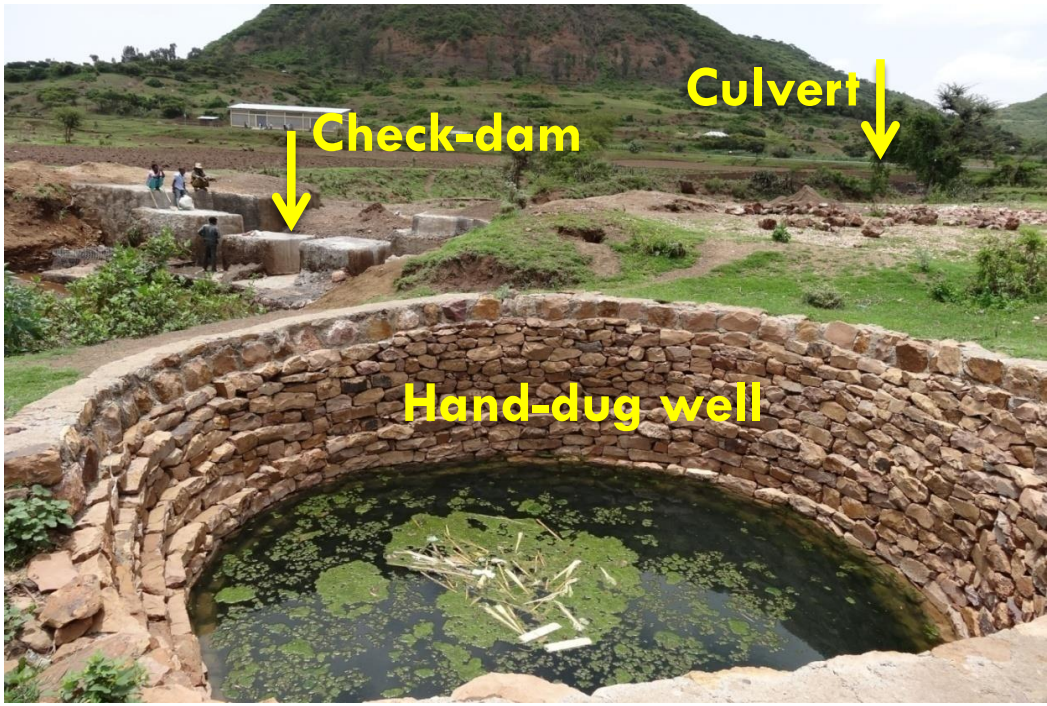
River crossings: water buffering.



5.3 Technologies at Downslope/ Downstream

Promote technologies that:

- Harvest/manage surface water,
- Enhance groundwater recharge,
- Control flooding,
- Reduce negative effects: erosion, siltation, etc
- Promote sustainable/ productive use of water.



6. The Way Forward

- Road development is part of land use planning: need for collaboration among various sectors.
- Resilient infrastructure development could be promoted through:
  - Landscape continuum approach of water management.
  - Design of multi-functional infrastructures.
- Governments, donors and others could align their programs and funding to create resilient infrastructures and enhance environmental management.

Acknowledgement

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- WARMA
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- All who supported the mission and workshop