ROAD WATER MANAGEMENT FOR RESILIENCE

NEPAL ASSESSMENT AND SCOPE OF OPPORTUNITIES

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The Roads for Water Initiative

- **Vision:** To have roads systematically used for water management in 25% of countries in ASIA and 50% on Africa by 2025 and create win-wins between road and water practices
- Working with partners
  - Global Resilience Partnership
  - World Bank
  - International Roads Federation

- Global Road Achievement Award
- Big impact – roads are major investment globally 1-2Tr USD/year + Measures at relative low-cost & life-cycle savings


Floods


Esp feeder roads damaged


Sedimentation


Erosion

Triple Win

REDUCED WATER
DAMAGE
TO ROADS
(-35%, -80%)

And more reliable
Roads

REDUCED
DAMAGE FROM ROADS

Through Flooding,
Erosion and Sediment
Deposition

WATER MANAGED
FOR PRODUCTIVE USE

Rising groundwater levels
and better soil moisture

Water retention

Erosion control

Flood management

Turning things around: Harvesting water from roads in Ethiopia

- Capturing rainfall for dry period as groundwater, soil moisture or surface water
- Implemented since 2014
- Withstanding 2015 El Nino
- Engaged> 2.75 M people in 2015/7 campaigns
- Benefitted 2.4 M people
- Guidelines being prepared
- Outscaling now to Bangladesh, Kenya, Malawi, Mozambique, Tajikistan, Uganda, Zambia, Nepal, Bolivia

Techniques - Three Approaches

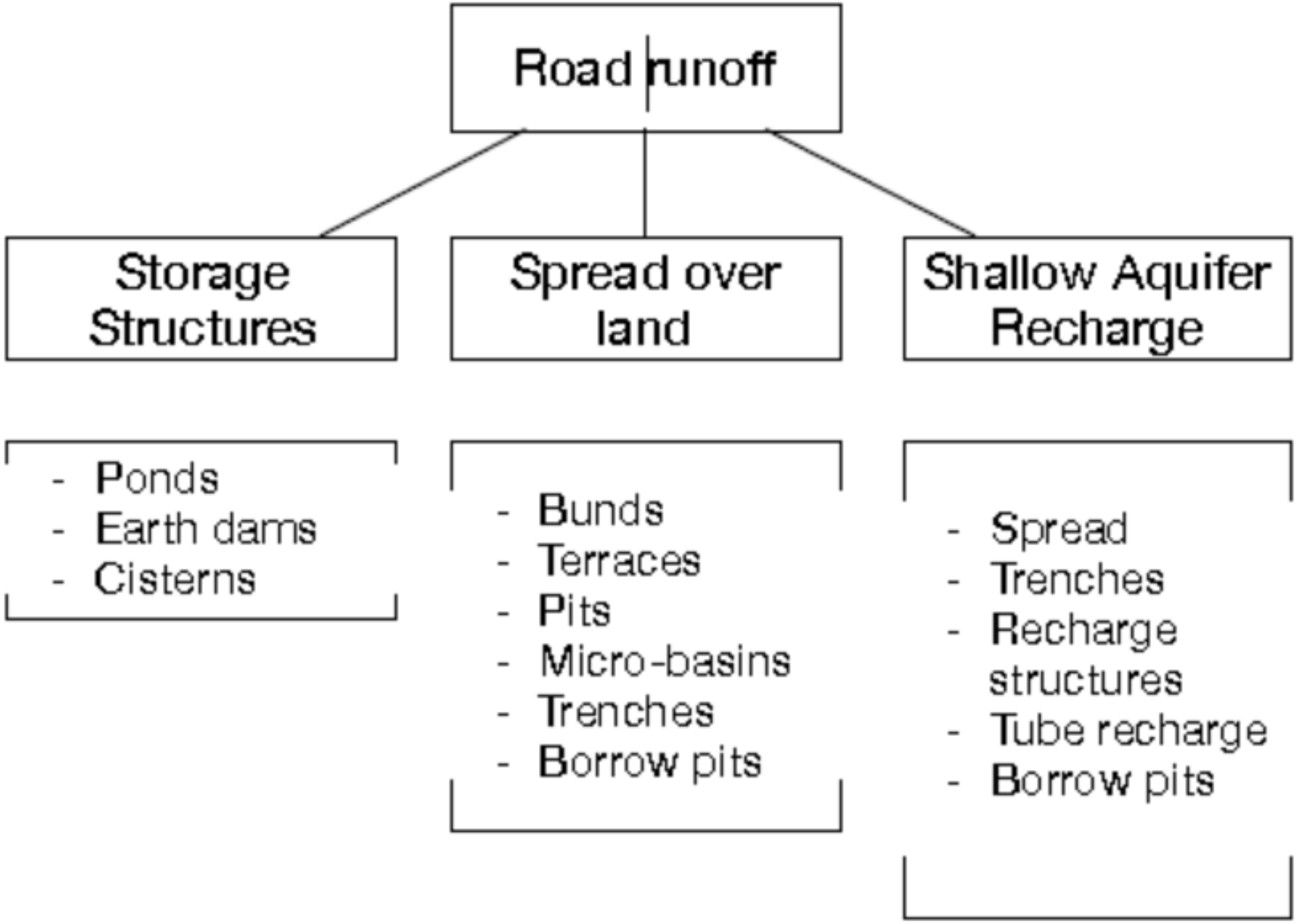
1. Making use of the road as it is for water management
2. Modifying design of the road
3. Additional measures & opportunities

Roads for Water

Different techniques

Adapting to changed road run-off

1. Spreading water from road surface
2. Harvesting water from culverts, side drains and depressions
   - Converted borrow pits
   - Infiltration ponds
   - Infiltration trenches/ pits
   - Swallows
   - Diversions/cutoffs/trenches to farm
3. Gully plugging for recharge
4. Spring capture


Road runoff
Storage Structures
Spread over land
Shallow Aquifer Recharge
- Ponds
- Earth dams
- Cisterns
- Bunds
- Terraces
- Pits
- Micro-basins
- Trenches
- Borrow pits
- Spread
- Trenches
- Recharge structures
- Tube recharge
- Borrow pits

Scour checks and mitre drains

Scour Checks

Gradient	Spacing
< 3%	Not required
3% - 5%	20 metres
5% - 7%	10 metres

Scour check made from sticks

- Sticks about 3 cm diameter 40cm long.
- Hammer sticks into ground so check is 15cm high.
- Apron of stones or grass sods.

Scour check made from stones

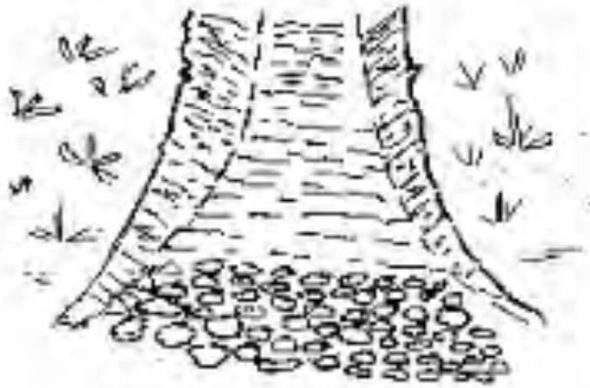
- Same dimensions as stick scour check

Turnout Ditch

Gradient	Spacing
< 4%	100 metres
4% - 6%	80 metres
6% - 7%	60 metres

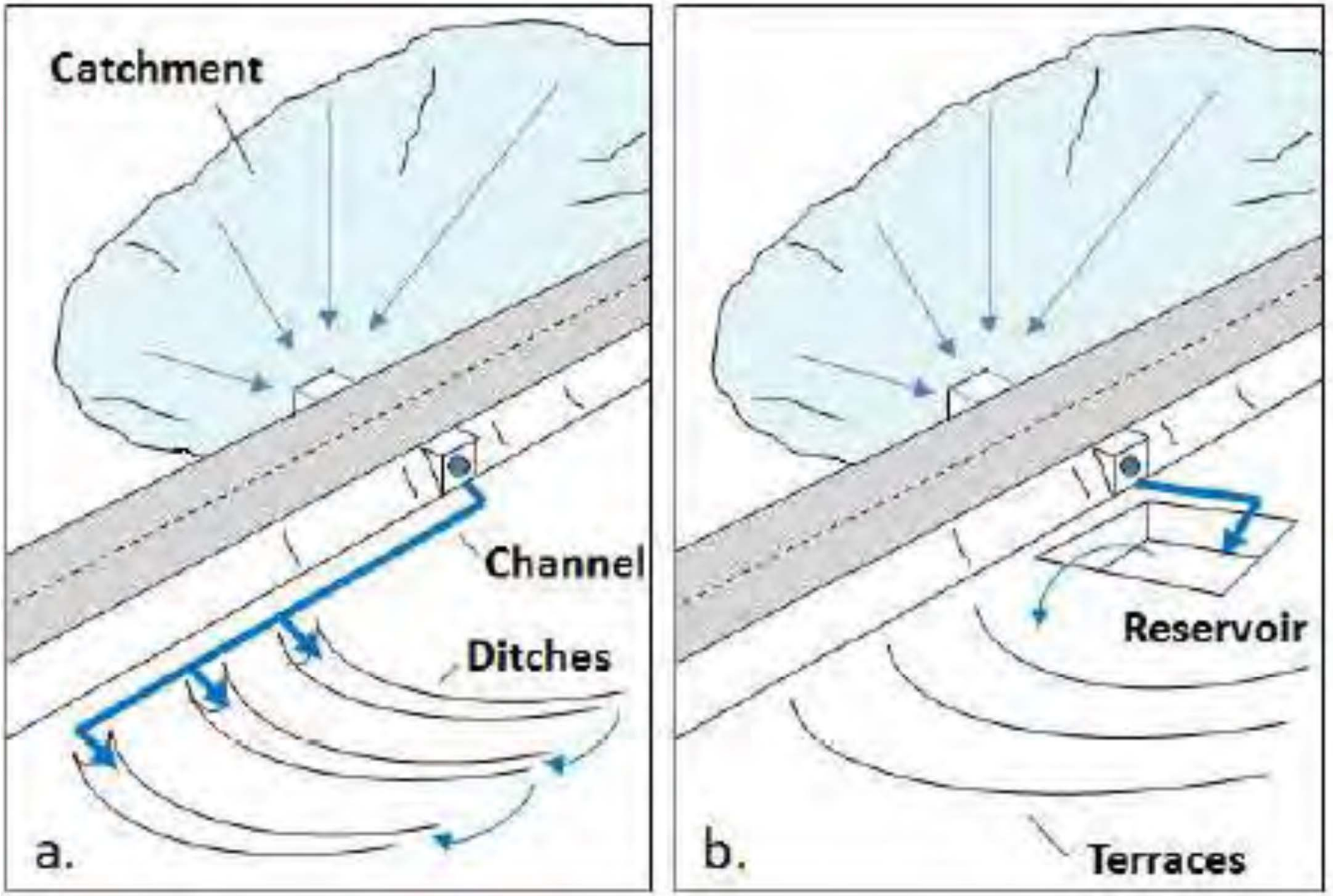
Turnout detail

- Minimum 10 metres long



- Provide stones at end of turnout to prevent scouring

Collecting water from a culvert



Bio-engineering

Gully plugging for recharge

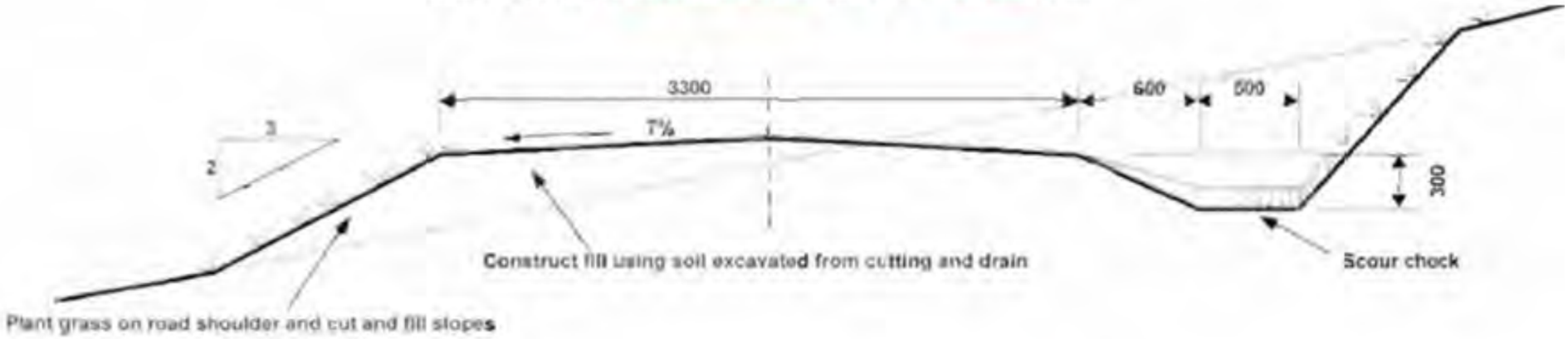
Different techniques

Optimizing road design for multiple functions

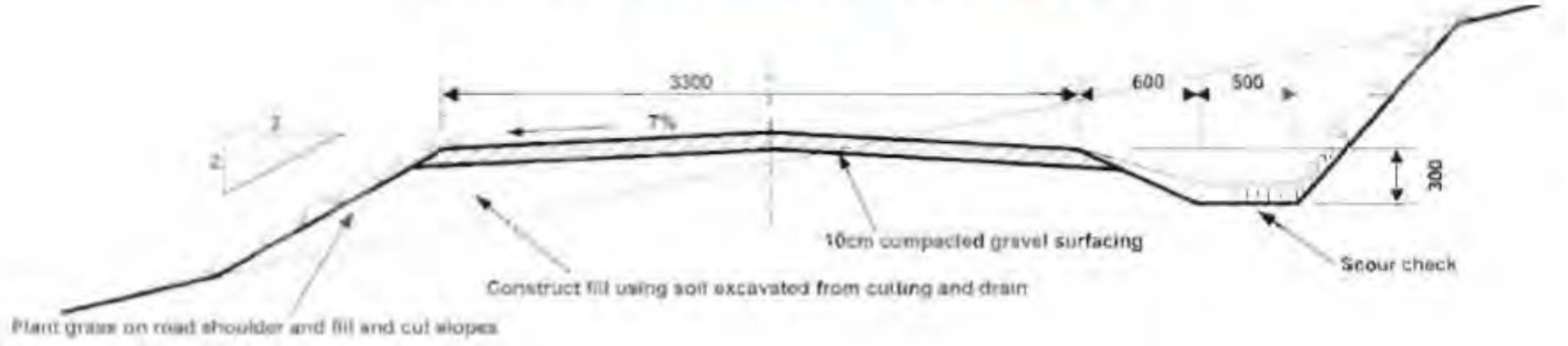
1. Irish bridges/drifts/low causeways
   - Flood water spreading
   - River bed stabilization
   - Acting as sand dams
2. Changing road alignment to recharge areas
3. Optimize culvert location

Road Alignment – mountainous terrain

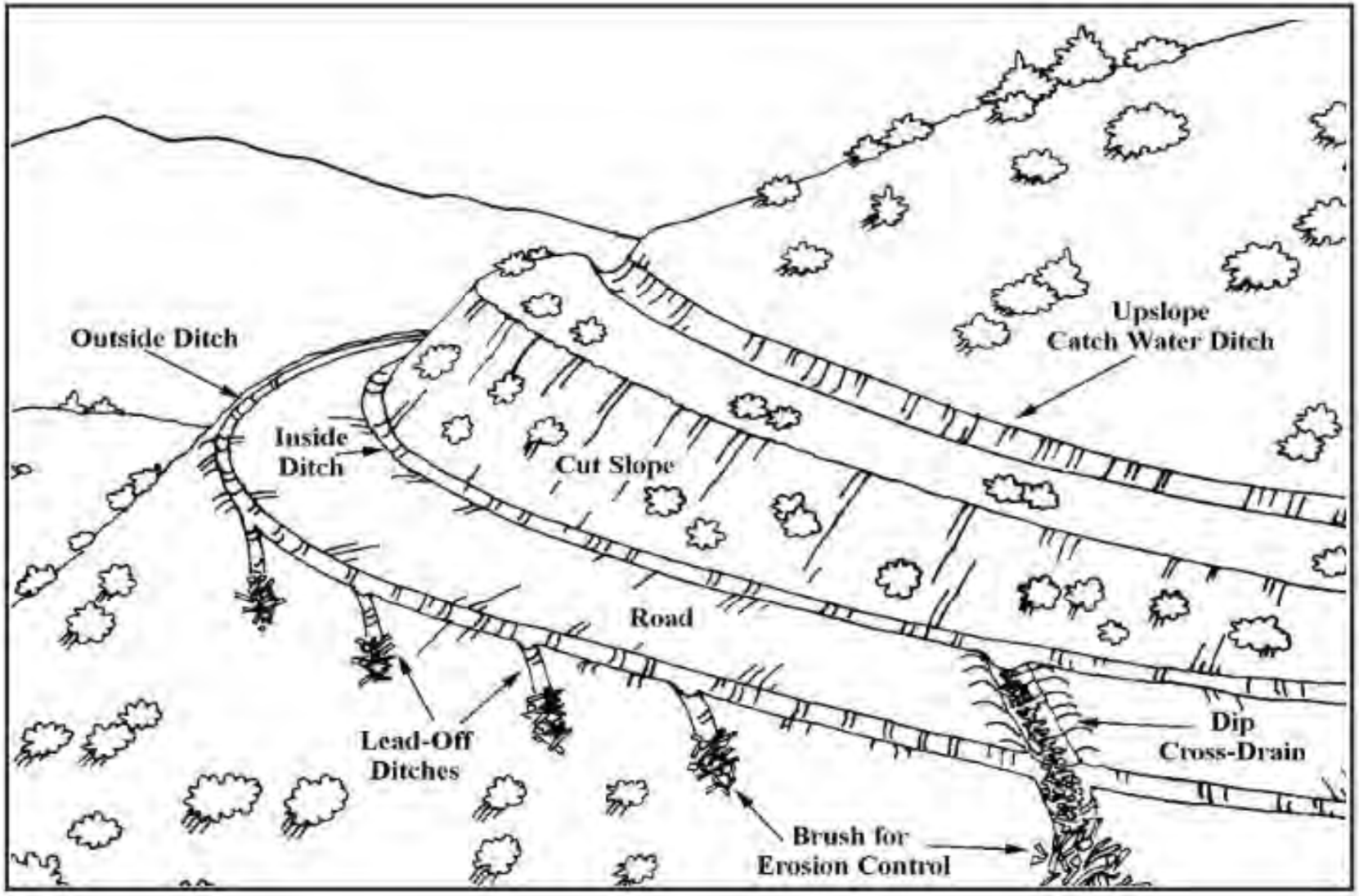
Earth road on mountainous terrain – stable soils



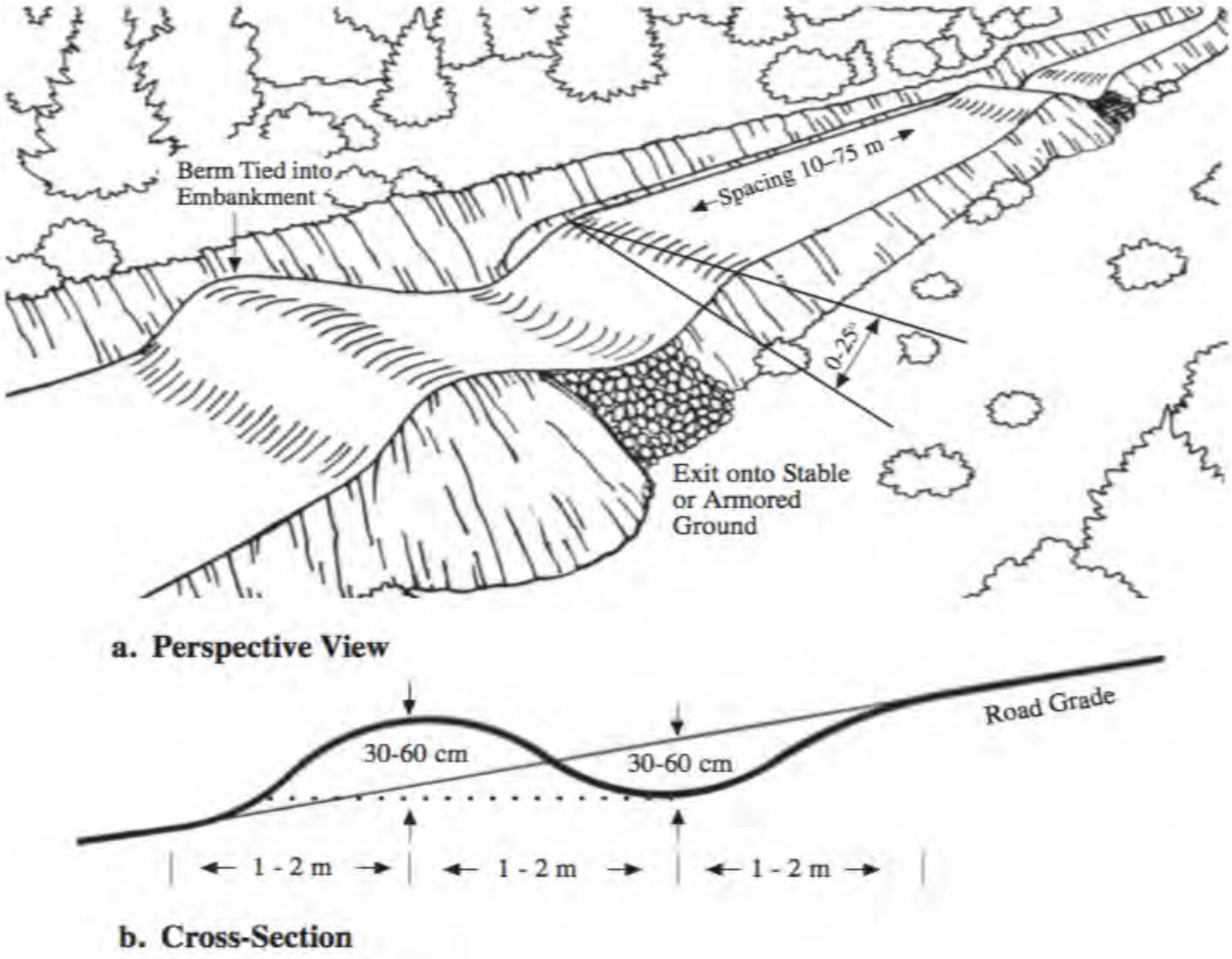
Gravelled road on mountainous terrain – weak soils



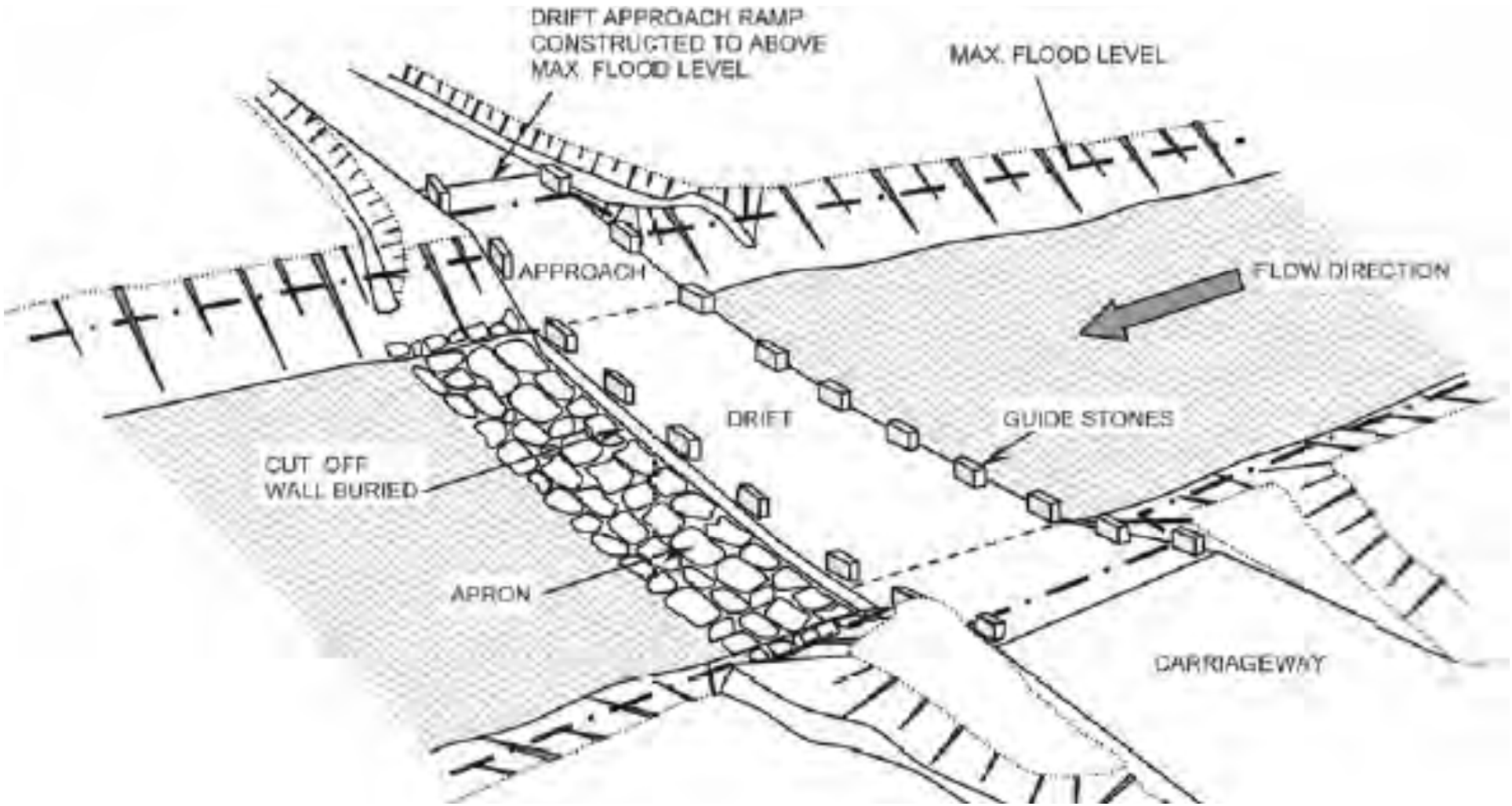
Slopes and ditches in hilly terrain



Water bars/rolling dips



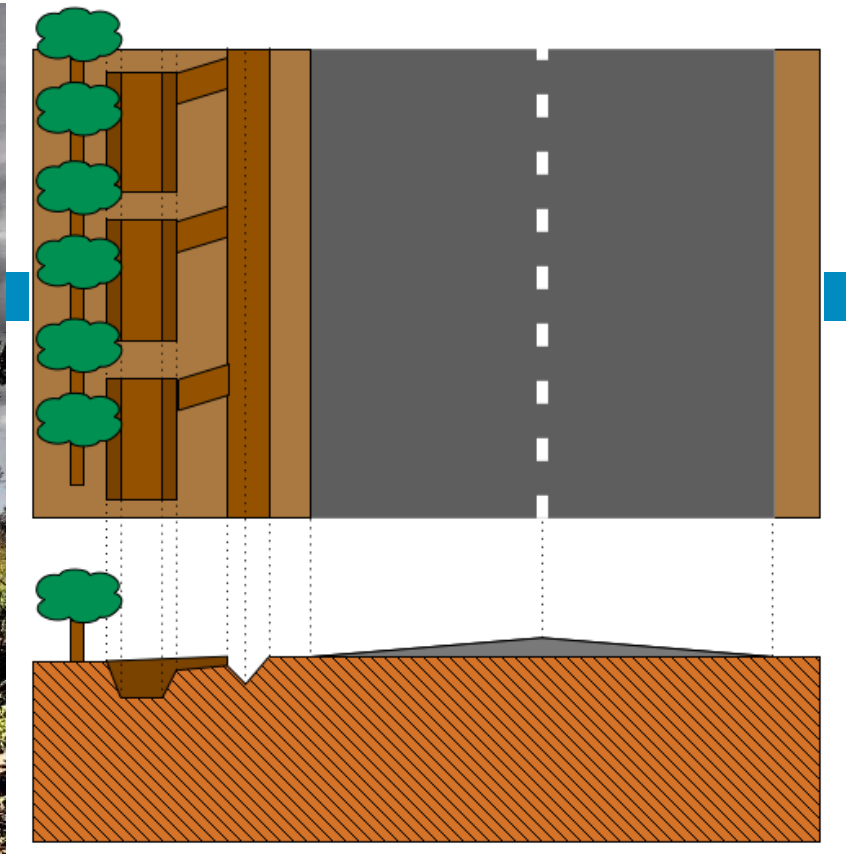
Non-vented drift/low causeway



Many additional opportunities to better use roads for water

1. Controlled sand mining along roads
2. Evacuation in times of floods
3. Road side tree planting
4. Brick making
5. Biological rodent control
6. Intermediate means of transport

>> We can turn roads into development reservoirs



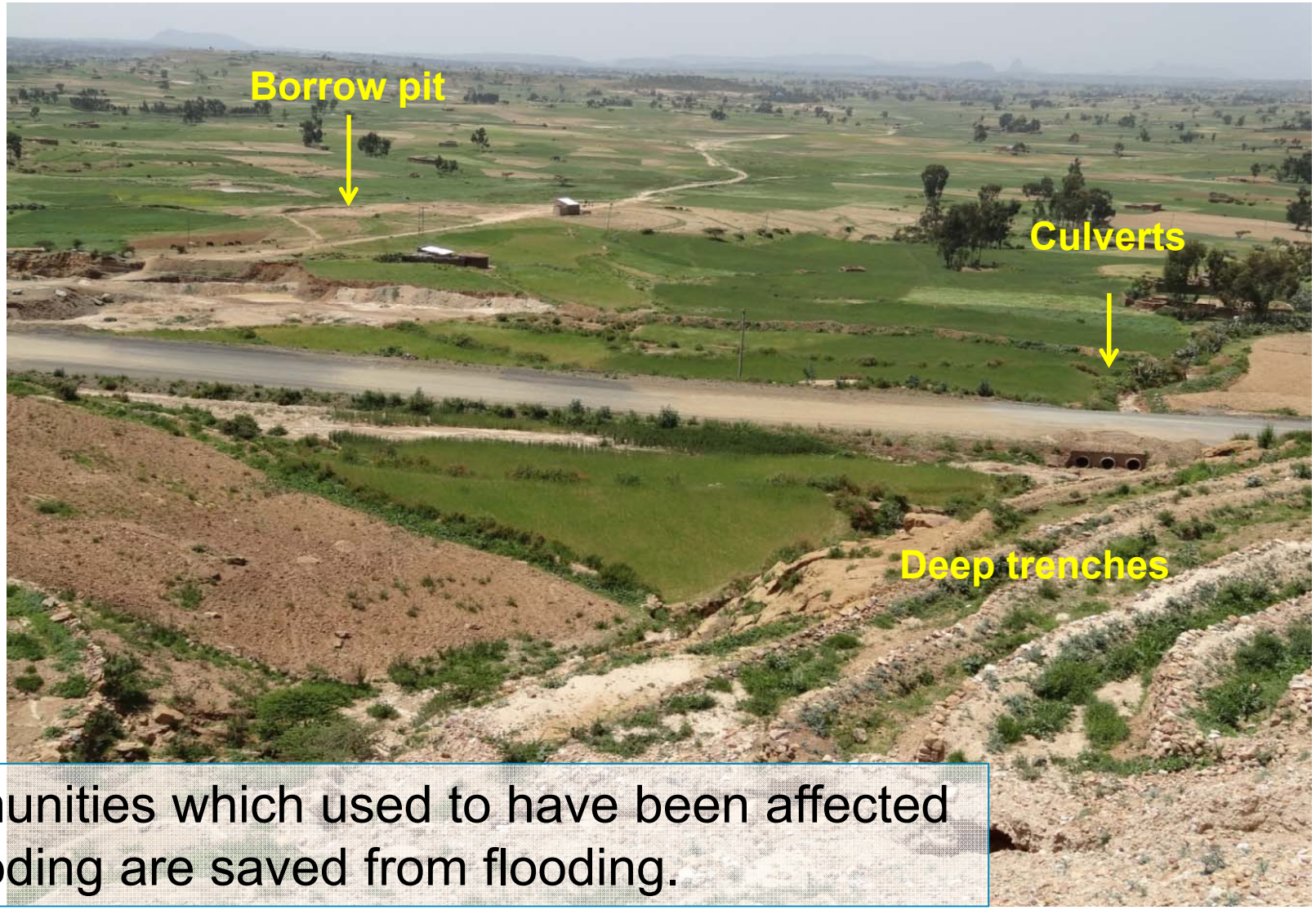
Road side tree planting

Brick making – using runoff sediments

Examples from different countries

ETHIOPIA: ROAD WATER HARVESTING CAMPAIGN

ETHIOPIA: CATCHMENT APPROACH

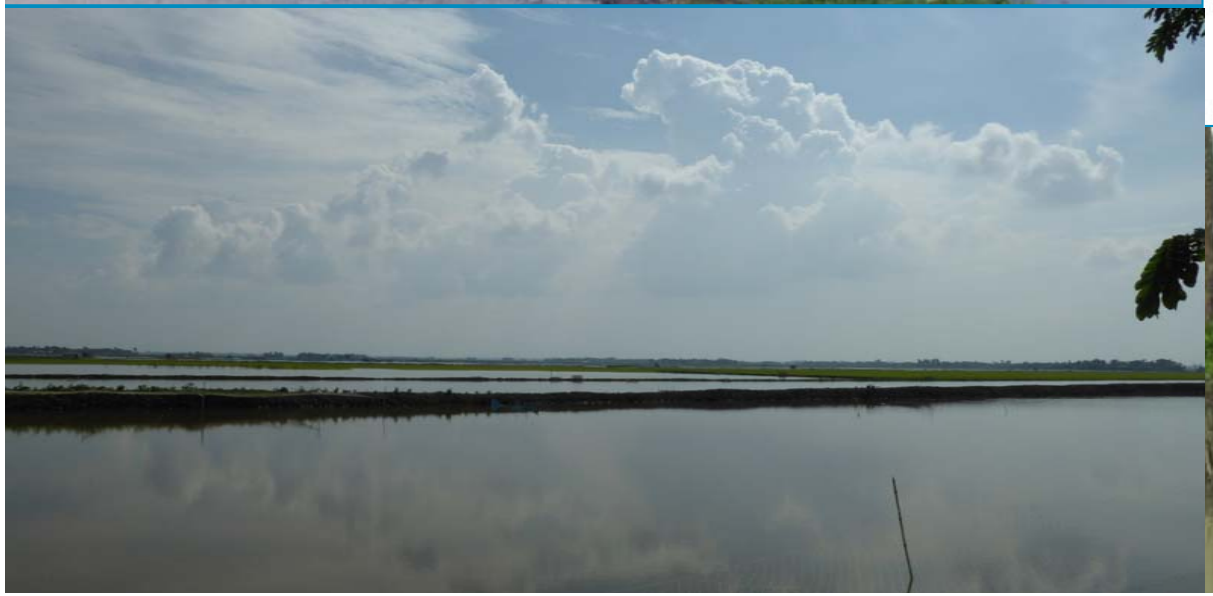


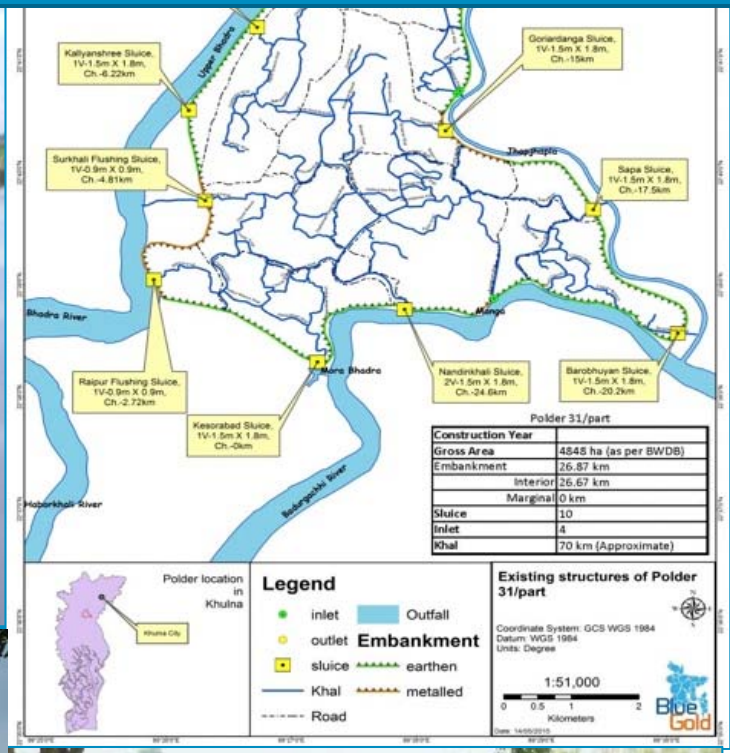
Communities which used to have been affected by flooding are saved from flooding.

MANY COUNTRIES, CONTEXTS AND SOLUTIONS

BANGLADESH: USING ROADS AS EFFECTIVE EMBANKMENTS

BANGLADESH: COASTAL AGRICULTURAL WATER MANAGEMENT WITH ROADS





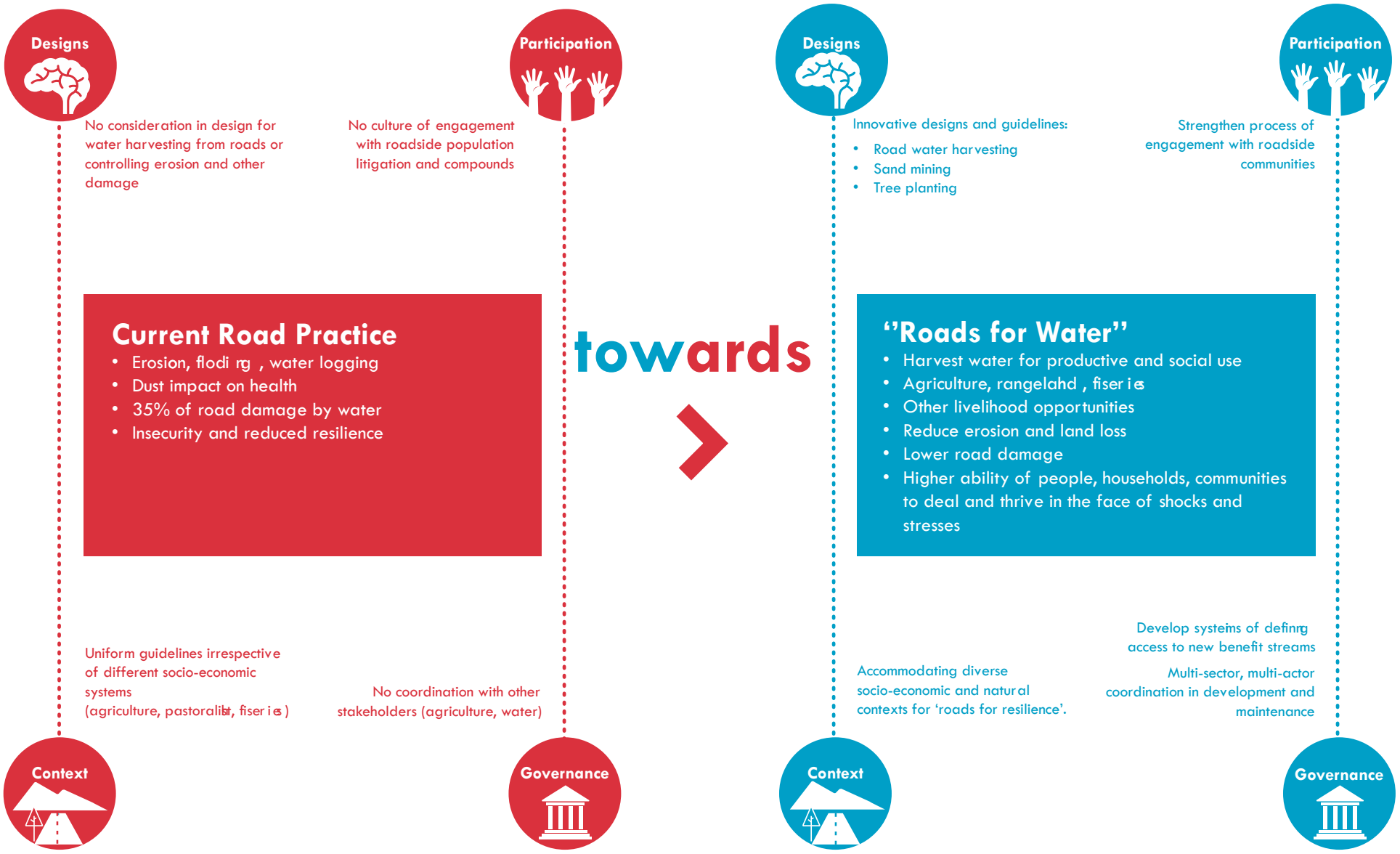
KENYA: ROAD RUNOFF COLLECTED IN STORAGE PONDS AND TRENCHES

KENYA: USING CULVERTS & DRIFTS

Cross-culvert used to harvest water in a trench

Beyond techniques, it's about Governance

1. Integrate in County Programs on Roads and Water
2. Community engagement
3. Change procedures in roads development
   - Manuals
   - Investment budgets
   - Maintenance budgets
   - Cooperation
4. Capacity building
   - Short courses
   - Tools (run-off models)
   - Guided learning
   - Research


Designs
No consideration in design for water harvesting from roads or controlling erosion and other damage
Participation
No culture of engagement with roadside population litigation and compounds
Current Road Practice
• Erosion, flodi rg , water logging
• Dust impact on health
• 35% of road damage by water
• Insecurity and reduced resilience
Uniform guidelines irrespective of different socio-economic systems (agriculture, pastoralibt, fiser i es)
Context
No coordination with other stakeholders (agriculture, water)
Governance
towards
Designs
Innovative designs and guidelines:
• Road water harvesting
• Sand mining
• Tree planting
Participation
Strengthen process of engagement with roadside communities
"Roads for Water"
• Harvest water for productive and social use
• Agriculture, rangelahd , fiser i es
• Other livelihood opportunities
• Reduce erosion and land loss
• Lower road damage
• Higher ability of people, households, communities to deal and thrive in the face of shocks and stresses
Accommodating diverse socio-economic and natural contexts for 'roads for resilience'.
Context
Develop systems of defining access to new benefit streams
Multi-sector, multi-actor coordination in development and maintenance
Governance

Now, let's go to Nepal

NEPAL: CHALLENGES IN ROAD CONSTRUCTION - TERAI

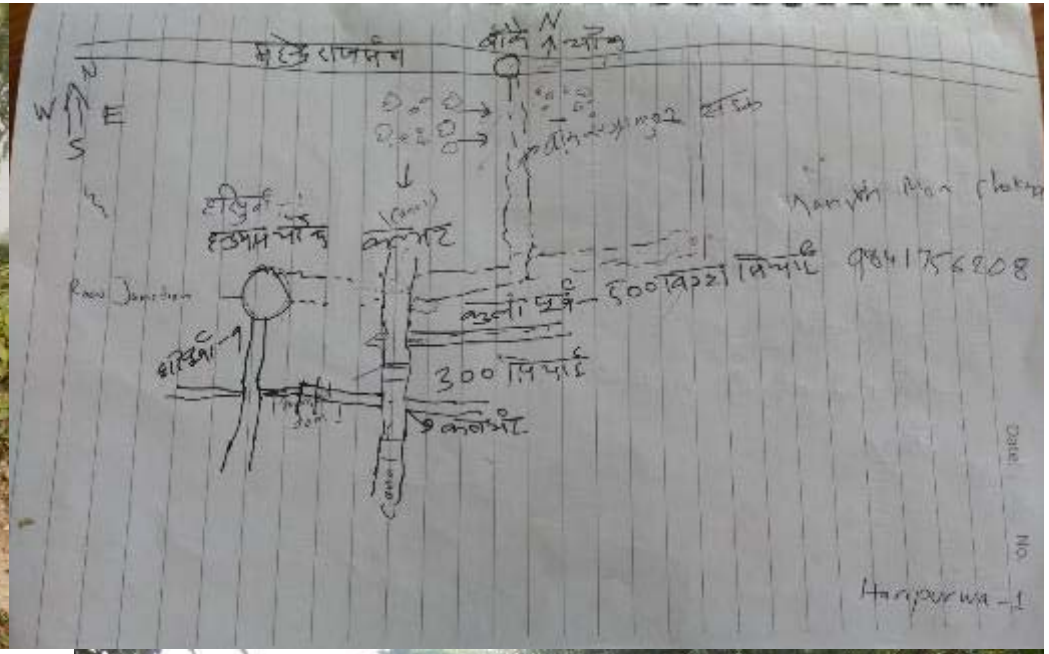
River embankment and sedimentation leaving little space for water to flow.
Problems of flooding, washed away bridge apron and blocked culverts.

NEPAL: OPPORTUNITIES IN ROAD CONSTRUCTION - TERAI

Cross-culvert and side drains used to harvest water for farming

Water stored in succeeding ponds

NEPAL: OPPORTUNITIES IN ROAD CONSTRUCTION - TERAI



Farmers have tapped into increased water flow due to road construction. Making use of road infrastructure.

Summary opportunities Terai

1. Compartmentalization
   - Gated culverts
2. Road embankments for flood protection
3. Road side ponds and trenches for water collection
   - Irrigation
   - Groundwater recharge

NEPAL: CHALLENGES IN ROAD CONSTRUCTION - HILLS

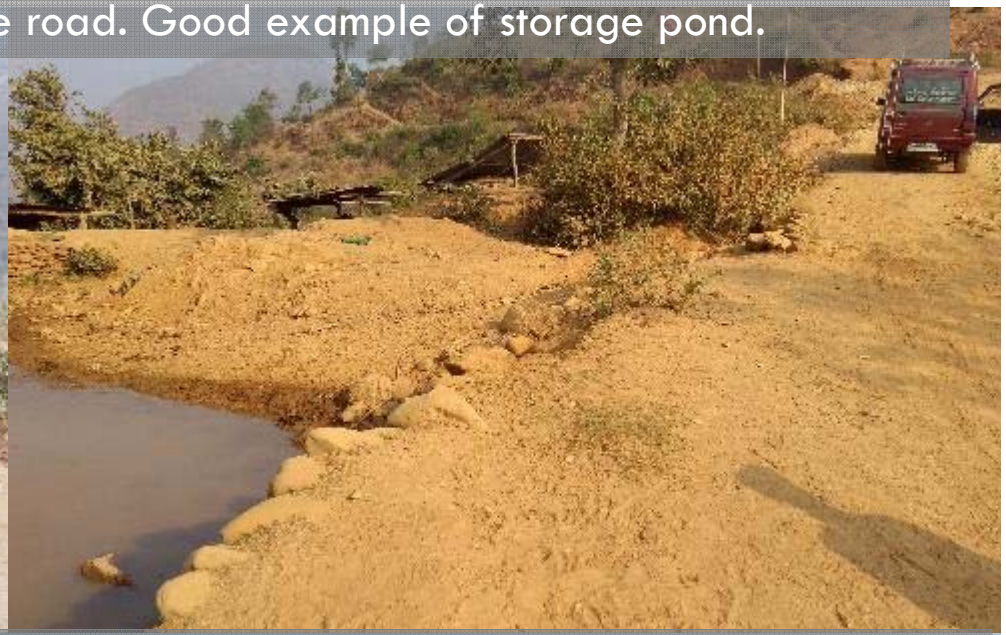
Issues: Landslides, destabilized slopes, sedimentation of rivers (also opportunity), debris blocking irrigation systems.

NEPAL: OPPORTUNITIES IN ROAD CONSTRUCTION - HILLS

Connecting road drainage to irrigation systems. Also in urban areas

NEPAL: OPPORTUNITIES IN ROAD CONSTRUCTION - HILLS

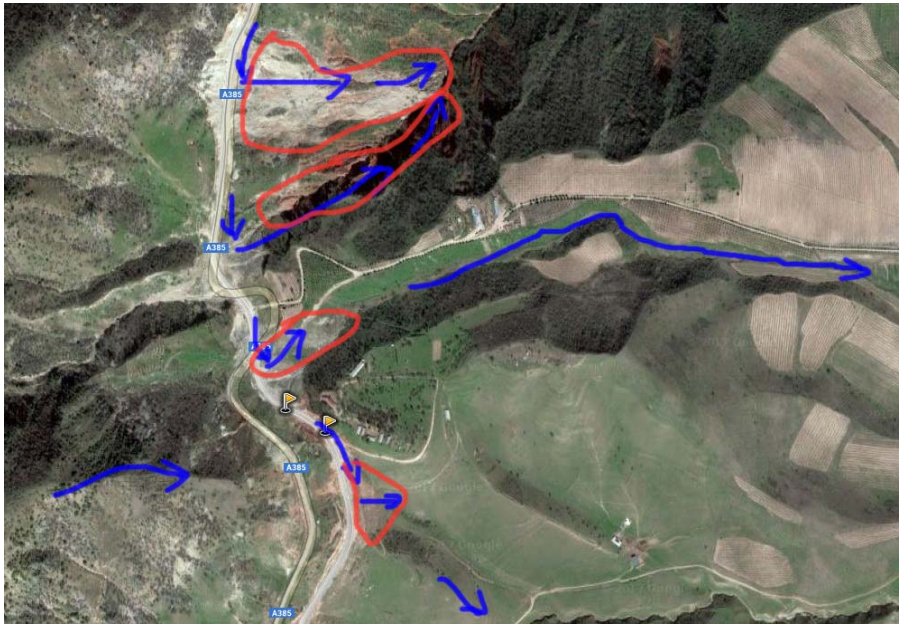
Using side drains to harvest water from the road. Good example of storage pond.



Erosion of the road – while agricultural land is adjacent. Opportunity to direct water to farmland

Summary opportunities Hills/Mountains

1. Link road drainage to irrigation systems
2. Stabilize hill sides with water retention systems combined with bio-engineering
3. Improved siting/locating of road + water structures
4. Controlled sand mining of sedimented rivers



Discussion

1. Challenges, good practices, opportunities
   - Drought - Flood
2. Role of governance – coordination
   - Public participation
   - Experiences?
3. Opportunities for linkages – partnerships
   - Climate change resilience

Road for water alliance

1. Work with water-road-urban-agriculture programs
2. Work on optimized practices
   - Pilot projects
   - Upscaling programs
   - Guidelines and designs
3. Capacity building
   - Short courses
   - Guided learning
   - Tools and research
4. www.roadsforwater.org

Join us!

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PARTNERSHIP

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