APPENDIXX XV [PCTA Item 6.3]

Agenda for the Second Meeting of the
TASK FORCE ON SEDIMENTATION OF RESERVOIRS (TF-SEDIMENTATION)
Tehran, Iran
16 October 2011: 09:00-12:30 hours

Year of Establishment: 2009

Terms of Reference: To look into the aspects of Sedimentation of Reservoirs and to come up with recommendations for appropriate strategies.

Members: (1) Mr. Hazrat Umar, Chairman (Pakistan, 2010); (2) Mr. David Meigh (UK, 2010); (3) Mr. Darwin Lubis (Indonesia, 2010); (4) Mr. Iman Ramdhani (Indonesia, 2010); (5) Mr. Syed Mansoob Ali Zaidi (Pakistan, 2010); (6) Mr. Reynaldo L. Baloloy (Philippines, 2010); and (7) Er. M. Gopalakrishnan, Secretary General, ICID.

Permanent Observer: PH Peter S. Lee, UK.

Item 1 : Confirmation of minutes of the 1st meeting of TF-SEDIMENTATION held in Yogyakarta, Indonesia

The minutes of the 1st meeting of the Task Force were circulated amongst the members. The TF will approve the minutes with amendments, if any.

Item 2 : Membership of the Task Force

ICID Central Office vide its letters of 3/10 March 2011 invited nominations from all the National Committees/ Committee of ICID for the membership of the Task Force. In response the following nominations have been received:

- Mr. Jack H. Meldrum (United Kingdom)
- Dr. U.C. Kothyari (India)

CVs of the above nominees will be tabled at the meeting for consideration.

The TF may also like to nominate a Vice Chair and a Secretary.

Item 3 : Terms of Reference

A short presentation prepared by PH Peter Lee was shown at the meeting. The presentation focused on sedimentation experiences and strategies highlighted the following:

- Sediment (especially bed load) discharge needs better measurement;
- Modelling of sediment rates may appear adequate but extreme events can trigger exponential increase in sediment inflow;
- Total sedimentation estimates is based on probability and may not give guide to useful life;
- Much experience relates to run-of-river barrage sedimentation rather than reservoir silting; and
- For reservoirs often dredging is the only solution.

It was brought out that long term solutions for controlling sedimentation must start with the catchment areas before moving on to the reservoirs themselves as well as other irrigation infrastructure in sediment laden rivers. A note prepared by David Meigh (UK) is shown as **Annex**.

After discussion, it was recommended to modify the emphasis of the TF to 'Sedimentation of irrigation barrages, weirs and intakes' in view of the following:

- There appears to be a lack of interest among members, particularly from South East Asian region who are mainly concerned with weirs and barrage sedimentation,
- The subject of major dam sedimentation is a core concern of ICOLD who have members with greater experience in this problem,
- The main centres of knowledge of sedimentation of Himalayan dams are in the Himalayan catchment countries themselves and the consultants that have worked with them,
- Sedimentation of barrages and weirs has greater relevance to ICID members worldwide than just the sedimentation of Himalayan major dams, particularly for irrigation systems in Indonesia, Philippines, Vietnam and other Asian countries where climate change, deforestation, land degradation, erosion and sedimentation of irrigation systems is of paramount importance.

In light of the above comments, the Task Force will evolve a more clearly defined term of references in this meeting by mutual discussion amongst the members.

Item 4 : Evolving work plan

Owing to low attendance at Yogyakarta meeting, the discussion on work plan of the TF was postponed to Tehran meeting. The Task Force members will discuss and prepare a draft work plan of activities to be completed in its proposed tenure.

Item 5 : Any other business

Annex [Appendix XV, Item 3]

ICID TASK FORCE ON SEDIMENTATION OF RESERVOIRS
(Note prepared by David Meigh, UK)

Long term solutions for controlling sedimentation must start with the catchment areas before moving on to the reservoirs themselves as well as other irrigation infrastructure in sediment laden rivers. Experience gathered so far is briefly summarized below;

1. Catchment /Watershed Management

This depends on the current land use and the need for spatial planning.

1.1 Forest conservation

Existing forests must be conserved especially on steep slopes and also for biodiversity as they provide the best means of preventing erosion and storing runoff and hence preserving river base flows, reducing flood peaks and minimising sedimentation at downstream structures.

1.2 Agricultural land

Improved agricultural practices are required to minimise soil erosion including integrated agriculture: field crops integrate with trees and bushes to hold the soil, mulching and avoidance of clear weeding, change to tree crops on steep slopes or regenerating forest. However, there are usually social aspects that must be understood such as short tenancies or illegal occupation where farmers have no guarantee of planting tree crops of obtaining the benefits and poverty needs where short timeframe economics are prevalent. Consequently interventions require long term legal land use. Countries in Asia are seeing frequent landslips/ landslides/ mudflows on previously forested land that is now being used for annual cropping. On smaller irrigation schemes, the WUAs can have an active role in catchment management and protection.

1.3 Improved Range Management

Improved range management in many hill areas and on erosive soils needed particularly where animals prefer selected, overused pathways or overgraze. Rotating land use or rotational grazing needs introduction.

1.4 Severe Terrain

The Himalayas are a recent and active mountain range of fold mountains caused by the Indian tectonic plate advancing into the Asian plate. Slopes are being steepened by natural forces so that rockfalls and landslides are also natural phenomena. Countries in this region are limited by what they can do in terms of engineering solutions and economic prioritisation will mainly focus on measures to protecting roads and habitation by stabilising slopes.

2. Interventions in Catchment Areas

2.1 Re-greening

The most effective interventions are likely to be the re-greening of damaged slopes and erosion hotspots by a mixture of vegetation that intercepts and reduced the energy of rain droplets, covers the ground with vegetation acting as a mulch to detain precipitation to facilitate percolation, holds the soil together with varying depth of roots and stabilises rivulets. Often grasses such as vetiver are used but also combinations of plants that also provide incomes to communities.

2.2 Engineering Interventions

Usually the greatest priority are slope protection measures, such as repairing landslips along roads and canals and to protect habitation, with gabions being a preferred form of construction.

Care must be taken with engineering interventions particularly with erosion check dams and gully head structures in erosive areas where inexperienced use can result in much greater damage. Check dam cascades need to be advanced upstream from stable baselines.

Serbo dams have been built in active volcanic areas to control lahar flows but the designs tend to be expensive and other options using the lahar material with protective spillways should be considered.

3. Sediment Entering Reservoirs

The scale of most reservoirs in the Himalayas means little can be done to intercept and remove sediments except build another major dam upstream in a staircase fashion. This appears to be an unsustainable and uneconomic solution to the problem whilst the cost and timescale of planning and implementation means that the downstream reservoir will have already lost a good proportion of the service life before the upper dam becomes operational (the current situation for proposals for Dasu and Basher reservoirs above Tarbela). Such proposals should be accompanied by end of service life plans for the sustainable use of the silted basin such as for agriculture and groundwater storage.

Dredging of reservoirs appears an expensive option unless a commercial use can be found for the material. One of these could be the construction of the more permeable parts of any upstream dam.

For smaller dams in Asia, particularly near towns and cities, the possibility of intercepting sediment in upstream sediment traps should be considered as such areas usually have a high demand for building sands, gravels and stones. Such traps could be operated commercially and the revenues valuable sources of income for O&M funding.

The planning of reservoirs should therefore include careful estimates of incoming sediments particularly during severe events to estimate useful life, available storage and possible later use.

Most large dams have sluicing facilities but these are rarely used on a routine basis for sluicing through sediments as they take a large time span out of hydro generation, irrigation scheduling. Sluicing is not usually that effective in large basins whilst the operation usually has to take place during the dry season when inflows are usually less than sluicing capacity.

4. Sediments Arriving at Barrages, Weirs and Intakes

This subject is of greater relevance to most irrigation departments in SE Asia as the number of weirs under their control usually outnumbers dams by some 100 to 1. Progressive deforestation of catchments has seen a gradual increase in the sediment volumes arriving and changes to the river morphology in which they are sited. Free intakes are particularly susceptible to river morphology changes and if not carefully selected in stable river channels or at permanent rock pools and invariably become ineffective due to river morphology changes or increased river bed elevations. Careful site selection and design of weirs and barrages can reduce the volumes of bed loads abstracted into main canals but even here there are common problems:

- Changes in river bed morphology, and rising downstream river bed levels in particular, can render the original design of sediment exclusion works useless to hydraulically flush sediments
- Increasing weir heights to facilitate greater flushing head can cause major upstream flooding and downstream erosion with resulting failure of stilling basins.
- Desilting basins are often poorly designed without the designer understanding basic hydraulics causing choking at control gates, low flushing velocities and material that will not flush.
- Lack of routine O&M allows sediments to solidify, making them harder to flush whilst on larger schemes designers rarely design multi-channel desilting basins that would allow continuous operation.
- Gated barrages can overcome some of these problems as they can provide a better balance to sediment transport along the river section but are far more expensive and can still be vulnerable to river morphology changes.