International Labour Organization

Guidance Note on Employment Intensive Tank Rehabilitation

Jobs for Peace & Resilience Programme – Sri Lanka

FOREWORD

Community based minor irrigation systems have proven an effective tool for water harvesting. In Sri Lanka, small-holder farmers have successfully utilized the system to capture seasonal rainfall to cultivate paddy and other crops in the dry zone. Water harvesting is often based on minor tanks, which are constructed by damming a natural stream, or a depression used to collect rainwater.

Ensuring year round access to water helps reduce the vulnerability of smallholder farmers and secure higher incomes. In recent years, the need for water harvesting systems has become even more critical with the effects of climate change. However, lack of maintenance and breaches arising from floods has meant that many of the smaller tanks are in a state of disrepair and require significant investments for rehabilitation.

Earlier tank rehabilitation programmes have often not been sustainable due to the lack of local community involvement. Beyond the engineering mechanics of tank rehabilitation, it is so important to identify ways for local engagement. The development of this basic technical guide on minor tank rehabilitation working with local farmers' organizations and with technical backstopping from the Department of Agrarian Development makes for an important contribution to address this key issue.

This guide has been developed as part of the ILO's Jobs for Peace and Resilience Programme in Sri Lanka. It represents an important tool to promote sustainable and labour intensive rehabilitation of minor irrigation systems with the engagement of local farmers and officials of the Department of Agrarian Development.

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Content

1 Tank Rehabilitation

Water harvesting facilities include minor tanks, which are constructed by damming a natural stream or a depression used to collect run off water for infiltration purposes. The command area of a minor tank is equal or less than 80 ha. The catchment area differs according to the soil type and the topography. Normally a minor tank is a farmer managed irrigation system at village level. A minor tank could be an individual tank or could be a part of a cascade system. There are around 14,200 minor tanks recorded in Sri Lanka but there are many more unrecorded or abandoned1. On average, a minor tank has a command area of 13 ha and a water spread area of eight ha. The capacity varies from 12 – 37 ha. m. Cultivable area under a minor tank is six ha on average and supplies some 26 farming families for cultivation and has an eco-system around it. A minor tank has components such as bund, sluice, spill and a command area. The command area has four phases high flood phase, shallow phase, deep phase and dead storage phase. These phases varies from tank to tank and with different eco systems.

In the dry zone, there are several small tanks in need of restoration and rehabilitation as components of integrated rural development projects to ensure climate resilience of the farmers of this region. Although some tanks have sufficient storage capacity and catchment area to supply adequate water, others do not have enough catchment potential or tank capacity to satisfy the requirements of the designed command area. The inability of a farming community to capture adequate water often results in persistent demand for augmentation of water supply through enlarging tanks or by taking water from other tanks, diversions from streams, or from drainage channels. In addition, rising population is leading to increasing demands for water for irrigation and domestic uses in the dry zone. The lack of capacity of the tanks means that the rainwater flow into the sea thus reducing the recharge of the underground water table. Usage of water from agro wells deplete the ground water and this over exploitation induce the seawater intrusion thereby causing drinking water problems during the drought season. Hence, to solve the above problems, small tank rehabilitation and improvement should generally aim to,

- Repair the distribution network to let the farmers improve the efficiency of water distribution and expand the irrigated area;

- Increase water availability by raising or extending the tank bund, or both, by augmentation from other tanks, or by other means;

- Increase the ground water recharge and the dead storage thus allows water availability for livestock and humans during the drought period;
- Improve the eco system development through catchment improvement by reforestation and replanting.

The tank rehabilitation process in collaboration with Department of Agrarian Development (DAD) and Farmer Organizations (FOs) could be carried out with the following procedures,

i. Preliminary investigation

ii. Need assessment

iii. Tank bed and sedimentation survey

iv. Preparation of designs and estimates

v. Ratification meeting

vi. Agreement among Department of Agrarian Development (DAD), Farmer Organization (FO) and Funding Agency

vii. Allocation of funds to DAD and FO

viii. Execution of work

ix. Work certification and completion and handing over

2. Identification of tanks for rehabilitation and restoration

Since there are many tanks to be rehabilitated and resources are limited, priority has to be assessed through a set of criteria. The criteria used to assess and prioritize are given in appendix 1. The Department of Agrarian Development (DAD), under the supervision and guidance of its Commissioner General, is the institution mandated by the Government to ensure proper maintenance and management of the small irrigation systems. Minor Irrigation Tanks are therefore under the technical jurisdiction of the DAD. After prioritization and selection, the renovation works could be carried out with the assistance of DAD. (Appendix 2)

The changes in tank bed geometry due to deposition of sediment could increase the water loss and reduce storage capacity. Raising the tank bund to accommodate the lost capacity of tank in rehabilitation programmes would lead to increased losses making less economic return to the investment. De siltation of small tanks should aim not only at increasing storage potential and reducing tank water loss but also at protecting the tank ecosystem. As de-siltation is an expensive task as well as a necessity, it is important to develop a technological strategy, which generates a low cost and effective de-siltation process. The partial de-siltation method was introduced with this background to improve the tank bed geometry to reduce tank water losses. Most important point is that soil should not be removed down to original tank bed to prevent high percolation losses. A layer of about 30 cm should be left undisturbed. Sedimentation studies indicate that half of the sediment deposited in minor irrigation tanks is found within one third of the tank bed area closer to bund. Thus, the same capacity can be maintained by removing sediment in this area and deposit it in the upstream area. These soil mounds must be formed at safe gradient and stabilized with trees and grasses to prevent washing down to the tank. The mounds would appear as micro-islands, where productive plant species could be grown. These soil mounds must not block the natural drainage, which supplies water to the tank.

Agrarian Services Department usually plans these activities in collaboration with the other stakeholders. Excavation of soil needs the support of machinery. However, shaping up of bunds, upstream drains etc. can be done by the associated farming community. Most important components in this programme are stabilization of bunds and mounds with vegetative cover, establishment of tree belt in upstream vegetation and interceptor area. Farmers must be aware right at the inception of the programme of how they are supposed to contribute in this programme. The work should be undertaken by the farmer organization to also ensure ownership. However, data collection and required technical supervision must be the responsibility of DAD staff.

3. Appendix 1

3.1. Tank selection criteria

As funds are limited, a tool for estimating the level of investment in tank repairs is used for planning. For this purpose, the tank system Physical Status Score (PSS) to give an idea of the level of investment needed for each tank system is used. The PSS system is shown in table 1. In this scoring system, the more critical components (tank bunds, tank sluices, tank spills, and the canal systems) are given double weight compared to the other components. The higher the score, the more the repairs needed; a tank system in the worst possible condition would receive a score of 100.

For simple estimation, if the computed PSS is greater than 60, then the tank needs heavy investment; if it is between 40 and 60, then the tank needs moderate investment. The score is less than 40, then the tank needs low investment. Table 1.

Table A

3.2. Physical status & scoring for individual tanks

Physical status of Tank bund	Score		Physical status of Tank Spill	Score	
Breached	20		Non existent	20	
Badly dilapidated	16		Needs replacement / needs major repairs	12	
Moderately dilapidated	12		Good / Minor repairs	4	
Fairly good	8		No problem	0	
Good	4				
No problem	0				
Score			Score		

Physical status of Tank bed	Score		Physical status of canal systems	Score	
Heavily silted	10		Heavily dilapidated	20	
Moderately silted	6		Moderately dilapidated	12	
Un-silted	0		Minor repairs	4	
			No problem	0	
Score			Score		
Physical status of Tank sluices	**Score**		**Physical status of Inflow stream**	**Score**	
Not working and need replacement	20		Heavily clogged	10	
Dilapidated & need major repair	12		Moderately clogged	6	
Good / Minor repair	4		Not much clogging	2	
No problem	0		No clogging	0	
Score			Score		

Table B

3.3. PSS Score for individual tank

Identification of need	Score
Physical status of Tank bund	
Physical status of Tank bed	
Physical status of Tank Spill	
Physical status of Tank sluices	
Physical status of canal systems	
Physical status of Inflow stream	
Total score	

3.4. Prioritization of the selected tanks

From the data collected, each tank is scored to assess its land, water, and labor resources potential. Table 3 shows the tabulation of data gathered. The following dimensions can be considered for evaluation of economic and environmental benefits:

- The greater the number of beneficiaries, the greater impact of the investment
- The greater the average landholdings, the greater the potential benefit for each beneficiary
- If yields are low due to insufficient water, the greater the potential yield gains from tank system improvements
- If the tanks spill, the greater the need for de silting
- If the tank systems are in poor physical condition, there is greater benefits to be gained from rehabilitation
- Having groundwater usage implies that improved water supply may improve groundwater levels
- The greater the potential to irrigate new land in proximity of the tank, the greater the potential to benefit from investment
- The greater the positive impact on the eco system of the rehabilitation should also be considered

3.5. Guide for prioritization

Category level	Investment level	Environmental benefits	Economic benefits
Priority 1	Medium	High	High
Priority 2	High	High	High
Priority 3	High	Medium	Medium
Priority 4	Medium	High	Medium
Priority 5	Medium	Medium	Medium
Priority 6	Low	High	Medium
Priority 7	Low	Medium	Medium
Priority 8	High	High	Medium
Priority 9	High	Low	Low
Priority 10	High	Medium	Low
Priority 11	Medium	Low	Low
Priority 12	Medium	Medium	Low

4. Appendix 2.

4.1. Rehabilitation of tank bund

i. Light jungle clearing along bund to a width of 20m inclusive of cutting and removing 0.3m girth trees, uprooting, clearing 30m away from bund by manually

ii. Scarifying & removing top soil to 75 mm depth

iii. Remove any anthills on bund completely

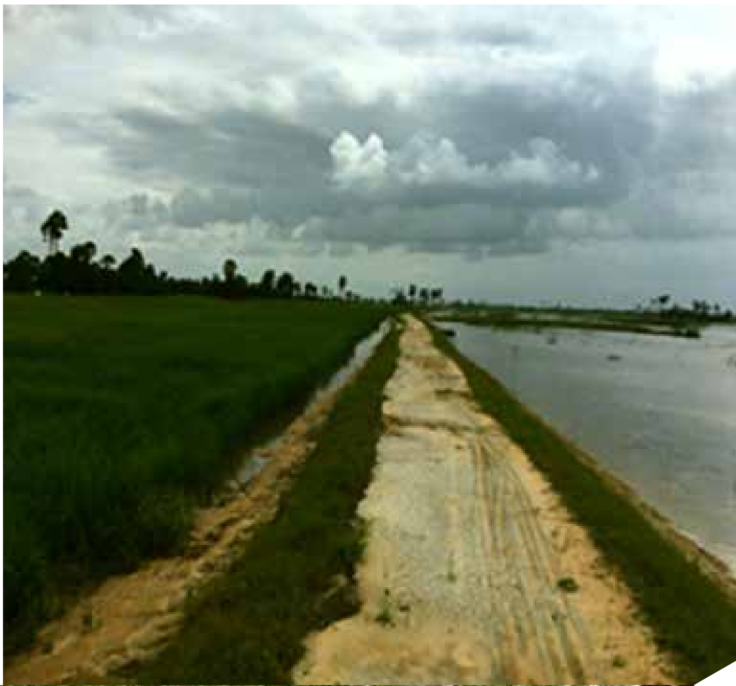
iv. Cutting benches to receive new earth.

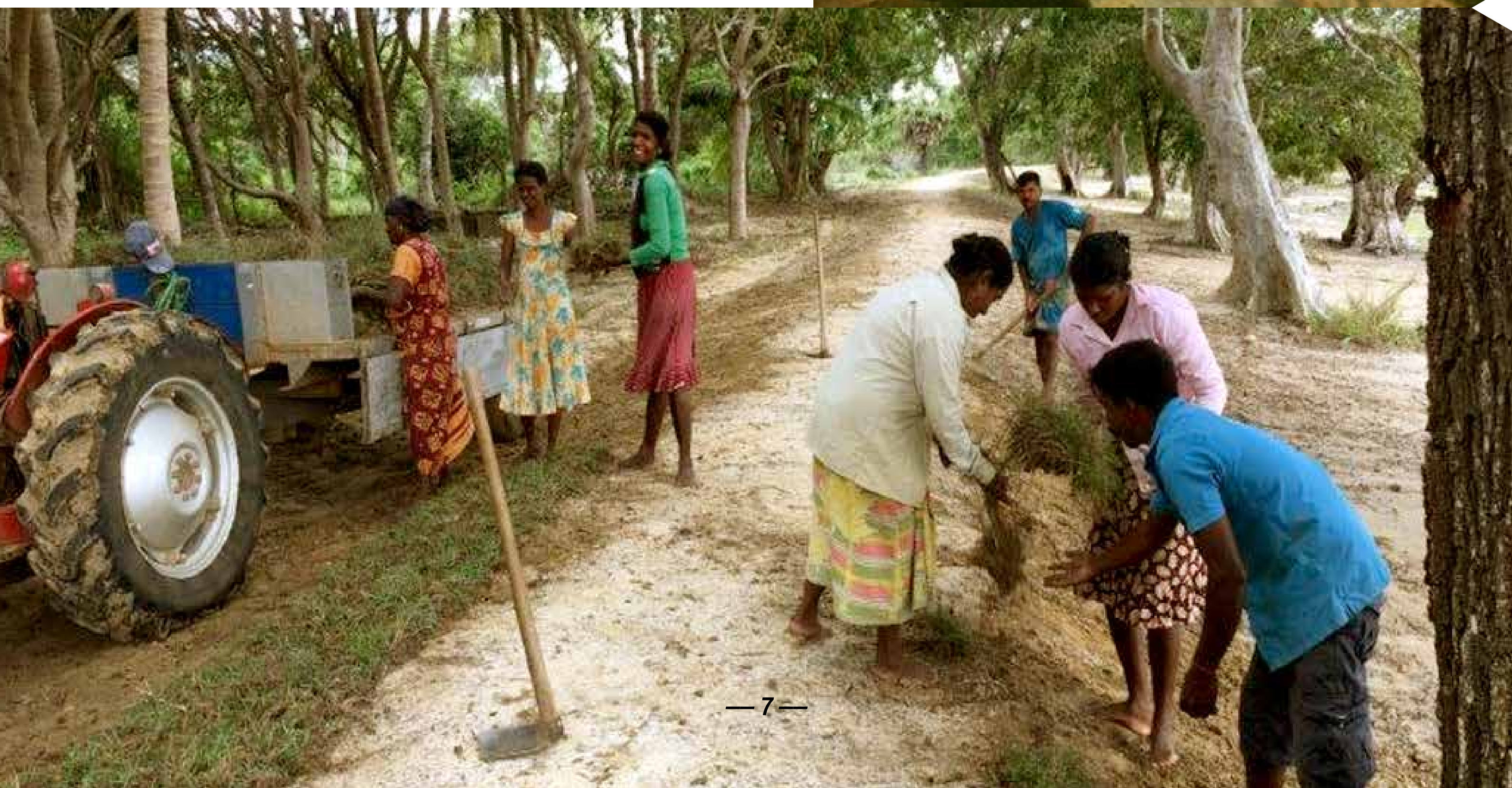
v. Earth excavation from borrow area (away from the bund) and forming bund to designed profile including watering and consolidation

vi. Providing bund level blocks on bund at 50m intervals

vii. Strip turfing to newly formed bund and watering until taken root including transport

viii. Providing bathing steps where necessary





4.2. Rehabilitation of sluice

i. Earth excavation for foundation

ii. 1:3:6 (40 mm) ct. concrete in foundation & structure exclusive of shuttering

iii. 1:2:4 (20 mm) Reinforced concreting for passerelle slab

iv. Shuttering of ½” thick planks including making, fixing and removal after works

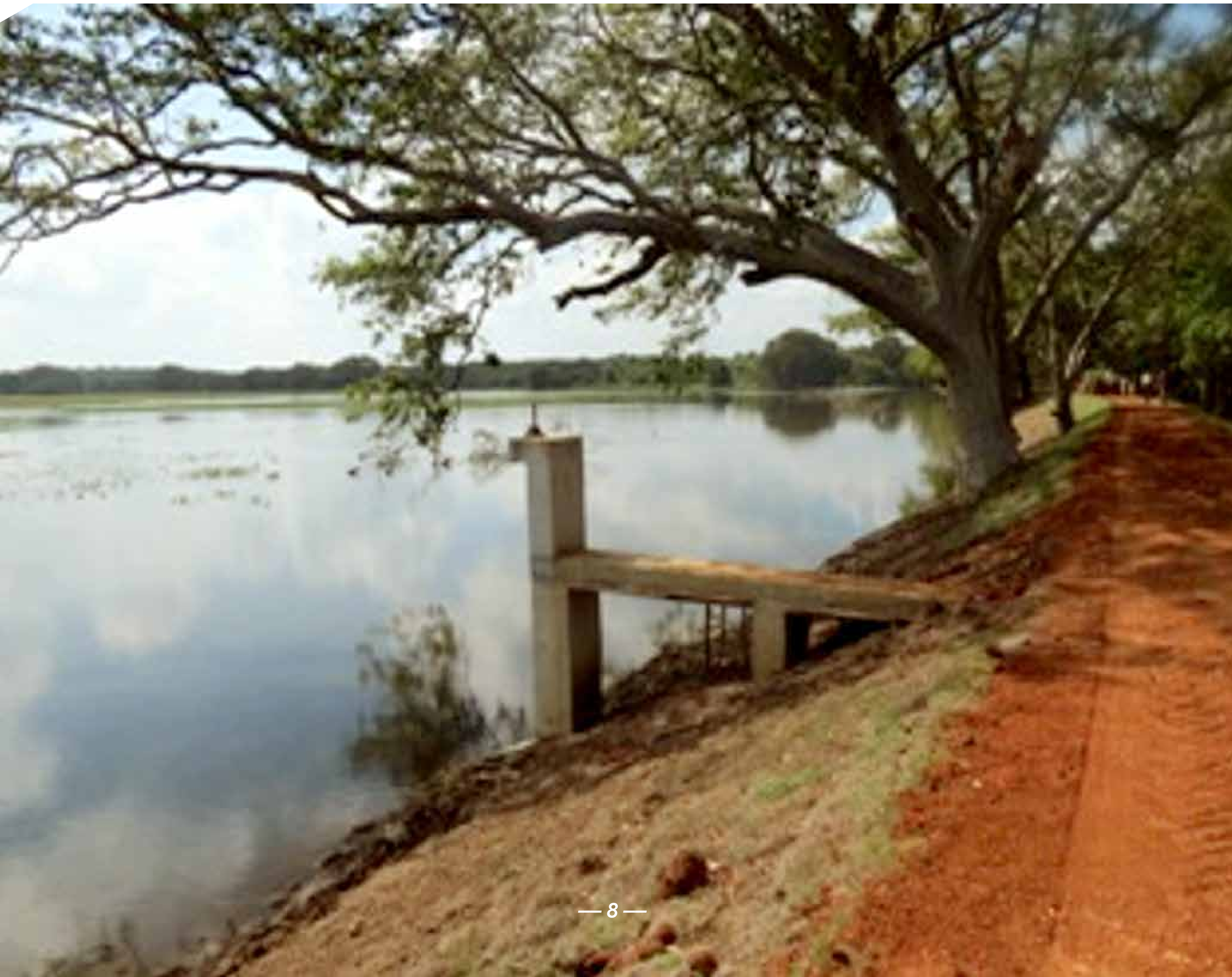
v. Providing gate set of required size including base plate, grooves that facilitate the movement of sluice

vi. Providing hume pipes of required size with collar joints including transport, where necessary

vii. Aligning and fixing gate in position with necessary fittings

viii. Laying and joining Hume pipes with collar joints in 1:2 mortar

ix. Reinforcement tying for passerelle slab (10mm dia.) 150mm c/c for primary bar & 225mm center to center for secondary bar



4.3. Rehabilitation of spill way

i. Clearing and excavation of the approach and tail canal where required

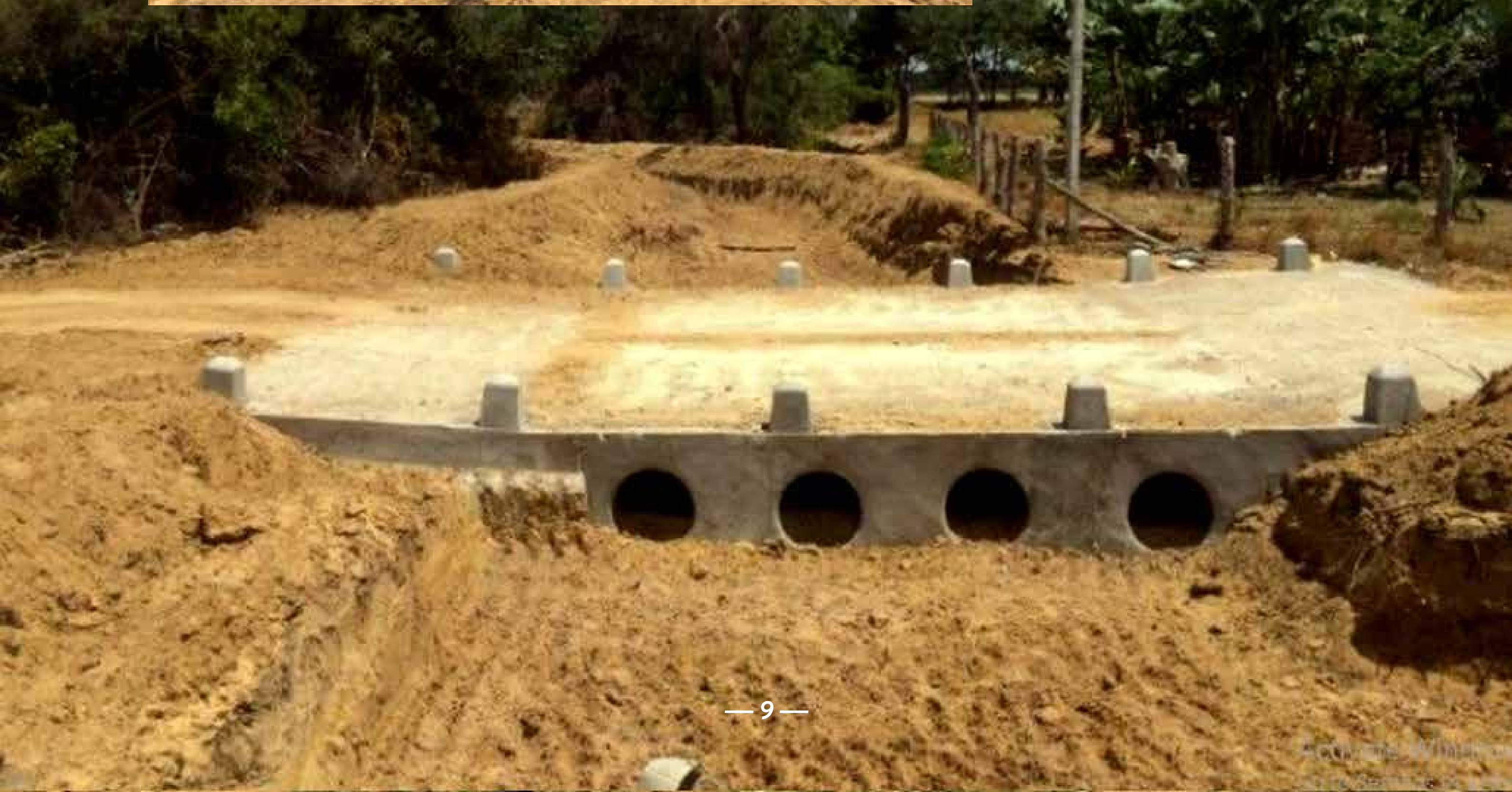
ii. Earth reduction in the spill channel and forming bund

iii. Excavation for spill construction and abutment

iv. 1:3:6(40mm) ct. concrete for Clear Over fall Spill construction and abutment

v. 6" – 9" Random Rubble Masonry in 1:5 cement mortar

vi. Shuttering of 40mm thick planks including making, fixing and removal after works



4.4. Rehabilitation of irrigation canal

i. Clearing shrub and jungle along the channel and training bund, remove outside the reservation

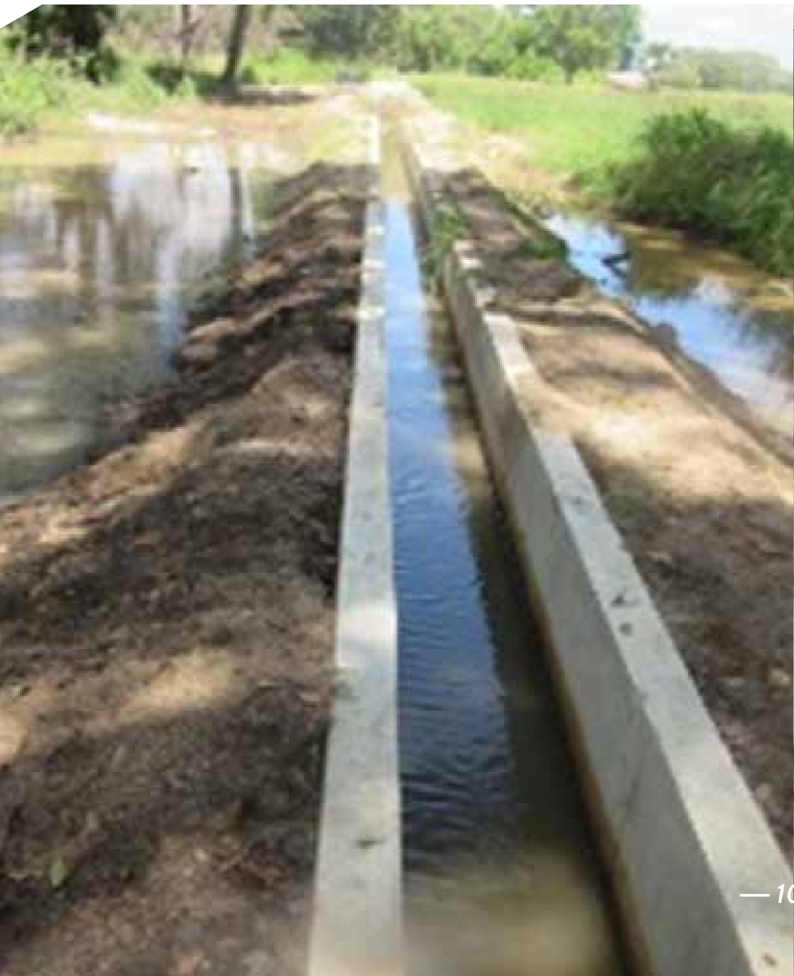
ii. Earth excavation and forming channel bund to designed profile

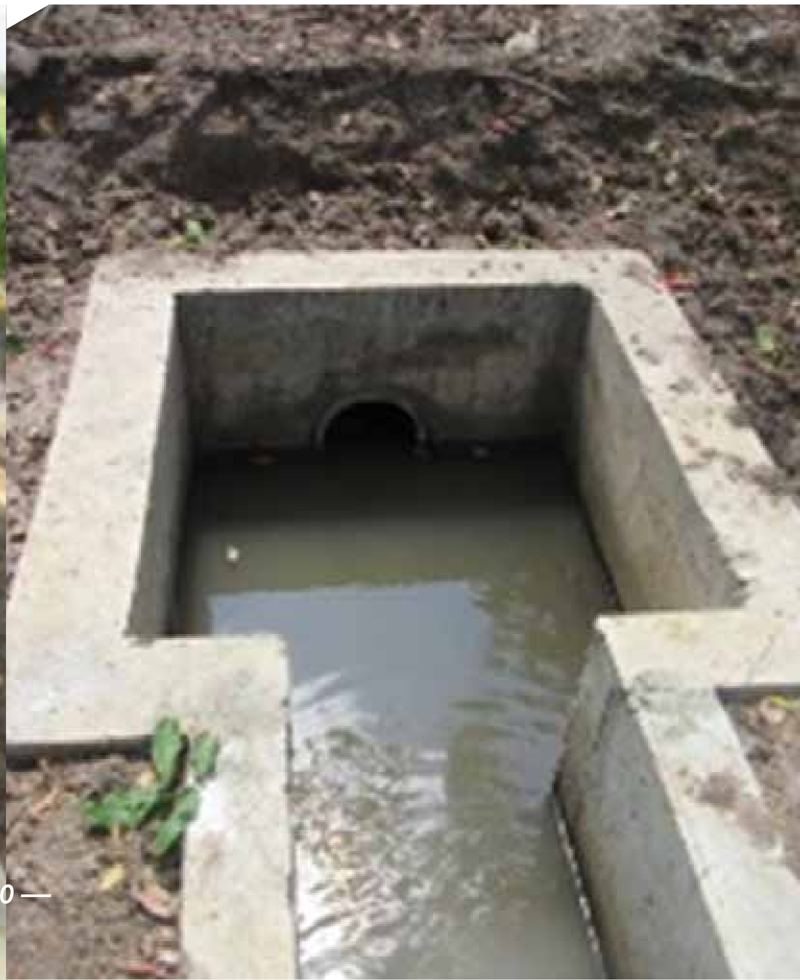
iii. Strip turfing to channel bund and training bund including transport, laying and watering until takes for L.B main channel

iv. Providing 0.15m dia, 2.4m long pipe outlet to field with head walls and control arrangement at main channels

v. Construct/ Repair the drop structures

vi. Construction of end regulator at end of the channel in 1:3:6 (40mm) cement concrete including rubble packing on the downstream with 1:3 ct. motor (2’ X 2’) as per sketch for Left Bank and Right Bank main channels





5. Appendix 3

5.1. Benefits from De-siltation

The concept of partial de-siltation is not meant merely to increase the storage unless there is a demand from the community or an additional storage potential in the system. The economic analysis should therefore, be based on consideration of following benefits in order to determine the return to investment of partial de-siltation.

Benefit – 1: Increased extent for cultivation

Even though the asweddumized (developed for paddy cultivation) lands are available for cultivation in most of the command areas, availability of water in the tank limits the cultivable extent. Reduction of tank water losses from partial de-siltation would lead to improve the water availability in minor tanks providing more opportunities for cultivating relatively a larger extent.

Benefit – 2: More agriculturally productive lands

Partial de-siltation reduces the water spread area. More than half the land inundated with tank water would be free of surface water after a successful de-siltation. Water body would be confined to the portion closer to tank bund. The land area freed from water spread can be utilized for agricultural purposes with measures to prevent erosion. This soil is fertile with nutrients and high level of organic matter (5 - 8 %) and also has an easy access to groundwater. This area can be transformed to paddy land or any perennial crop which is tolerant to shallow ground water.

Benefit – 3: Opportunities for cottage industries

In a cottage industry improvement programme, this land may best be utilized to grow Bamboo (Bambusa spp.), Rattan (Calamus spp.), Mat grass (Cyperus pangorei), Vetakeya (Pandanus spp.), Patabeli (Hibiscus tiliaceus), Palmaira (Borassus flabellifer), Kithul (Caryota urens) etc. all of which provide various row materials for cottage industries.

Benefit – 4: Possibility for yala cultivation

Water storing efficiency of the tank would be increased with improvements on tank geometry by partial de-siltation. Any water remaining in the tank after `maha' cultivation can be kept without many losses for yala cultivation.

Benefit – 5: Increased cropping intensity

Further, this tank storage can raise the groundwater in the command area and yala cultivation can be supplemented by well water with a great assurance. Both these reasons could lead to increase the cropping intensity of the command area.

Benefit – 6: Fresh water fishery

Minor tanks are mostly seasonal reservoirs. These can be utilized for raising fish species of short duration or harvesting half-matured fish stock. An adequate dead storage of a tank with favourable geometry can improve this situation for rearing even long duration fish species. The other advantage of having a good dead storage during dry periods is that these tanks can be utilized for raising fingerlings in protected areas.

6. Bibliography

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