PRODUCTIVE SAFETY NET PROGRAMME PUBLIC WORKS OPERATION AND MAINTENANCE GUIDELINE

A practical guideline manual for development agents in Ethiopia

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FOREWARD

The Productive Safety Net Programme (PSNP) is one major component of the food security program implemented by the government of Ethiopia with the support from donors that aimed at providing more reliable and timely support to chronically food insecure households starting from 2005. It extends support to these households through two channels: Direct support (DS) and Public Works (PW).

PW is a major component of the PSNP designed to address the underlying causes of chronic food insecurity by creating access to market, improving access to services and natural resources, and rehabilitating and enhancing the natural environment. This is achieved by engaging the labor rich but poor households in the construction of various Public works as an employment opportunity in the rural Ethiopia.

Since the beginning of the programme in 2005, a number of subprojects have been implemented and it is believed that different community assets are already created. However, results of the progress assessment of the program conducted through PW reviews (PWR), rapid response team mission (RRT), joint review and implementation supervision missions (JRISM) and regular monitoring and evaluations revealed that some of the completed and on-going PW subprojects lack appropriate management and maintenance mechanisms. Hence, developing O&M guideline focusing on key subprojects to have a common and standardized operation and maintenance mechanism among programme areas to address the drawback observed on sustainability of PW was supposed to be important.

Thus the Natural Resource Management Directorate of the Ministry of Agriculture has developed this guideline with the intent to provide woreda staffs, DAs and the communities with a practical guidance on PW O&M, in order to address the shortcomings in sustainability of community assets created and increase pace to meet programme objective. The guideline is developed as a reference guide, focusing on key O&M mechanisms for PW subprojects and able to be applied in most of the programme regions. Regions can tailor to suit the local conditions and adapt the guideline to achieve the intended

programme outcomes. The guideline can also assist other programs and projects that have similar subprojects implemented at community level.

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List of Abbreviations and Acronyms

AC	Area closure
CBO	Community Based Organizations
CBPWD	Community Based Participatory Watershed Development
CDMT	Community Development Management Team
CWT	Community Watershed Team
DA	Development Agent
EIA	Environmental Impact Assessment
ESMF	Environmental and Social Management Framework
FSP	Food Security Programme
FTC	Farmers' Training Center
JRISM	Joint Implementation Review and Support Mission
KDMT	Kebele Development Management Team
KFSTF	Kebele Food Security Task Force
MoA	Ministry of Agriculture
NGO	Non Governmental Organization
NRM	Natural Resource Management
NRMCP	Natural Resource Management Core Process
NRMD	Natural Resource Management Directorate
O&M	Operation & Maintenance
PIM	Program Implementation Manual
PSNP	Productive Safety Net Programme
PW	Public Works
PWCU	Public Work Coordination Unit
PWFU	Public Work Focal Unit
PWIA	Public Work Impact Assessment
PWR	Public Work Review
SHG	Self-Help Group
TF	Task Force
TNA	Training Need Assessment
ToT	Training of Training
UG	User Group
VWSC	Volunteer Water Supply Committee
WatSan	Water & Sanitation
WFSTF	Woreda Food Security Task Force
WoA	Woreda office of Agriculture
WT	Watershed Team
WUA	Water User Association
WUC	Water User Committee

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PART ONE: INTRODUCTION AND BACKGROUND TO THE OPERATION & MAINTENANCE GUIDELINE

Chapter 1: Introduction

1.1 Background

The Productive Safety Net Programme (PSNP) is a component of the Government of Ethiopia (GOE) Food Security Programme (FSP), and is an essential feature of the food security investment strategy for chronically food insecure Woredas. The Goal of the PSNP is Food security status for male and female members of food insecure households in CFI woredas improved. It provides resources to chronically food insecure households through: (i) direct grants to labor-poor, elderly or incapacitated individuals, and (ii) payments to able-bodied members for participation in labor-intensive Public Works (PW) activities.

Since the launch of the programme in 2005, more than 8 million beneficiaries repeatedly affected by food shortage have received transfers on a regular basis and have consequently been able to meet their food needs, while protecting their assets. To date, the PSNP has enabled the creation of an estimated 180,000 community-level assets, planned and implemented following the country's integrated Community-based Participatory Watershed Development guideline and Pastoral PW Planning guideline where selection of subprojects is driven by a community-needs-based planning process.

The PSNP Woredas often suffer from severe environmental degradation and limited access to infrastructure. The available labor from able-bodied PSNP clients is used to address underlying causes of food insecurity by rehabilitating the natural environment, and constructing social and market infrastructure. The majority of the PSNP PW subprojects focuses on the rehabilitation of natural resources but also includes construction or expansion of community-level infrastructure such as feeder-roads, extensions to health posts and primary schools, water-supply projects, small-scale irrigation, and construction of Farmers' Training Centers. Sustainability of these

community assets is ensured by establishment of appropriate management, operations and maintenance procedures. This contributes to the enabling environment for community development and addresses the underlying causes of food insecurity by transforming the natural environment.

Since the beginning of the programme, a number of PW reviews (PWR) Joint Review and Implementation Supervision Missions (JRISM) have been conducted to assess the progress of the PW implementation. These assessments revealed that some of completed and on-going PW lack appropriate management and maintenance mechanisms. Hence, this O&M guideline is developed as a general guide focusing on key subprojects to have a common and standardized operation and maintenance guideline among programme areas to address the drawback in sustainability of PW and met the programme objectives.

1.2 PW indicators and Guideline statement

The monitoring and evaluation of the PSNP is integrated into the overall monitoring and evaluation of the Food Security Programme (FSP). The FSP has an overall logical framework laying out Goal, Outcome, Outputs and Activities along with the indicators required to measure their achievement. It is the combination of the various components of the Food Security Programme, including the PSNP, working together and complementing each other which are expected to bring about the achievement of the objectives of the FSP. Assessment of programme impacts and of progress in achieving these objectives will therefore be conducted in an integrated manner; assessing the effects of the combination of programmes.

The PSNP also has its own logical framework, nested within the overall FSP logical framework, which includes greater detail of the Outputs that will be delivered and activities that will be conducted through this programme. This more detailed description of expected Outcome, Outputs and Activities, along with their indicators for measuring achievement, will be the basis for monitoring programme efficiency and effectiveness and will inform day-to-day management decisions to improve the running of the programme.

The PSNP PW output states that: "*Quality, new and existing community assets with operational mechanisms established*". To

determine whether this output has been achieved, reference is made to the four indicators stated in the log-frame (refer PSNP PIM for detail). The indicators are:

The indicators are developed during programme formulation to verify whether:-

- The principles of CBPWD process have been applied and that the process is resulting in good quality planning documents;
- The ESMF screening procedures have been applied correctly to all PSNP-PW subprojects;
- Management and maintenance issues planned for PSNP-PW subprojects and activities have been implemented and result in appropriate functioning mechanisms; and
- The issues of quality and long-term sustainability included during the planning and implementation of PSNP-PW subprojects and activities give practical results.

The overall purpose of these indicators is to measure the PSNP PW programme effectiveness in terms of quality and sustainability (environmental, technical, social, managerial and resource) towards achieving the FSP super-goal. In order to successfully meet the indicator on O&M, this guideline will have a paramount importance. Hence, to maintain quality and ensure sustainability of PW, this guideline is developed to assist implementers. The guideline focuses on key O&M mechanisms and major subprojects to create a common awareness and provide practical guidance on PW O&M at grass root level.

1.3 Major constraints/problems/ associated with sustainability of PWs

Though, the PW subprojects are significantly contributing to address underlying causes of chronic food insecurity and have good progress towards the achievements of the PW target indicators, in some cases the progress is lagging behind the expected time and proportion. The following were some of the key major constraints/limitations that directly or indirectly hinder the long-term managerial and resource sustainability of community assets created by PWs:

- Insufficient integration of key sector offices/bureaus;
- Disappointing management of rehabilitated communal areas, due to lack of appropriate user groups, legally certified entities with long-term management and use, and lack of bylaws;
- Lack of technical sustainability to the required level due to design and implementation gaps;
- Financial un-sustainability of some drinking water supply projects owing to lack of service charging system; and
- Gaps in ESMF compliance.

The intent of this guideline is to provide woreda staffs, DAs and the communities with a practical guidance on PW O&M, in order to address the shortcomings in sustainability of community assets and increase pace to meet programme objective. It is developed as a reference guide, focusing on key O&M mechanisms for PW subprojects and able to be applied in most of the programme regions. Regions can tailor to suit the local conditions and adapt the guideline to achieve the intended programme outcomes. The guideline can also assist other programs and projects that have similar subprojects implemented at community level.

Chapter 2: Overview of the guideline

2.1 The need for O & M

The overall objective of O&M is to improve the effectiveness of community assets created through the PSNP-PW in terms of quality and sustainability (environmental, technical, social, managerial and resource) and contribute towards achieving the FSP super-goal through providing O&M mechanisms. It is an instrument to strengthen community ownership, increase commitment at grass root level and promote integration and responsibility of stakeholders.

2.2 Purpose of the guideline

The main purpose of this guideline is to provide practical direction on PW O&M for PW implementing regions/woredas in order to address the shortcomings in sustainability of community assets and increase pace to meet PSNP objective. It is developed as a reference guide, focusing on key O&M mechanisms for PW subprojects which are common and basic O&M mechanisms that possibly applicable for other similar development projects implemented at community level.
The specific purposes of the guideline includes:-

- **Create awareness** among program implementers or stakeholders on the O&M of PWs;
- **Create ownership**: Level of O&M is highly linked to ownership of a facility and the basic understanding of the technology and its functions;
- Enlighten **institutional responsibilities** as well as effective mechanisms;
- Encourage **cost recovery** to ensure sustainable O&M.
- Used as a **training tool**: empower stakeholder to make decisions regarding basic O&M approaches;
- **Save time and expense** by reducing the mishandling of standard operational activities through the use of concise documented guidance; and
- Provide **simple and friendly templates** to help implementers and the community adopt in their context.

Regions might modify templates, provided in this guideline, to suit the local conditions and adapt the guideline for different subprojects to

achieve the intended programme outcomes. The guideline can also assist other programs and projects that have similar subprojects implemented at community level.

2.3 The challenges and opportunities

2.3.1 Challenges

The challenges for carrying out O&M services ranges from poor planning, lack of ownership or delegated responsibility for O&M, commitment, integration, lack of skilled labor, and failure to generate revenue for repair and replacement expenses. In addition, technical options/technology selection may not always the best suited to the environment in which they shall be operated. Other reasons are closely related to the set-up of subprojects, which often focus only on construction of hardware instead of software components, because it is simpler and less time consuming. Consultation with local stakeholders and users regarding the most appropriate system for the local conditions is often low.

Inadequate integration of key sector offices/bureaus at all levels; disregard to establish appropriate user groups during planning stage; poor technical design and implementation gaps; financial un-sustainability; and gaps in realization of the programme supporting guides coupled with absence of standardized O&M guidelines were some of the key challenges that directly or indirectly hinder the long-term managerial and resource sustainability of community assets created by PWs.

2.3.2 Opportunities

2.3.2.1 Developed planning guidelines

The CBPWD guideline, prepared by MoA in 2005, aims to build upon existing community-based participatory watershed efforts to harmonize and consolidate planning procedures at the grass-roots level. The intent is to provide DAs and rural communities with a **workable and adaptable planning tool**, whether located in a low rainfall or high rainfall area, in a severely degraded and food-insecure area or in a food secure and not yet seriously affected by land degradation area.

In this regard, another main objective of the participatory watershed planning guideline is also to provide practical guidance on the **correct selection of technologies** under different conditions and their sequentially correct implementation. For that purpose different interventions with summarized information are included in the CBPWD guideline (MoA, 2005). Currently, Pastoral area PSNP PW guideline has been develop and published. Familiarization of the guideline and trainings has been conducted and the pastoral regions are using the guideline for planning and implementation of PW. These two guidelines have been and would be used as a reference, in PW implementation, thereby believed to strongly support O&M implementation of the PSNP PW.

2.3.2.2 Institutional structure and capacity building arrangements

The Productive Safety Net Program is a component of the larger Food Security Program of the Government of Ethiopia. Food Security line agencies at every level of Government are accountable for the oversight and coordination of the FSP with implementation being undertaken by line ministries, Government agencies and other partners at all levels. These arrangements are cemented in a Memorandum of Understanding between Government and development partners. The roles and responsibilities of implementing partners are described in detail in the program document. (Ref 2010 PIM for more detail information).

2.3.2.3 ESMF operational guideline

PW are intended to make a major contribution towards environmental transformation, and consequently improved agricultural productivity and more sustainable livelihoods. Hence, Public Works projects must be environmentally and socially sustainable. They should be adapted to local conditions and protect the environment. They should be based on sound technical advice, and adequate technical supervision should be available to ensure the quality of work.

The instrument commonly employed to ensure that projects are designed to avoid or minimize negative environmental and social

impacts is Environmental Impact Assessment (EIA).[1] The EIA requirements of both the Government of Ethiopian and the PSNP donors are addressed through an **Environmental and Social Management Framework** (ESMF). An ESMF operational manual had been developed and used since 2009. Use of the ESMF procedures during planning stage will contribute to ensure quality of PW and thereby, reduce O&M costs.

The ESMF specifies (i) criteria for PW selection at Kebele level, thereby avoiding PW locations or designs that might give rise to unacceptable or unmanageable impacts, and (ii) simple procedures for PW design screening at Woreda level to verify that there will be no significant impacts, and to identify PW that may require EIA.

The Regional PWFU and the extension services case team are responsible for ensuring that the ESMF is implemented. At Woreda level, the Woreda Land and Environmental Office/Environment and Natural resources Case Teams are responsible for implementing ESMF having technical backstopping from respective zonal/regional units.

2.3.2.4 Community mobilization guideline

A Participatory community mobilization and organization guideline has been developed and applied by regions in the last two years. The purpose of the guideline is to endeavor participation of the rural community in watershed development planning, implementation and M&E for integrated & sustainable NRM. The guideline supposed to create favorable agricultural development that enable sustainable production, increase income of the rural community for better livelihood and mitigate the appearance of recurrent drought. Following the guideline, promising achievements in awareness creation, establishment of development armies and implementation in conserving the natural resources recorded in most of the regions. It is also believed to be a good opportunity for the effectiveness of assets created through PW and contribute for sustainable development of natural resources. It is believed to strongly support the fulfillment of O&M of PWs.

[1] In keeping with Ethiopia's *Environmental Impact Assessment* proclamation, the term 'environment' in this context covers biophysical, social and cultural heritage impacts.

2.3.2.5 The land-use certification

Linkages with land-use certification is an excellent incentive to enable land users to value their land holding but also to encourage investments in degraded and marginal areas. The certification process should be closely linked with watershed development/PSNP PW planning. The responsibilities of households in managing their land should be related to the management of the measures implemented in such landholdings, following watershed development logic and interventions. Specific arrangements at *Woreda* and regional levels are needed to ensure that land certification is integrated with PSNP PW watershed development and avoid that interventions undertaken on private or communal areas are disconnected and of poor quality.

2.3.2.6 Strategy on rehabilitated areas

Based on the proven achievements recorded in utilization of rehabilitated areas following watershed development and the need to scale up the experiences gained, a strategy for use of rehabilitated land was prepared by the NRMD of the MoA. The strategy aims to ensure sustainable development and secure economic and ecological benefits of our untapped natural resources by handing over rehabilitated areas for private or group of individuals, associations, the community or government development allies.

The strategy will help in further development opportunities and create ownership rights. This strategy is too, a key mechanism for sustainability of rehabilitated areas by the PSNP PWs.

PART TWO: DESCRIPTION OF THE O&M GUIDELINE

Chapter 3: Concepts and Principles of O&M

3.1 Definitions

Operation

Operation refers to timely and day-to-day actions to keep public work projects (scheme/infrastructures) functioning properly. These relate to the technical, administrative and socio-economic components of the project. It is a daily activity of running and handling projects. It involves the technical and service activities to run projects as well as the correct handling and usage of the facilities by users.

Maintenance

Maintenance is defined as the art of keeping the public work structures, plants, equipment and other facilities in an optimum working order. Maintenance is periodic activities that ensure proper functioning of the projects in the long term. Regular maintenance reduces the chance of project breakdown and results in sustainability of the project. Maintenance includes preventive maintenance or corrective maintenance, mechanical adjustments, repairs, corrective action and planned maintenance. However, replacements, correction of defects etc. are considered as actions excluded from preventive maintenance.

Maintenance involves the activities required to sustain existing assets in a serviceable condition and includes:

- ***Preventive maintenance*:** Systematic routine actions needed to keep the project (infrastructure, installations, equipment) in a condition that will ensure they can be operated satisfactorily, function efficiently and continuously, and last as long as possible at lowest cost.
- ***Corrective maintenance*:** The range of activities starts with minor repairs and replacements as dictated by the outline examinations up to corrections of serious damages and malfunctioning.

- ***Crisis /emergency/ maintenance*:** Maintenance which is undertaken only in response to breakdowns and/or public complaints.

3.2 Elements of O&M mechanisms

3.2.1 Community participation

Peoples' participation is defined as employing a method where the community is motivated to function and contribute as a group to perform various tasks. They all contribute to identify, select and design and implement subprojects.

In any society, there are different levels of interaction, not only "rights" but also "responsibilities", a judicial system that looks after conflict resolution, traditional structures and religion, different levels of vulnerability, intra and inter community relationships, State laws and regulations, and others. In other words, a community is made up of all these interactions, some defined as coming from "inside", and others coming from and going to the "outside". This includes use and management of land resources, peoples' assets and farming system, economic activities and coping mechanisms. Participatory development planning should capture the essential components of all these elements and interactions to formulate a development plan that satisfies both the community in terms of addressing the main needs and aspirations of its members, as well as fulfill the principle of sustainability of the use/management of natural resources.

Why should people participate? It is generally agreed that unless the direct and visible benefits of the program are in line with the interests of the people, participation comes slowly. Experience has shown that it is not very difficult to organize and convince people to undertake useful and profitable activities for a while, but sustaining such interest over a long period has been difficult.

The sustainability of PW or watershed management development projects therefore, depends on the level of participation, which requires effective planning and implementation. Participation builds ownership of the people over the resources being managed in the program. Planning with the community also increases participation and produces better results.

The sustainability of a project refers to the proper functioning of the infrastructure, the people, management and social systems in the long run. This happens if all factors are considered at planning and design of the PWs, but require regular updating with changing circumstances. Experience has shown that if farmers are not involved in all the development stages of a project, they lose the sense of ownership and hence do not feel obliged to facilitate its functions. Consequently, long-term performance and sustainability of the project is negatively affected. Thus, projects planned with beneficiaries, rather than for them, have proved more sustainable and less costly. Problems of community participation are rarely encountered in privately owned schemes or those initiated by the community themselves. However, for PW initiated by donors or governments, there is a need for close consultation between community and implementing agencies in all stages of development. This can be achieved through participatory planning, designing, construction and management of PW subprojects. The following factors are taken into consideration:

- The importance of participatory planning in management of PWs,
- Sustainability indicators of PWs,
- Concepts of operation, function and maintenance of assets created by PWs,
- Principles of establishing the organization structure and initiate preparation of an action plan from each participant,
- Interrelationships of the biophysical, social, economic and policy dimensions in sustaining PWs.

Communities need to be involved in all stages of planning, implementation and management of watershed development activities. It is a continuous process and not a onetime exercise. Different participatory techniques will be used based upon existing and innovative experience.

Participation of community in planning and design: Proper planning depends on the human element and not only on physical or technical aspects. Therefore, planning must start from the bottom. Local peoples, other land users and the wider community who depend on the land/asset created, must be involved from the very beginning of the planning process since they are the ones that will live with its results.

To improve the performance and sustainability of the PWs, it is important to instill best practice at planning, through detailed analysis of physical as well as social assets and limitations. This is because implementations of the identified technical solutions depend on the extent of understanding and addressing socio-economic issues first, followed by policy and biophysical constraints. Therefore, professional experts, technicians, kebele managers and social workers charged with the responsibility of PW should initiate the process of participatory planning for harmonious working and ultimate improvement of the efficiency of the whole system. This should include the following:

- The community should be involved in the selection of the PW subprojects and the DAs should assist the beneficiaries by assessing the suitability of the interventions;
- The communities within the watershed/planning area should participate in the technical as well as the environmental screening (ESMF) or environmental impact assessment (EIA);
- The beneficiaries should be fully involved in the selection of the intervention and the DA/local staffs should guide them on the technical, environmental and socio-economic matters related to the suitability of the subproject;
- The local staffs should provide extension and training on the subproject;
- After completing the designs, the local staffs should explain the need of operation and maintenance costs, environmental aspects, land use patterns and other considerations;
- Finally, the community should decide and drive O&M mechanisms, including by-laws, which serves the majority and has least risks.

Participation of community in the implementation of PW: The Kebele food security task force (KFSTF) reviews the community public works plans, ensures they are compatible and consistent with the Kebele plan, and consolidates them into the PW component of the KASNP. The implementation of PW involves identification of eligible conditional able-bodied clients, timing of PW and labor organization. The community should be involved in all these processes. The relevant sectoral experts should provide technical information to assist the clients in reaching decisions.

All labor for PW subprojects comes from PSNP clients. People, who are eligible for conditional transfers, both men and women (who are above 16), participate in PSNP PWs. People who are eligible for unconditional direct support do not participate in PSNP Public Works.

DAs and the local community watershed teams WT/ task forces TF(s) will play a major role in maintaining a high level of participation during implementation. They will coordinate the efforts provided by the community and those of single individuals or target groups.

3.2.2 Community Institutionalization

3.2.2.1 Local level institutions/Community Based Organizations (CBOs)

Rural organizations are key elements both for participatory planning and for the sustainability and continuity of the project once implementation begins. Without them, no dialogue can take place between government agencies and the community beneficiaries.

Government agencies need to identify appropriate rural institutions and formal as well as informal leaders that could speak on behalf of the group or community. There are no established rules or models for rural organizations, and several will be important for their involvement in community project planning and implementation. A group may be formed on the basis of a variety of interests common to its members: religion, trade unions; growers associations (coffee for example); grazing or livestock associations; extended family; common boundaries; women's groups; cooperatives; and others. The important question is not what it is but how well it functions, how well it represents the interests of its members and to what degree its leaders really speak on behalf of all members. Therefore, the focus should be on strengthening and/or building ***appropriate institutions (CBOs)***that would be directly involved in watershed development activities on different levels.

3.2.2.2 Establishment of User Groups

A **Users' Association or Group** is a group of land users (farmers, pastoralists, urban dwellers) within a given geographical location who come together for the collective interest of utilization and sustainable management of a common resource.

Associations or groups are important to support community development and make it more effective. Associations and groups should be responsible to discuss and agree about what can be done using self-help contributions and what needs other forms of support. Self-help contributions can be generated using self-help institutions or modalities of mutual support. For example, self-help groups (SHG) can be formed building upon traditional work parties (such as wonfel and debo), traditional structures (edirs, and the like), and economic / common interest activity such as black smith, potters, weavers, dairy and goat rearing.

The contribution of **self-help groups (SHG)** to community planning and implementation could be at various levels. Firstly, at decision making level for interventions planned at the scale of individually used lands and for interventions that may need to be implemented in communal areas. Secondly, self-help efforts could also be a collective effort undertaken by the community for specific activities targeted to help specific categories of people, particularly some vulnerable ones (for example women headed households). Thirdly, the role of SHG should not be seen only as a means to provide the groups' own contribution. Its role should also be to efficiently utilize available resources from other sources (projects, safety nets, and the like) to cover specific areas and activities as well as to help most vulnerable categories of people in the community. In this regard, the role of SHG is broader and should include modalities for using part of the available resources (internal and external) to assist those most in need.

For a specific combination of activities, **User Groups (UGs)** can be formed. Examples could be hillside closure groups, community plantation groups, quarry development groups, rangeland development groups, water pond users groups, and the like. Some groups already exist while others can be created based upon the watershed development activities. These groups have to be fully involved in planning, implementation and maintenance of their respective development activities. Group wise planning helps to treat the area in an integrated way.

Group formation, community and social organization: Beside, the proper selection and quality construction of measures, proper management of assets helps much on sustainability. It is not only

necessary to sustain and improve measures but also to initiate their replication and expansion. Development initiatives will not be sustained unless beneficiaries make some form of resource commitment to support those initiatives. Watershed development and management should be thought as a contract where self-help and external support efforts translate into commitments to manage, protect and eventually improve assets once established are considered part of the agreement.

Social organization built on traditional or new methods is also intended to promote initiatives and activities that enable improved social interactions between groups and people, highlight gender issues constructively as well as optimize sharing of benefits and enhance mutual mechanisms of solidarity.

Group formation for social organization and income generation initiatives is, on the other hand, meant to strengthen local capacities required to sustain community focused development, to improve the living conditions and income of rural households, the poor and disadvantaged in particular.

A long-lasting, collective responsibility for natural resources requires the construction of a common vision rooted in the values of farmers who live on the watershed and experts in the Wor*eda* line agencies. This can lead to adoption of new social norms and a refusal to allow land degradation to continue. This is also linked to gradually building an increased capacity of the watershed communities and the broader watershed continuums to build enough resilience to sustain them and exit from external assistance.

3.2.2.3 Kebele Development Management Team (KDMT)

The KFSTF is a decision-making body that oversees all planning and implementation of safety net activities on behalf of the kebele cabinet. A management body (KDMT) will be established after the project execution to facilitate the implementation of O&M activities in the respective kebele. The KDMT could either be created from existing community institutions and associations, KFSTF, or its members could be newly elected. Its members should be elected fairly and represent the main interests of households and their livelihood profile, including vulnerability and social status. The same local institutions should be established to perform the O&M activities at community level.

3.2.3 Capacity building

In general, capacity building refers to long-term investment in people and their institutions to enable them to effectively and efficiently carry out specific activities to achieve specific development objectives. It is much more than the narrow perspective of training which merely concerns impartation of knowledge, skills and attitude change.

PSNP management systems, staffing, human resource development, and equipment are the four main areas to be considered for enhancing the effectiveness of PSNP implementation. Each of these areas, associated with financial capacity, contributes to effective PSNP implementation.

3.2.3.1 Staffing

Staff turnover is a critical challenge at kebele and woreda levels, which should be assessed at least once a year by each line sector, and compiled by WoA. The assessment result should indicate the staffing capacity and measures to be taken. The woreda needs to plan to ensure it has sufficient staff, both permanent and on contract, to implement the PSNP PW effectively. For PSNP implementation minimum staffing levels at each level has been decided in the PIM. These positions may be filled by regular government staff, contract staff or technical assistants. Regions and woredas should not follow these minimum standards only. Based on their assessment of the programme requirements, they should hire all the staff required to ensure that they meet the performance targets in their areas.
Filling all the required staff at woreda and regional level, rooted from their assessment and need, will have a contribution in effective performance and sustainability of PWs. Based on this, regions and woredas need to assign or recruit relevant O&M technical staff(S) who will have a responsibility to oversight and facilitate the O&M activities of the assets created through PSNP PWs.

In addition to this, the WFSTF review the woreda plan and identifies support requirements from woreda-level line Departments and other organizations, like Roads desk, education, health offices and others. The line departments are expected to support in O&M of PW in addition to the usual participation in planning, implementation, M&E of the programme.

3.2.3.2 Equipment needs

PSNP staffs not only need the right skills to do their jobs, they also need access to materials and equipment. At woreda level, equipment is often shared among offices through the 'pooled' system. To make this work, staff must plan their activities in advance to secure access to the resource they need.
The PSNP also has resources to purchase the equipment and materials staff needs to implement the programme. Minimum standards for equipment and materials have been developed, while for other items programme coordinators must assess the needs of their staff and procure accordingly. However, all materials and equipment purchased must be cared for and maintained to ensure their effective functioning for years to come.

The woreda sector offices implementing the public works are responsible for ensuring the availability of the necessary hand tools such as spades, shovels, hoes, crow bars, sledge hammer, rakes, pick axes, and mattocks. Tools must be appropriate to the nature and scale of the works to be undertaken and to the local terrain and traditions (familiar to the people who are to use them). The hand tools and construction equipments should be available at kebele or community level to use for operation and/or maintenance of PWs.

Much of the equipment required for implementation of the public works may be needed for O&M activities and can be shared between different sites within a woreda. Equipment, such as GPS and other surveying equipments can usually serve more than one site, and should be available at the level of the woreda.

The PSNP requires certain physical resources to function effectively. Each woreda must make sure that all hand tools and equipments are available for the O&M of PW through pooling arrangements, other sharing arrangements, repairing existing equipment, and/or organizing community private tools and equipments.

3.2.3.3 Training

Building the capacity of **local communities** and **extension workers** is an important component in community development. Different people will have different roles and responsibilities in project implementation and there is a need to train people involved in the community development program/project at various levels: villagers,

CBOs, extension staff, and others. The purpose is to achieve sustainable village/community-based development. Training can enhance knowledge, attitude (problem solving, behavior, commitment and the like), skills (communication, technological, demonstrations, conceptual) and relationship (trust, respect, co-operation and team work).

Basic Training programs for community development users:

Training is aimed at imparting knowledge and skills for effective planning, implementation, operation, maintenance, monitoring and evaluation. Training can be implemented in a classroom setting or through seminars, workshops, exposure visits, or video conferencing. The main training topics relevant to development users include the following:

Introduction to participatory development: Project stakeholders and their roles; capacity assessment, situational analysis, problem and objective analysis, project cycle and community roles in each phases of the cycle; community participation; gender issues in project, etc

Leadership and management: Roles of project/scheme leaders; management and leadership styles; Resource mobilization; management of community meetings; decision-making methods; networking/information sourcing; project reports; sharing of responsibilities.

Operation, maintenance and management: Specific operation of the project (schedules, distribution, application method, conservation, frequency...); System/part maintenance; Equipments and Maintenance.

Financial Management: Farm records; Budgeting/financial plans; credit sourcing and management; fundraising; organizing for repayment of loans.

Monitoring & Evaluation skills: Selection of capacity & performance indicators; record keeping and observations; progress reporting.

Each development users should put in place a monitoring and evaluation system to facilitate assessment of the impacts of the various capacity building interventions on the realization of the project objectives.

How to assess training needs: The role that one is expected to play in development programs/ projects often determine training needs. We need to determine roles and responsibilities of the stakeholders (*Woreda* team, DA, *kebele*, innovative farmers, and others). What are the activities that the stakeholder was involved with during the specified time frame and what are the skills/capacities required to effectively and efficiently undertake these activities? Before arranging a training programmme a training need assessment has to be conducted in order to determine the gaps and relevant trainings and decide the training topics, methodology, time and duration.

In order to equip the personnel with the right knowledge and skill, systematic identification and analysis of the training needs at all levels is required. Staff training development is essential preliminary strategy to avoid problems through proactive planning. Therefore, the objective is to conduct training needs assessment (TNA) of the different actors at the different levels engaged in implementing PSNP PW.

3.2.4 Integration

Public work subprojects are harmonized with woreda development plans and planned on an inter-sectoral basis.

3.2.4.1 Coordination between programme implementers and with other development efforts

The PSNP is a complex programme implemented by multiple Government ministries and departments at Federal, Regional, Zonal and woreda levels. The PSNP is also supported by NGOs and WFP in some areas. To achieve its objectives, efficient coordination is required between these institutions at all levels. In addition, the wider economic, social and climatic context can impact significantly on whether or not the PSNP achieves its outcome of protecting food insecure households and promoting graduation from food insecurity. Integration of the PSNP with the Government's Food Security Programme and broader development initiatives will maximize the impact of the PSNP on households and the likelihood that households graduate from food insecurity, while effective coordination with the emergency systems required to protect all food insecure households from shocks, such as droughts.

However, coordination cannot be assumed; it must be actively sought. Therefore, while the PSNP is not responsible for the actions of other institutions implementing Government programmes and services, programme coordinators at all levels need to ensure that it coordinates sufficiently with these institutions and actors to achieve Programme outcomes. For this, the PSNP has adopted the following as the 'building blocks' for achieving effective result-oriented linkages:

The objectives of the PSNP are common to all institutions implementing the PSNP; linkages beyond the PSNP are built from the shared vision stated in PASDEP, food security policy and others. These organizations are all working towards the same goal and so coordination is necessary for all of them to achieve their individual objectives collectively;
PSNP institutional arrangements provide the framework for sharing responsibility for PSNP success between implementing partners and with other contributing organizations;
Specific processes have been adopted to promote effective coordination: Technical Committees, Taskforces, and others;
Effective coordination must be planned into programme activities, with specific staff assigned the responsibility to coordinate with other institutions and to judge staff performance based on the delivery of shared objectives. Communication and the sharing of information is a critical requirement for effective coordination, both within PSNP implementing organizations, and between organizations;

3.2.5 Technical standardization of PW

In the CBPWD guideline of the MoA and the recent pastoral area PW guideline, information on techniques and technologies or information kits materials are prepared to assist development agents and various experts at *wereda* level with minimum practical information on work norms and technical standards required to undertake various works related to soil conservation, water harvesting and some basic community infrastructure like feeder roads.

The main purpose of the technical kit (Info-techs) is to guide field staff to follow correct and quality oriented technical standards in respect of local conditions of soils, slopes, vegetation, rainfall, and livelihood patterns. It attempts to summarize several aspects related to the proposed interventions, providing information on key design features of the measures and their implementation requirements. It is action-

oriented summaries of different measures and technologies commonly applied in various parts of the country. It has been used within the context of ongoing national safety nets public works programme.

In addition to CBPWD & pastoral area PW guidelines different training materials has been prepared and suggest various integration requirements and modifications to standard design necessary to accommodate various local conditions. In this regards, flexibility in design is essential to provide sufficient adaptability to local conditions within the quality standards proposed. The guidelines were developed to be as brief and descriptive as possible. In this regard they should not be seen as comprehensive and sufficient for all situations. They are simple guidance notes on major activities based on farming and pastoral areas work norms. Accordingly, additional technical references and materials (and expertise) should be consulted whenever necessary.

At *wereda* level, info-techs can be used during field work and training as quick references. They need to be explained to DAs by professional natural resources conservation experts and other experts (road authority, water resources, etc) and/or used during on-the-job or in-service training.

For each activity, minimum technical standards and work norm elements are developed (Work Norm Guideline – 2000). All measures include technical standards, which are key technical requirements related to the dimensions, size, spacing, and others, required for each activity currently supported by the project and work norm elements, which refer to the main operations necessary to accomplish a given measure. For additional information, experts should refer to the info-techs attached in Part 1 of Community-based Participatory Watershed Development: A Guideline as well as other technical manuals and training documents.

3.2.6 Developing bylaws

Bylaws are defined as a local or subordinate law; a private law or regulation made by a corporation for its own government, or a law that is less important than a general law or constitutional provision, and subsidiary to it; a rule relating to a matter of detail; as, civic societies often adopt a constitution and by-laws for the government of their members.

Bylaws/Constitutions that a community or users may adopt should in principle provide sufficient for the equity of rights and responsibilities among members, accountability and transparency in its project operation.

Establishing bylaws had been one of the initial steps undertaken along with the formation of CWTs upon starting the PW activities. For most of the community watersheds, the byelaws have been approved and secured recognition of their respective Kebele Administrative Councils before they were put into effect. The justice systems in Kebeles use the byelaws to fine transgressors.

Although the number of transgression is fluctuating from year to year; the overall trend of transgression is declining over time. This is because of strict observance of the byelaws by community members who have acquired better awareness of the benefits gained from the PWs.

3.2.7 Cost recovery Mechanism or Cost Sharing

Operational costs are the expenditures for operating, maintaining and managing a project/scheme. These expenditures come back year after year, for as long as the project/scheme is kept in operation. Therefore, they are also called ***recurrent costs*****.** An important principle is that operational costs of a project/scheme should be paid by the users. If users are not capable or willing to pay the operational costs, this is an indication that something is wrong. For example:

- Recurrent costs are too high, or
- Additional income from the project/scheme is too low, or
- Farmers believe they can get away with not paying.

The causes and cures for each of these situations are discussed below.

Fee collection planning

There are two possible sources of fee:

- Usage fee
- Membership fee

Accordingly the monthly amount of fee to be collected from users and membership fee is estimated allowing reasonable deviation that could be encountered due to seasonal, cultural, social factors, etc.

Fee collection methods and accounting system

Fee collection

Up on the agreement of project/scheme users the amount of fee to be charged per member and user is decided taking the frequent and amount of usage, the paying capacity of users and other reasonable factors in to consideration.

Contribution may be in terms of:

- ✓ Cash
- ✓ Material
- ✓ Manpower/labor
- ✓ Donations

The fund may be used:

a. For repair
b. For maintenance
c. For the construction of additional projects/schemes(as a contribution to develop sense of ownership)
d. For emergency cases
e. For other rehabilitative and development purposes
f. For capacity building activities

For this end legal receipts are prepared as agreed up on by the users/representatives based on which smuggling in fee collection and usage can be controlled, as the collected fee is to be used for further common purposes like repairing and maintenance of project/schemes, payment for guards, for fencing and even for further expansion of projects/schemes at least as a contribution of some proportion.

Accounting systems

Once the amount of fee rate is determined, the vouchers are prepared and fee collector is assigned fee collection begins. Here at least two committees are required. Consequently, formal accounting systems of receiving and paying are introduced to assure transparent collection and usage of money by avoiding any kind of mistake, mismanagement as well as fraud and smuggling. For this purpose committees are formed.

Committee combination

- User association for the respected project/scheme
- Fee collection committee
- Development committee or KDMT/CDMT
- Audit committee

3.2.8 Developing a handing over plan

The WFSTF should develop a handing over plan as a project exit strategy, for the transfer of its responsibilities at the completion of the PW project to the relevant local level management committee(KFSTF or KDMT or User groups) and local government technical bureaus/offices, as appropriate. There are several points at which the woreda PWFU/NRMCP terminates its responsibilities to a project:

- The first is at the completion of PW project implementation, when the PW project meet its objective by creating asset to the community and the community becomes responsible for on-going operation and maintenance of the system.
- The second is when the woreda PWFU/NRMCP is no longer able to provide periodic technical advice and assistance.

To help the community understand and be prepared for these transitions, the WFSTF should work with the community to prepare a plan for transferring responsibilities to the relevant local level management committee.

Although the community is expected to undertake routine maintenance and repairs of the assets created, it probably will need technical and financial assistance for major technical problems and repairs. The WFSTF should help in setting up an arrangement with the local government technical bureaus/offices, which have been involved throughout the project development cycle, for assistance in the event that major interventions are needed in the future.

3.2.9 Management Systems

The key determinant of success in the PSNP is timeliness of transfers and sustainability of public works. If transfers are timely then people can be sure that transfers are coming, and can plan their consumptions and expenditures to guarantee sufficient food and avoid asset loss. If public works are sustainable, they have been built to technical sound specifications and have operations and maintenance systems in place.

Timeliness of transfers and sustainability of public works are directly related to the effectiveness of programme management. The PIM describes the processes and procedures that, if implemented correctly and on time, will result in timely transfers and sustainable public

works. It is the role of management at all levels to ensure that each of these processes is followed as described and on time.

The institutional arrangements for the PSNP are designed to create effective management structures. Programme coordinators within each PSNP implementing institution are responsible to manage their staff, physical resources and capacity building activities, such as training and procurement, in an efficient manner.

The PSNP has resources to build institutional capacity over time and a key function of management is to identify and fill capacity gaps that hamper programme implementation. The key principle behind decisions to invest resources in additional capacity is that these decisions must be evidence-based, driven by specific assessments that provide a specific justification for capacity-building expenditures.

Even when minimum standards have been set, programme coordinators can exceed these minimum requirements if their analysis shows that additional staff, equipment or trainings are required to implement the PSNP effectively and efficiently. Capacity has to be assessed each year to ensure that adequate capacity is maintained. However, it is critical that these capacities – human, physical or educational – be managed correctly and used efficiently. These are all elements of sound programme management, which is critical to ensuring the success of the PSNP and in the meantime the sustainability of assets created by the PW through O&M mechanisms.

Chapter 4: System Operation and Maintenance Plan/Strategy

4.1 System Operation

Proper operation of some of PW subprojects needs knowledge and skill on how to operate some components of the projects. There are three fundamental causes for the poor operation of a system: 1) Lack of technical skills in planning, implementing and monitoring the system; 2) Poor management and 3) Technical deficiencies in the physically operating the system.

Often times there is a tendency to believe that out of the three fundamental causes outlined above, those related to technical deficiencies are the main ones responsible for low efficiency. Although any generalization in this respect may be risky since exceptions are bound to exist, the chief reasons for low efficiency are more often associated with lack of technical knowledge among the people operating the system and management issues. Nevertheless, it is obvious that any serious attempt to evaluate the operation of any given system must take a close look at the above three groups of problems if suitable improvements are to be achieved.

Commonly to solve knowledge and skill gap in operating the system, members from beneficiaries are trained during construction of the system or after completion of the project before handing over on how to operate the system. These trained persons are generally known as local technicians like Gate operators, local technicians, water supply care takers, foreman etc responsible for monitoring the day to day operation of the system. The system operation may need a close supervision of the technicians on daily basis spending their valuable time that could otherwise be spent for another personal productive work. Therefore, the user groups are expected to logically device a system to compensate for the service they have got from these local technicians.

4.2 Maintenance Plan

The planning of the annual maintenance should take the form of a strategic planning process which will be constantly monitored, reviewed and adjusted accordingly. Each year the established user groups (beneficiaries) will have to carry out some major (annual/seasonal) maintenance, as well as routine tasks and occasional emergency works. Major maintenance works should be carried out during suitable time for maintenance, which will vary according to the subproject. Works need to be planned in advance to decide what is required, what funds are available, and what can be carried out.

The process of creating a strategic maintenance plan is an opportunity to take a coherent, as opposed to ad-hoc, approach to improving the manner in which the maintenance works to the systems are to be undertaken. The maintenance plan will be constantly reviewed through a monitoring and evaluation process and modified from year to year as necessary, to ensure long term sustainability of the projects. There are two stages in the planning process; firstly, the preparation of the **annual maintenance budget** and then the planning of the actual maintenance to be carried out.

Maintenance planning involves a series of steps that include:

1) Determination of maintenance cycle for the maintenance of the main system.
2) Potential problems identified, as part of routine maintenance inspection.
3) Regular (weekly) inspections when new problems or significant deterioration are noted.
4) Annual/seasonal inspections made, review of problems already recorded, any new issues entered like details of problems, work envisaged, estimate of resources required, prioritization of works and decision of works to be carried out.
5) Survey and design (if required)
6) Estimating and budgeting like cost of maintenance works, revision of scope of works (if required), overall budget and calculation of maintenance fees (if applicable)
7) Discussions with stakeholders (farmers), agreement of scope of works within the budget, approval of budget and fees and agreement of how works should be implemented.

It is most important that all stakeholders become aware of what maintenance works are required, where problems may arise, what priorities they should be given and modality of implementation. The responsibilities of operation and maintenance (O&M) of any subproject should be clear to all parties from the outset.

It is recommended that all minor or routine maintenance works shall be undertaken by the beneficiaries or (user groups) under the technical supervision of the Woreda and Kebele technical expert. The farmers are expected to provide voluntary labor service to carry out the maintenance work. (e.g. some two days per week), during the maintenance period.

Provided that major maintenance, crisis or deferred maintenance is still the responsibility of the beneficiaries, however if the nature of the works are of a complex nature and requires large relative funding, the government should be approached, through woreda respective sector offices. It is expected that each sector offices at woreda level shall play a leading role if rehabilitation work is required.

PART THREE: PRACTICAL GUIDELINE FOR OPERATION AND MAINTENANCE OF MAJOR SUBPROJECTS

Chapter 5: Operations & Maintenance for Major PW Subprojects

5.1 General

Operation and Maintenance arrangement is crucial in order to sustain the benefits of the various public work infrastructures. Before any infrastructure is built its management, operation and maintenance arrangement should be coined well so that it can give the intended full benefits to the beneficiary communities.

Community infrastructure can provide long term benefits to the community only if they are managed with care and appropriate preventive maintenance and repair are done on timely basis. To this end, before engaging on the construction of communal infrastructure an accepted and appropriate mechanism should be in place. In general larger and more complicated infrastructure should be linked with the existing appropriate government structure and smaller and simpler infrastructure should be supported with community based infrastructure management systems. If an asset is built only to be damaged short after construction it is only a waste of public resources. Therefore, PW assets should be built only after establishing an appropriate exit strategy or handover mechanism to either community or government structures. In this section some useful suggestions on the establishment of community based asset management structures are presented for major PW subprojects.

PW subprojects like, biophysical soil & water conservation, water including SSI and road subprojects have challenges related to sustainability. These PW subprojects are identified as major subprojects that need an O&M guideline. Hence, O&M mechanisms for some activities of these subprojects presented below. For other sub projects O&M mechanisms, illustrated in chapter 3, can be adopted accordingly.

5.2 Guideline for O&M of major Subprojects

5.2.1 Biophysical soil & water conservation

5.2.1.1 Maintenance of Soil Conservation Structures

Both biological and physical soil conservation measures need proper maintenance to ensure their continuous provision of the intended benefits.

A. Protection and Maintenance of Physical Structures

Unlike biological measures, physical structures lose their strength due to the effect of flood, human and livestock disturbances. Every year before the inception of the rainy season and immediately after a heavy flood, structures need to be checked for any problem or damages and if there is any, it must be maintained timely. The fact that failure of a physical soil conservation measures actually increase the risk of soil erosion makes its regular maintenance more important. But the most important challenge for maintenance of physical structures is related to their number and distribution.

The possible arrangements for maintenance could be:

- To give responsibility for the owner of the land to regularly maintain the structures and protect structures from livestock and humans trampling effect.
- For communal areas established user groups (local landless) or other CBOs bear this responsibility or follow the strategies to use rehabilitated area if needed.

B. Managing Grasses Planted on SWCs or Marginal Areas

Grasses provide double benefit when planted on physical soil and water conservation structures by providing protection for the structures and providing fodder for livestock or thatching. If grasses are not well protected and maintained they will not provide the intended benefits. The most important problem with regards to grass is overgrazing by livestock. Whenever possible cut and carry system is the most suited management practice to ensure grasses are not grazed for more than their capacity. By doing this, we can increase the yield and ensure the protection of physical structures.

C. Protection of newly planted trees

- Protection includes preventing damage by fire, pests, domestic animals, wildlife grazing and human being.
- Hence, it is extremely important to make the whole community aware of the importance of protection.
- Damage to small trees is sometimes caused by wild animals, but more often by livestock.
- In areas where browsing pressure is high, it might be necessary to erect fences or construct protection round the young seedlings.
- Of course, the easiest way will be keeping livestock away from the plantation.
- All species, particularly fodder species, require protection from grazing animals during the first 2-3 years after establishment.

In general, the average annual growth rate increases slowly during the first initial years, then reaches a maximum and falls gradually as the tree becomes older.

5.2.1.2 Management of Area Closures (AC)

Area closure can only sustain if there is willingness from the community on its protection. To that end, the community should first be convinced about the benefits of AC and agree on how to share the benefits. AC are more sensitive than other conservation measures as they demand the community forsakes its use rights of the area for some time and conflict on sharing the benefits on the land is also possible. Thus, before closing the area the community should agree on the area to be closed and how it should be utilized after its restitution. A formal written agreement including the following information should be made with the village leaders (Kebele Leaders):

- Size and boundaries of the enclosure;
- Tasks and responsibilities of the community;
- Tasks and responsibilities of the Government, e.g. provision of seedlings when enrichment planting is required;
- Modalities of joint management, future beneficiaries of produce, etc.

A. Organization in management of enclosures

Successful management of enclosures requires that there is an organization in the village that can handle difficulties that may arise. It is also essential that there is a continued dialogue between the village and the representatives of Ministry of Agriculture.

In most cases, the existing Kebele leaders assume responsibility for the enclosure, just as with any other development activity in the village. But if the villagers prefer it, a committee can also be elected specifically to handle the management of the village enclosures.

B. Management of permanent enclosures

As soon as human activities and livestock grazing are restricted, grasses will regenerate very quickly, followed by a variety of bushes that grow from foot sprouts of the remnant vegetation or from seeds dispersed from mother trees in the vicinity.

After 3-4 years, the grass and other vegetation will have reached a stage that is good enough for harvest of some produce. The respective communities and Ministry of Agriculture extension agents should decide together on the different management options for the closure. There are two management options: one is to designate the closure a forest area and the other is to use it for grass production.

The following management interventions should be essential if it is decided to make the closure a forest area:

- The boundaries of the enclosure should be demarcated with visible permanent structure or marks
- A buffer zone at the periphery of the permanent must be established
- Economically valuable trees may be planted in gaps to enhance production
- People should be allowed to cut and carry grass, and even undesirable bushes can be removed, otherwise there will be considerable increase in the risk of fire
- The enclosure must be divided into blocks of compartments by fire break lines

- Fire towers at the corners and at points of high ground in the closure may be constructed, and fire-protection equipment must be made available.

The above management interventions are primarily the responsibility of the villagers, with technical advice from extension staff.If enclosures are to be sustainable, the surrounding communities must obtain as many benefits as possible and as early as possible.These benefits include:

- Cut-and-carry grass
- Collection of dry wood
- Collection of wild fruits and traditional medicines
- Placement of beehives and collection of honey (with care fire!).

Management of temporary enclosures is designated for grass production rather than to become forest, and in such case the enclosure can be utilized earlier. Such an enclosure is usually called temporary enclosure.
Re-seeding the area with more palatable and nutritious grasses may be useful to increase the productivity of the land. If the regeneration of grasses is good, the villagers may be able to start to cut and carry grass within a year, but preferably this should be after the grasses have seeded naturally.
However, from the palatability and nutritive value point of view, grasses should be utilized soon after flowering, and in subsequent years earlier harvest is recommended. Grass harvested from enclosures near roads has a market value and can either be sold or used within the village. There are two options for the use of grass: either it is used directly after cutting for a stall feeding of livestock or alternatively, it can be dried and used as hay during the long dry season when little other fodder is available.

Woody shrubs and bushes are very important for browsers such as goats and camels. However, if the bushes and shrubs are too thick, they suppress growth of the grasses underneath. Therefore, in order to keep a balance between shrubs/bushes and grasses, some of the woody perennial may be thinned or removed. On well-developed enclosures controlled grazing with periodic resting can be a food management option. In this case, the closure can be divided into sections and grazing can be allowed on them on a rotational basis.

C. Utilization of rehabilitated areas

The strategy designed for **utilization of rehabilitated areas** aims to ensure sustainable development and gain economic and agro-ecological benefits of our untapped natural resources by transferring protected and rehabilitated areas for private, associations, community and government development partners.

The strategy will help in further development opportunities and create ownership rights. This strategy is a key mechanism for sustainability of rehabilitated areas by the PSNP PWs. The strategy is a mechanism for sustainability of rehabilitated areas by the PSNP PW as a result of:-

1. Solving absence of clear Ownership and management system for protected communal areas that leads to unsustainable system by creating proven ownership;
2. Encouraging the participation of deprived youth, women and low income community members, that are not benefited from the natural resource development and make them sustainably beneficial;
3. Promoting regional stakeholders participate in development activities to tackle recurrent drought and hazards together with the government;
4. Scaling up demonstrated achievements recorded in watershed development and in utilization of protected and rehabilitated areas in all regions;
5. Commencement and growing the participation of associations/organizations and stakeholders in watershed development.

By transferring rehabilitated areas for private, associations, community and government development partners the strategy focus to develop and utilize rehabilitated hilly and gully areas using selected tree species. The following are part of the strategic packages to develop rehabilitated areas:-

- Forest development;
- Fruit and other multipurpose tree production;
- Bee keeping/honey production;
- Animal fodder production;
- Bio-fuel production; and

- Flavors plant production and other agro-ecologically appropriate and economical plant production will be developed in rehabilitated areas.

5.2.2 Water Projects: community and Micro-level

5.2.2.1 Rural Water Supplies

A. How can a village improve its O&M?

Efficient and effective operation depends upon sound village water supply strategies made up of (a) water safety plans to ensure good quality water, (b) standard operating procedures including who will do what and when, and to identify associated annual expenses and revenues; and (c) service improvement plans to set out future investments to ensure improved, sustainable service delivery.

A water safety plan is developed by surveying the water supply system from source to storage/treatment to distribution to household (also known as a sanitary survey). This helps to identify risks of contamination and corresponding operational control measures to reduce those risks. The controls have to be monitored to check that they are working, specifying how often the check should be carried out, and identifying who is responsible for checking. If a control is deemed to have failed remedial action should be taken.

Standard operating procedures are essential to identify what local operators should do in terms of routine operation and maintenance related to water sources, storage and treatment units, and distribution systems including connections; and for annual budgets of operating expenses and income, and annual surplus/deficit. Someone with good experience and analytical skills would be needed to train operators and assist them when problems arise.

Often the tasks required can overwhelm a local operator who has only basic skills and limited experience, but by providing basic orientation in terms of what to do and when, the operator can quickly gain hands on experience and build confidence to do the job well. Likewise, the operator's fees and incentives can be made transparent and this also helps to improve their performance.

Service improvement plans are important to define management improvements, service delivery improvements and actions to improve accounts, billing and revenue collection. The benefits and costs need to be considered and priorities set (such as immediate, this year or next year).

B. Operation and Maintenance Activities for a Hand Dug Well

The daily O&M activities should include:

- Check for any debris in the well by regular visual inspection
- Clean the concrete apron
- Clear the drains
- Check that the gate is closed
- Check the condition of the handle and fence by regular visual inspection
- Report problems to the WatSon Committee

The weekly O&M activities should include:

- Clean the hand pump and spout pipe by hand
- Check all the flange nuts and bolts and tighten as needed
- Make sure the hand pump is firm on its base, and fix as needed with the help of a mason
- Check the axle bolt and tighten as needed
- Make sure the lock nut is tight
- Make sure the hand pump is firm on its base
- Check the flange bolts fastening the water chamber to the pedestal are tight

Monthly activities should include:

- Replace any broken part; check the hand pump
- Collect community contributions or user charges and deposit with the WatSon Committee
- Check the concrete apron and well seal for cracks and repair with cement mortar as needed
- Testing water quality using a Field Test Kit
- Tighten the handle axle nut and lock nut
- Check for loose or missing flange bolts and nuts and tighten as needed
- Open the cover and clean inside the pump

- Check the chain anchor bolt for proper position and tighten if needed
- Look for rusty patches, clean with a wire brush and apply anticorrosive paint
- Find out whether the hand pump base is loose and arrange for repair of the foundation as needed

Annual activities should include:

- Dewater the well and clean the bottom
- Inspect the well walls and lining and repair as needed
- Disinfect the well as needed and especially immediately after the end of the rainy season
- Check the hand pump and repair as needed
- Ensure discharge is satisfactory
- Check whether handle is shaky
- Check whether guide bush is excessively worn out
- Check whether chain is worn out
- Check whether roller chain guide is excessively worn out

O&M resources for a dug well

- Unskilled labor (WatSon Committee) is required for daily tasks and for collecting user charges. Semiskilled
- Semi skilled labor (water caretakers) is needed to carry out weekly and monthly O&M tasks; a private technician may be needed to repair the pump. Skilled labor (mason) is needed to work with the caretaker on yearly O&M tasks and to repair the concrete apron and support posts for the pulley.

Materials and equipment include the bucket and rope, fencing, support posts, brush, digging and

- Hand tools, cement, hand pump parts, and masonry tools to be provided to the caretakers by the WatSon committee.
- Finances would be from the WatSon committee for labor, replacement parts and maintenance equipment.

C. O&M activities for springs and gravity fed piped systems

The daily O&M activities at each stand post should include:

- Check if the tap works

- Check the flow of water
- Attend to any dripping tap
- Attend to any leaking valve
- Clean the stand post platform, drain and surroundings
- Inspect the stand post structure, platform and drain – repair any cracks in the plaster with cement mortar

Weekly activities at the tank should include:

- Check there are no leaks, the overflow is in good order, valves are in the correct position, and water is flowing into the reservoir at the required rate
- Walk the distribution pipeline, check for leaks, look for disturbed sections of pipeline, check valves are working, inspect valve boxes – repair as needed including pipes and areas of erosion around pipes.

Monthly activities should include:

- Collect user charges and deposit with the VWSC

Annual activities should include:

- Drain the reservoir, clean and disinfect the tank
- Plaster and repair cracks in the walls and floor of the tank
- Check that valves are working and repair or replace as needed
- Open the washout to flush pipes
- In the dry season remove soak away stones, clean the soak away pit and stones before replacing them

D. O&M resources for gravity fed piped systems

A semi-skilled stand post caretaker is required to carry out daily inspections at stand posts and assist in repairing pipeline leaks and erosion control. The VWSC should collect user fees and purchase spares as needed, and keep a record of leak detection and repair. The stand post caretaker would also carry out daily and weekly activities on the distribution system. Skilled labor (pipe fitters, masons) are needed to repair pipe leaks and the tank or stand post infrastructure.

Materials and equipment include sand and cement, stones for erosion control, brushes for cleaning, tools for maintenance and repairs, PVC, PE or GI pipes, and spares for taps and valves. Finances would typically be from the user charges, GP resources or Government funds for labor, materials and spare parts.

E. Reservoirs including service reservoirs

The main function of Reservoirs and Service Reservoirs (SR) is to cater for daily demands and especially peak demands of water. Operators/managers must be concerned with the amount of water in the storage reservoir and the corresponding water levels at particular times of the day.

Procedures for operating the Service Reservoir will depend upon the design of its storage capacity and on the water demand.

Service Reservoirs have to be operated as per the design requirements. Normally the service reservoirs are constructed to supply water during periods of high water demand and hence the SRs are filled in low water demand periods. At times pumps may be used only for filling the SR before the next supply timing or can be used also during supply hours to maintain the levels in the SR. Old SR should be evaluated from time to time to ascertain its structural stability and take corrective measures.

Small changes in the distribution system such as pipeline extensions or the addition of few more connections will not require additional storage requirement. Major system changes such as addition of larger size of main pipelines and increase in large number of connections may require additional storage.

Routine inspection is the best way to determine when a tank requires maintenance and cleaning.

A visual inspection can be made from the roof manhole with water level lowered to about half full or less. Alternatively a detailed inspection can be made after draining the tank and then cleaning or washing. Best time of the year to take up cleaning of SRs is during the period of lowest water consumption.

The following activities are normally involved in cleaning of a tank/SR:

- Make alternate arrangement for water supply to consumers served by the SR,
- Close the inlet line before commencing cleaning of SR,
- Draw the water from the SR till 200-300 mm water is left in the SR,
- Close the outlet valve so that no water will be used while the tank is being cleaned,
- Collect sample of water and silt/mud accumulated in the Tank and get the biological analysis and for presence of snails and worms. If snails and worms are found find the source and eliminate it,
- Drain and dispose-off the remaining water and silt,
- Wash the interior of tank walls and floor with water hose and brushes,
- Inspect the interior of walls and ceiling of tank for signs of peeling off or deterioration,
- Apply disinfectant (Supernatant of Bleaching powder) to the walls and floor before start of filling the tank/SR, and
- Frequency of cleaning of SR depends on the extent of silting, development of bio films and results from water quality monitoring.

Identification of the valves as to their intended purpose such as inlet, outlet, scour, bye-pass etc. and their direction of opening are to be prominently marked. The operator/manager shall ensure that all valves in a SR are in good working condition and are operated as per the schedule for such operations.

All valves should be inspected and operated regularly:

- The manager shall specify frequency of inspection,
- A small amount of penetrating oil is poured down the spindle to lubricate packing gland and soften the packing,
- Valve spindles that develop leaks on turning should be repacked,
- Rust and sediment in the valve is removed by shutting the disc hard in the seat, then opening about a quarter way and closing tightly several times; the increased velocity usually flushes the obstructions away, and
- Valve chambers of the SR also require maintenance to ensure that the interiors of chambers are not silted up and

also ensure that the covers are in good condition and are in position.

- Alignment, stability and leakage of the duck-foot pipe of SR should be checked regularly.

Water from all SRs should be regularly sampled especially once, before and after monsoon to determine the quality of water that enters and leaves the SR. Sampling data can help in setting up periodic cleaning of SR. Indicators that help to decide when the tank is due for cleaning is turbidity, excessive color, taste and odor.

The following operation and maintenance records should be kept:

Operation:

- Water levels in the SRs (for all compartments) at hourly intervals,
- Time and relevant operation of control valves with time of opening and closure or throttling position of the valves,
- Hourly flow meter readings both on the inlets and outlets,
- Hourly residual chlorine readings of inflow water and outflow water, and
- The man-hours spent on routine operations at the SR in previous year and the cost thereof.

Maintenance:

- When the gland ropes of the valves at the SR were changed,
- When the spares of the valves were changed,
- When the manhole covers were changed/replaced,
- When the water level indicator was repaired or replaced,
- When the reservoir was last cleaned,
- When the out-fall drain for scour and overflow was last cleaned,
- When the ladder was changed,
- When the structure of the reservoir was last repaired to attend to structural defects or arrest leakage,
- When the reservoir was last painted,
- When the piping at the reservoir was last painted, and
- Total cost of repairs and replacements at the SR in previous year along with breakup of material cost and labor cost with amount spent on outside agencies for repairs and replacements.

I. Institutional roles and responsibilities

It is clear that local governments and communities cannot succeed on their own. They need to be given clear-cut roles and responsibilities. These include responsible government institutions, line departments, training institutions, and the local private sector and NGOs. It is now possible to take up capacity building programs on redefining roles and responsibilities using public funds.

II. Actions Plan

- Regions should introduce standard operating procedures for O&M of hand pumps and piped water supplies and WatSons should identify and assign key functions to the appropriate person such as the hand pump caretaker or operator.
- Timely transfer of O&M funds is necessary to enable water caretaker to operate and maintain schemes without service breaks.
- For hand pumps, the WatSon committees needs to be provided access to spare parts and trained mechanics.
- For piped water supply systems with community stand posts and/or household connections, the WatSon committees' needs to make sure that community based operators receive training to gain the technical and financial skills to do the job.
- Woreda or Joint WatSon committees benefited by the scheme are responsible for overseeing multi-village schemes.
- Customer consultation and grievance redressal mechanisms should be established

F. Operation &Maintenance of Birkas

Introduction

Water sources available to satisfy human and livestock water needs in pastoral areas prior to the existence of Birkas were (i) rainwater collected in reservoirs, (ii) water from seasonal rivers if available, and (iii) Developed shallow wells. These water resource start to deplete during the dry season hence either water had to be brought by camel from far away distances or people had to migrate usually long distances in order to find enough water and fodder for their livestock, a typical, environmentally sound, pastoral behavior, but very laborious.

Thus this problem forced people to look for new technology like embankment. Water harvested during the rainy season could be used later in the dry season. Birkas are believed to be introduced during the British colonial rule time in neighboring Somalia in 1950.The technology soon spread to Somali region of Ethiopia. It is well adopted in both pastoral regions of Ethiopia, improving water availability in most areas. It has helped more people to relatively settle down, rather than migrate from place to place in search of water.

Birkas are underground water harvesting cisterns constructed to store rain water during the rainy season to be used later in the dry season for both livestock and domestic purposes. Birkas could be built with masonry or Ferro-cement concrete having circular or rectangular shape. The circular structure being more stable distributing force uniformly over the whole area while the rectangular structure having weak points around its joints. The capacity of Birkas varies from place to place due to water need and mainly cost of construction. The technology is widely adopted in areas of Somali and Afar regions where surface and underground water resources are unavailable or uneconomical to develop. Currently through PSNP-PW resources, a lot of Birkas are constructed in the pastoral regions, however proper operation and maintenance for longer lifespan of the structure needs further attention. Lack of sense of ownership, poor site selection, poor quality of material for construction, poor quality workmanship, lack of proper curing and lack of proper operation

and maintenance are believed to be major problems contributing for the short service lifespan of these structures. Therefore this section focuses more on providing Woreda staffs, DAs and the communities with a practical guide on how to properly operate and maintain Birkas for improving their service lifespan.

Operation and Maintenance

Often times Operation and Maintenance activities are perceived as an issue to be considered after completion of construction but the fact that, if we want to achieve more economical O&M and sustainable utilization of the structures, operation and maintenance is something to be considered from the start to end of the project life. Before establishing O&M system for Birkas it is advised that during planning and construction of new Birkas specially DAs or experts at grass root level should consider the following issues which have a paramount importance in longer lifespan of the structures:-Community Participation, site selection, sanitation and quality of water harvested, quality of construction material and good workmanship, proper handover to community representatives for O&M.

Community Participation: - Experience shows that there are many examples of community water projects that were built and ended up being abandoned or broken down soon after completion. Such experience highlights the need to involve the community in all stages of a project in order to ensure that the community owns the project and willingly takes responsibility for its O&M. Community participation is essential to ensure a genuinely sustainable project. It is obvious that Birkas may also be done at an individual rather than community level, however for community owned Birkas, in order to make sure that constructed Birkas are sustainably used, there is a need to identify and follow clear steps in the planning and implementation process. For that matter the DAs are advised to follow either CBPWD guideline or the pastoral guideline whichever available.

Site selection:- Specially for longer service life of Birkas as well as better management site for construction of Birkas must be near the villages and the type of soil has to be suitable for construction i.e. avoid expansive or unstable clay soils.

Sanitation and quality of water:- The rainwater runoff which fills Birkas flows over ground that is usually exposed for contamination. The ground on catchment areas can have animal droppings, human excreta (especially from young children) and other rubbish on it that will pollute the water. While this water may be used for livestock, small-scale irrigation and construction work it is NOT safe drinking water for humans. Therefore when planning, be sure to survey the catchment for minimizing soil erosion and identify all possible sources of contamination that could jeopardize water quality and users health.

Quality of construction material and quality of workmanship:-Good, solid masonry workdepends to a large extent on the quality of construction materials, the curing process and the skill of workmen. It is recommended stones used for masonry work should be of good size hard Black stones (basalt, granite) while avoid using white porous lime stones. The stones must be well shaped and clean, if dirty washed and brushed with wire brushes. Use good aggregates for concrete work i.e. clean sand, good gravel from hard stones, and fresh cement of good quality without hard lumps. The mortar to be used for Birka construction has to be prepared from clean good sand, without clay particles, needs good mixing to a good consistency. Proper and carful curing has to be given due emphasis for maintaining the strength of construction works.

Proper Handover:- After completing the construction of Birkas proper hand over of the Birka to the community has to be carried out for proper operation and maintenance. At this stage it is expected that there is a formally established management body democratically elected by the community responsible for

managing the structure. If not establish considering the following issues.

Forming a management structure In order to implement a successful Birka water project, the community will need to select a suitable management structure. Possible approaches might include:

- Starting by understanding the existing structures, including traditional clan leaders or elders.
- Raising awareness about the need for constructing Birkas and the need for a management structure with the local leadership.
- Helping the community to develop the roles and responsibilities of the proposed committee either traditional or new one. Don't forget >50% of the committee members to be females

Within most pastoral communities in Ethiopia, there are traditional management structures for water resources that existed in the past and possibly current management structures for new projects. It is up to the DAs and the community to decide which type of management structure is more suitable for the area.

The responsibilities that the management structure will have to take on behalf of the community for the sustainability of the project include:

- Coordinating construction and maintenance of the Birkas by the community.
- Operation and maintenance of the embankment. Having the technical knowhow to carry out repairs with little or no reliance on external support.
- Charging for providing services. Establishing the best revenue collection method. This includes a cost recovery system for operation and maintenance and managing the funds.

- Assigning and supervising community members who work on the water supply system, i.e. operators, fee collectors, caretakers, guards.
- Attending meetings and having periodic elections in acceptable format for all community members.
- Implementing decisions discussed and taken in meetings.
- Equitable distribution of water resources, formulation and enforcement of by-laws to ensure effective distribution.
- Engaging community members on their own terms, minimizing and resolving conflict, and identifying and resolving community problems.

Having analyzed the existing management structures, it is possible to agree with the community on the most appropriate structure for the planned project.

Operation of Birkas

Operation of Birkas focuses on preventing contamination by fencing, balancing water demand and supply and scheduling withdrawal or abstraction, enforcing bylaws and establishing the best revenue collection method charging for providing services with a cost recovery system for operation and maintenance and managing the funds.

Fencing of Birkas is done with locally available bushy trees around the Birka that prevent animals to have direct water access, while entrance with locked gate will be provided for human access at the downstream side

(opposite of the inlet). Life-fence can be ma de sometimes using locally adaptable perennial species.

In pastoralist areas, the water in the Birka is reserved and kept for the most critical periods, for use when all other closer water sources are used up. This should enable an extended water supply possibly until the next rain season. If used up earlier, the tanks will be empty the communities are forced to migrate, purchase or get emergency water supply from other nearby places/towns. Water is a scarce resource in arid agro-ecology of the pastoral areas for both livestock and domestic use. Thus the community with management body/ clan leader should make a plan of water consumption for the coming dry months considering whether the water available in the Birkas is sufficient or not. During rationing we have to consider (i) The total water consumption per family per month, including human water consumption (drinking water, and water for domestic use) and livestock water consumption. (ii) Evaporation losses. Then a plan is made on how much water each family is allowed to fetch during the dry season and the water is economized. In somali region Garbi kebele of Keberibeyah Woreda it was observed that each family of the community is given a quota for water withdrawal from the Birka in a week based on the water availability. Community members are charged for one Jerican (20 lt) 50 cents. The money collected will be spent for maintenance of the Birka.

Maintenance of Birkas

Maintenance refers to activities carried out for prolonging the lifespan of Birkas through routine maintenance, repairs and desilting. As we are an able to control the entry of sediments to the Birka each year we have to clean the embankment. Before the first rain clean the channels, intake area and the bed of

embankment from all debris, garbage and sediments etc. The desilting should be done annually; organized user groups should contribute labor. While removing sediments care must be taken not to scour the bed of Birka as well as removed sediments should be disposed away from the structure without impounding water around the Birka .

Careful inspection of the Birka for cracks should be done regularly; further inspection must be done if there is a sudden drop in the volume of the Birka. Cracks must be repaired properly by locally skilled mason as follows:-

- Chisel minimum 30cm on both sides of the crack right to masonry.
- Splash and clean the crack and surrounding surface with water
- Fix a layer of chicken mesh wire;plaster it with mortar (1:2). Next day a second layer of mesh plus mortar.
- Let it rest for 4 days.
- Then continue the plastering as usual, with always abundant curing mainly on the edges.
- Plaster it with mortar and leave it for minimum of 1 day.
- Apply a second layer of chicken wire and plaster it with mortar on the following day.

- Let it set for 48 hours.
- Complete the plastering including cement slurry for surface smoothening within 2 days.
- Cover the repaired area and keep it really wet for min 5 days.
- The maintenance of minor cracks should be covered from users' contribution while major rehabilitation works could be supported by the program.

g. Operation and maintenance of Ponds

Introduction

During the operation and maintenance stage it is assumed that a committee or individual has already taken on responsibility for managing the pond. Their mandate is to ensure that the agreed by-laws are adhered to and that funds are handled properly. Operation entails balancing water demand and supply and scheduling withdrawal / abstraction. Maintenance entails prolonging the lifespan of ponds through routine maintenance, repairs and desilting. Fencing the completed ponds is generally recommended for places, where livestock are allowed for grazing in adjacent areas of the farm pond. The fencing provides the protection and also helps in maintaining the vegetative cover over the embankment section.

Preventative maintenance is the key to ensuring a long life for a pond. Regular monitoring of the embankments, reservoir and catchment area should be carried out to make sure that maintenance needs are identified early enough to take action. Each year when the water level is lower deslting must be conducted

Operation

Controlling access

In most ponds it is advisable to control access to the water both to protect the reservoir and embankments and to reduce contamination. Where practical build a thorn fence around the reservoir to keep people and livestock away from the water and embankment of the pond and put up a lockable gate. Open water is dangerous because small children and animals can fall in and drown. In pastoral areas livestock are the primary users of water. During the dry season when there may be large concentrations of thirsty animals, it is not practical

to keep them out of the fenced area. However, there are ways to control where the livestock enters and how they are watered.

Demand management

Very few ponds hold sufficient water to meet all demands throughout the dry season, especially during droughts. There is a need for the managers /*Aba Harroo*/ to restrict the water abstraction in order to make sure that some water remains for essential uses. To do this the manager should:

- Look at the volume of water impounded.
- Estimate the livestock, irrigation and domestic demands
- As the dry season progresses, use a gauge or marker (e.g. a concrete post set in the reservoir) to estimate the volume of water remaining and decide if further restrictions/rationing are needed.

Operation of abstraction devices

The pond may have abstraction devices such as pumps or pipes and taps which need to be operated efficiently. In all cases the equipment should be made as durable and simple to operate as possible. During times when water is rationed the managers may need to prepare a schedule for water collection to minimize queuing and arguments.

Revenue collection

All ponds and dams require money for maintenance which will be raised in the community. Charging for the use of the water is the most common way of raising funds and payment can be done in several ways:

- In kind — in the form of labor for maintenance.
- In cash — per animal watering or per Jerrican collected.
- Through a monthly/annual fee.

For community projects the committee should establish by-laws to govern the sale of water and set tariffs for different water uses. Collection and use of funds should be transparent and accountable.

Good management skills

Community projects require good management to ensure sustainable operation and maintenance. Committees and the community as a whole may require capacity building to assist them to take on new roles and responsibilities for managing and maintaining ponds.

Maintenance

Catchment protection

Catchment protection is actually another technical term for soil and water conservation. It is important to make soil conservation structures on farmland to prevent siltation of pond reservoirs, otherwise layer of silt and soil will fill up the pond reservoir. Heavy silt loads reduce the volume of water a pond reservoir can hold, and once it becomes shallow the evaporation loss increases as well. In the worst scenario, pond reservoirs will be filled to the *berm* with soil and cannot hold any water at all. Since desilting of such reservoirs is more expensive than building new reservoirs, silted-up ponds are often abandoned. However, for pond reservoirs situated on sandy soils, a thin layer of siltation is beneficial because the silt seals the floor of a reservoir against seepage.

Catchment protection on farmland can be implemented in several ways. Maintaining the vegetation cover within the catchment by taking steps to avoid overgrazing by livestock and deforestation, which are key aspects in the battle against soil erosion. The adoption of agro-forestry is also helpful along with some of the physical measures.

Pond Reservoir protection and maintenance

Fence the reservoir

Where feasible it is often appropriate to fence off reservoirs to keep livestock out. This helps to maintain better quality water and avoids the problem of cattle getting stuck in the mud. Since fencing material is expensive the planting of live fence may make better sense. In sandy soils it is actually beneficial to let livestock walk into ponds because they mix soil, silt and dung to form an almost watertight floor which reduces seepage loss. Water mixed with urine and dung from animals is also another sanitary problem especially if the water is used for domestic water supply.

Control pollution/contamination

To prevent contamination of pond reservoirs by people bathing, washing clothes, and watering livestock directly in the reservoirs, build washing stands and bathing facilities downstream of a embankment wall next to the draw-off point. Where the slope is sufficient, a watering trough for livestock can be included.

Build pit latrines

During the rainy seasons rainwater runoff washes the excrement into pond reservoirs where pathogens can multiply and transmit human diseases. The construction of pit latrines is therefore encouraged. The latrines should be situated well away from pond reservoirs.

Plant windbreaks

Evaporation losses from ponds can be high in dry, windy areas. Plant a stand of trees such as Neem on the windward side of the reservoir to reduce evaporation. To maintain the windbreak the trees have to be densely planted.

De-silting

Rainwater transports topsoil and other light surface particles from a catchment to a pond reservoir where some of it settles to the floor of the reservoir as a layer of silt. A layer of silt that is only a few centimeters thick is good because it reduces seepage, but thicker layers of silt decrease the water storage capacity, reducing the period during which water can be drawn from pond reservoir. Catchments without soil conservation and ponds or embankment ponds without silt traps may result in pond reservoirs that cannot store any water after only some years. De-silting can be done using any of the techniques suitable for construction (manual, draught animal). De-silting should be done regularly, preferably once a year in areas where heavy siltation occurs. The depth of silt deposited (and hence the quantity to be removed) can be measured easily if a marked post is installed in the reservoir floor at the time of construction. De-silting should be carefully supervised to ensure that the very bottom layer of silt, which helps seal the reservoir, is not removed.

Embankment preventative maintenance and repair

Preventing embankment leakage

Newly built pond embankments do not usually hold water for as long a period as expected during the first couple of years, due to leakage. There are various reasons for leaks through embankment ponds walls but the most common include:

- Inadequate compaction resulting in air and water filled voids which become water channels over time.
- Old tree roots and tunnels of small animals which form channels for water to escape through.
- Porous materials which are not sealed properly with water tight materials in the embankment wall.

- Embankment walls which do not key into impervious rock or soil layers under the dam wall.

Preventing embankment walls from washing out (breaches)

There are several reasons why a embankment wall gets washed out but the most common one is that the spillway becomes blocked, or was made too small and fails to discharge flood water fast enough. The water level in the reservoir therefore overflows the embankment wall at its lowest point and causes a washout of that section, or perhaps of the whole embankment wall.

The most common problem with pond embankments is that blocked and silted overflows cause the water level to rise so that the embankments are acting as structural dam walls. These are not strong enough to hold water and will breach when the pond gets too full. This usually damages the embankment and the excavation. There are several ways to prevent washout of embankment walls and ponds:

- Obstructions such as trees and bushes, carried into a reservoir by floods and block the spillway should be cleared immediately.
- Embankment walls must always be maintained with their crests at least10 per cent higher at the middle (convex) than at the ends to prevent a breach at the centre.
- Embankment walls should always be carefully compacted. The height of embankment walls must be increased 30 per cent to compensate for the settlement of soil when the reservoir is flooded.
- The freeboard may reduce to 1.2 m after a reservoir has been flooded several times and the soil in the embankment wall has settled completely.
- Erosion of the embankment wall should be controlled. This can be done using riprap (stones placed along the upstream face) or by planting grass (but not trees or shrubs) along the embankment wall.
- Routine maintenance of embankment walls should include removing roots, repairing cracks and sealing tunnels of burrowing animals.

Breached ponds are difficult to repair and the cause of the breach should be fixed before repair work is started. Repairing a breach requires reconstructing part or all of the embankment of the pond and compacting it thoroughly.

5.2.3 Small Scale Irrigation Subprojects

5.2.3.1 Introduction

PSNP has delivered a significant volume of satisfactory quality community assets built through public works. A very large number of subprojects are completed each year, PWIA reports show that unlike water and road subprojects the majority small scale irrigation (SSI) projects are implemented to a satisfactory technical standard and with management, operation and maintenance arrangements in place on completion.

It is a usual practice that once the small scale irrigation (SSI) scheme construction is finalized, the project is handed over to the Woreda office of Agriculture (WoA) and beneficiaries through the newly established user groups i.e. either Irrigation Water Users Association (IWUA) or Irrigation Cooperatives (ICs) for management, operation and maintenance of the scheme. Putting a system for management, operation and maintenance on completion of projects is a major step however, it doesn't mean that the system is going to be operated and maintained efficiently, rather a continuous follow up and support is expected to run projects efficiently. The operational policy and rules during handing over states that, the operation and maintenance manual and full design document (as built drawings) of the scheme should also be handed over at the same time, the basis of which will form the operation and maintenance guidelines for the sustainability of the scheme. However, this was apparently not the case in most schemes. Design documents mostly are not available in case a need arises to refer for redesigning and rehabilitation of the scheme. Similarly developed manual for operation and maintenance of the scheme are not handed over, if handed over, the operation and maintenance manual is not well implemented as per the document by woreda office of Agriculture experts as well as established user groups. Thus the performance of most of the irrigation schemes has not been up to expectations.

5.2.3.2 Operation and maintenance concepts

Good management, efficient operation and timely and well executed maintenance are essential prerequisites for the success and sustainability of small-scale irrigation schemes. With the growing competition for both water and finance, the emphasis on good

management and efficient operation and maintenance is even more important. This will increase the awareness of the need for more performance-oriented use of water and financial resources.

The performance of an irrigation system depends not only on how the system is operated, but also on the condition of different component of the system and the type and timing of maintenance carried out. The consequences of poor maintenance can lead to rapid deterioration of the infrastructure requiring replacements, reduced timely water delivery, reduced crop yield and productivity. The causes of poor maintenance could be as a result of lack information available in preparing the annual budget, poor maintenance planning lack of user's participation, poor execution of works. Legally established water user groups (IWUAs or ICs) will have overall responsibility for keeping the irrigation system working in a satisfactory manner, within the limitations imposed by the initial design.

1.1 Need for Establishment of Legally Registered Water Users' Organization

When several farmers are carrying out irrigated agriculture using a common point of water supply, certain tasks or activities must be properly coordinated. To ensure the smooth running of the scheme and to avoid conflicts, it is important to have an Irrigation Water Users' organization for organization and self management. Thus irrigation schemes should be managed by a legally registered irrigation water users' organization.

At present, the existing legal framework for the establishment and registration of WUOs as legal entities is the (Federal) Proclamation No.147/1998 – Establishment of Cooperative Societies; and additional supporting proclamations might be there at regional level.

According to Article 29 (2) of the (Federal) Council of Ministers Regulation No.115/2005 related to Water Resources Management in Ethiopia, a water users' cooperative society established to undertake small-scale irrigation shall be registered by an organ established by law to organize and register cooperative societies.

The Cooperatives Promotion Agency (CPA) issued Irrigation Cooperative Organizational Guideline No.2/2000 for the formation of Irrigation Cooperatives. The agency has representative staffs at different level federal, regional, zone and woreda level responsible for

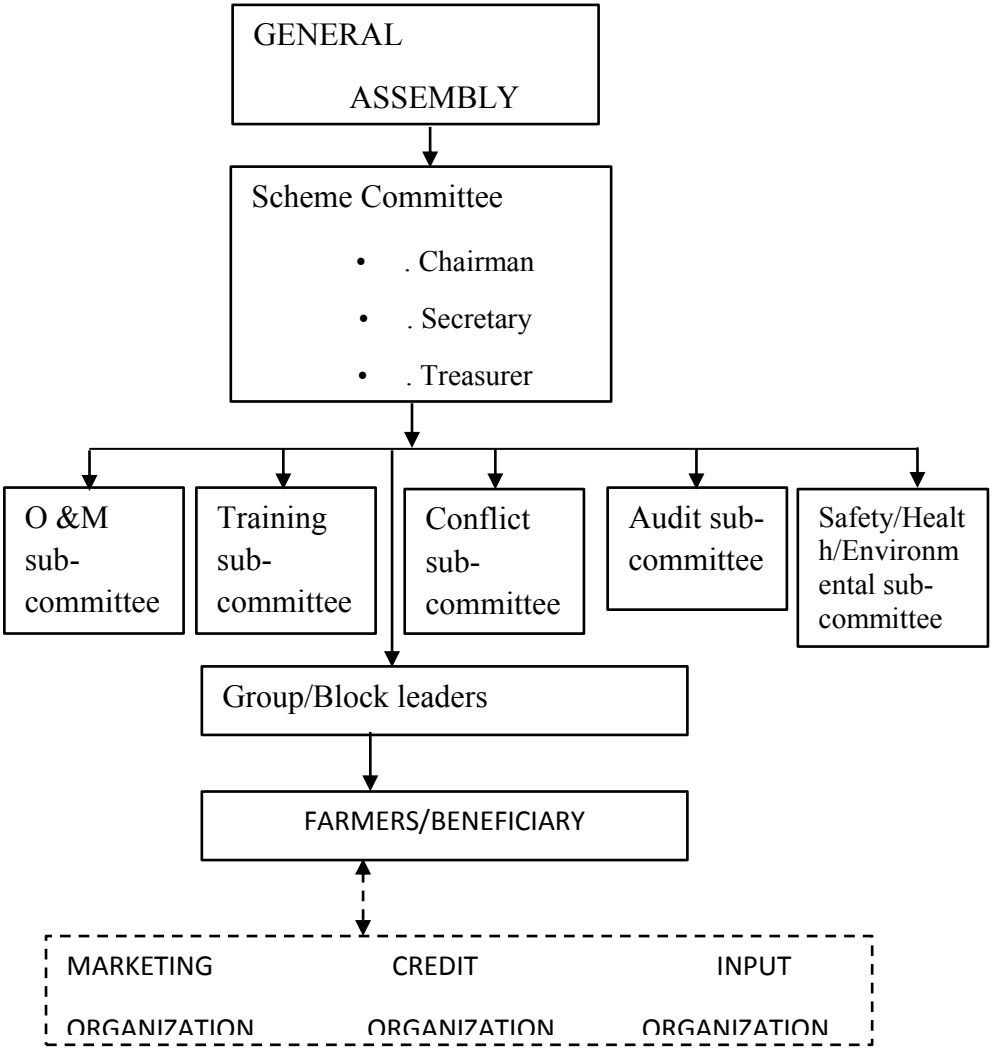
establishing and providing continuous support to cooperatives, which can be considered as a good opportunity to establish legally registered Water User Organization and follow up until Irrigation cooperatives become mature and functional and perform their various tasks effectively.

On the other hand under the World-Bank funded Ethiopian Nile Irrigation and Drainage Project, a draft Proclamation on Agricultural Water Users' Associations has been prepared, including model bylaws, model service agreement, model transfer agreement and model water delivery contract. Annex 2 shows the sample model by-law attached for further reference.

Hence it is up to the regions to select either Irrigation Water User Association (IWUA) or Irrigation Cooperatives to establish as legally registered water user organization. But it is observed that in some parts of the country well organized ICs have formally reached stage of developing IC Union. ICs are supported technically by cooperative Authority.

However, when we think WUA, a WUA must be constituted under legislation through a WUA law, which addresses the following issues organizational structure; method of formation, model charter directing the process of WUA formation; management structure setting; membership fees; water charges; applying sanctions and penalties; non-profitable, and having a tax free status.

For efficient management of WUAs, the formulation of by-laws and enforcement, election of effective leaders, establishment of committees with clearly defined roles and functions and good teamwork and effective conflict management is crucial for a successful WUA.



Legend

----- Outside WUA organization

Figure 1: Organizational structure of a typical water users association

Source: Mati, B.M. 2012. Participatory Operation and Maintenance of Irrigation Schemes. Training Manual 10. Nile Basin Initiative (NBI), Nile Equatorial Lakes Subsidiary Action Programme (NELSAP) - Regional Agricultural and Trade Programme (RATP), Bujumbura, Burundi.]

5.2.3.3 Classification of Maintenance Works

Maintenance works can be classified as minor maintenance or major maintenance works.

Minor maintenance includes all necessary works to keep the entire irrigation system functioning satisfactorily .This type of maintenance covers small scale work that needs to be done as required throughout the year. It includes minor earthworks repair, filling holes in canal banks, removal of trash and silt in front of structures, and greasing of gate operating devices. Most of these works can be done manually.

Major (Annual or Seasonal) maintenance includes any work necessary to regain the lost flow capacity in canals, and structures when compared to the original design. It often includes modifications to the canal system and structures arising from changes to the cropping patterns, drainage problems etc. that have occurred in the irrigation system. It covers repairs that are too large to undertake routinely; so it must be planned when the irrigation is shut down. It includes re-sectioning of canals, de-silting, and removal of weeds from channels, grass cutting and vegetation removal from banks, gate repair and painting, repair of failed parts of structures, channel protection works, earthworks, cleaning out cross-drainage structures. These works can be considered preventative in nature (not allowing the system to deteriorate to an extent that capital or rehabilitative works will be necessary).

Emergency Maintenance covers urgent or temporary repairs that are required to maintain water delivery following breaches or sudden failures in the irrigation system. It includes construction of temporary canal sections, strengthening of structures, repair of any landslides and breaches.

Keeping maintenance current on all facilities is the keystone of the success of the irrigation system. Routine and preventative maintenance not only pay dividends in the form of economical operation and a smooth working system, but means an uninterrupted delivery of water.

Deferred maintenance may serve in the beginning when things are working well, but the deterioration tends to be geometric which means that in the future the problems multiply rapidly to the point where massive amount of works are required. Due to deferred maintenance

of irrigation canals, operational efficiency can decrease to such a level that it will be difficult even to sustain present agriculture.

The actual annual costs to keep the canals and structures in good repair, if regularly maintained, are relatively small compared to the profits gained if all the farmers obtain a reliable and equitable water supply.

5.2.3.4 Maintenance Planning and Implementation

Some years after rehabilitation, the small scale irrigation schemes will begin to deteriorate. The works that need to be done may require more resources than the yearly cash flow or labor contributions which farmers and the ICs are willing and afford to make.

It will be then necessary to prioritize the works, selecting tasks which will have most effect in improving flows to the greatest areas or in preventing future costly failures of important parts of the system. For this inspection of the irrigation system has to be carried out.

There are two types of inspections:

1**. Regular – those carried out regularly during the irrigation season**

The inspection should be taken along the canal system regularly when it is operating. Any small leaks should be noted, or other problems that could get worse and any minor work should be carried out immediately. Farmers groups, and the ICs must be involved, to decide together, if any repair work is required and how it should be carried out. It is recommended that the inspection of the secondary/tertiary canals should be carried out once a week during the peak irrigation season. Any new problems or significant deterioration in problems previously identified should be noted. Any operational issues should be discussed with the woreda expert. At other times of the year less frequent inspections are required.

2. Annual or Seasonal – carried, out annually or at the end of the irrigation season

It is important that a thorough inspection be carried out of the whole irrigation system before the main maintenance period, even though the canals probably cannot be dried out before then. Depending on

the state of the system, additional inspections may be required before the start of the other irrigation seasons.

The inspection team (Woreda experts, ICs, WUAs, farmers) should walk down the canals from head to tail, checking each reach and each structure. The aim is to identify repairs to be carried out during the annual maintenance closure, not minor repairs to be completed under regular maintenance.

The inspection team should be particularly aware of problems that if left undone, could become considerably worse in the next year, especially the effect of a defect which is important if you are going to spend maintenance money most effectively. The inspection team will need a clipboard, inspection charts (register), tape measure and a spade. The charts should be completed canal reach by reach and structure by structure as the inspection team walks down the canals.

At the secondary/tertiary levels much of the work will be concerned with the channel (de-silting, bank repairs, vegetation removal etc.) and should require little survey and design. The ICs, WUAs and farmers group should be able to make an estimate of the resources required, principally labor. For small structural repairs (such as repairs to gabions, gates etc.) the ICs, WUAs, and farmers groups should be able to estimate the labor, materials and the costs on the basis of past experience. Local masons or skilled laborers if available may be able to assist in the estimating.

Especially at the main canal level, for larger repairs, designs may be needed if a structure begins to fail, Woreda intervention will then be sought.

Inspections should start at the top of the main canal and work downstream. The first priority is to maintain components which serve the largest areas, where gradual deterioration or sudden failure would be particularly costly, both in terms of replacing the component and crop lost.

The head regulator and the main canal control structures are of first priority, followed by canals and embankments, and other structures (turnouts, culverts etc.) located primarily in the upper reaches of the main canals. If a defect is noted which affect water deliveries or is about to do so, action is needed.

The priority of works depends on making a judgment about the seriousness of the problems. De-silting and vegetation removal at the head of a canal will take priority if the flow of water down the canal is restricted. Minor structural problems will then have lower priority.

However, if a structure is at risk of failure, threatening supply, then repairs are needed urgently.

Minor defects need to be recorded, whereas a component further down the canal system which is in poor condition may demand immediate action. Move down the irrigation system, constantly comparing judgments about the need for work with what was found upstream.

The defects that have been noted, but not dealt with, should be re-inspected at intervals. They may worsen with time and must be repaired before they affect the performance of the irrigation system.

There are many potential problems, but their importance to the proper functioning of the system will vary. De-silting, weed removal, and canal re-sectioning, are usually done either annually or seasonally before the irrigation season, since they have a big impact.

Rough Priorities can be assigned to the works as High, Medium, or Low.

Guidelines for deciding on maintenance priorities:

1. The larger the area of irrigated land downstream of the point of repair, the higher should be the maintenance priority.

2. The larger the impact on water delivery of the point of repair the higher should be the maintenance priority.

3. The higher the probability of rapid deterioration of canal and structures, the higher the maintenance priority.

4. The more the need to provide an equitable distribution of irrigation water, the higher the priority for maintaining the control structures and canals.

Not all repairs can be done as soon as they are identified, they should be prioritized. Problems which are not dealt which will gradually get

worse, and their priority will increase in time. It is essential to plan in advance, decide what and when works to be carried out before they become expensive and /or difficult to repair.

Priorities should ensure the following:

- To maintain good water control
- To prevent water losses
- To allow water to flow freely (prevent blockages due to silt, weeds etc .in the canals and structures).
- To give remedy to defects that might develop into major problems.

Not all repairs can be done as soon as they are identified, they should be prioritized. Problems which are not dealt with will gradually get worse, and their priority will increase in time. It is essential to plan in advance, deciding what and when works to be carried out before they become expensive and /or difficult to repair. (Is the canal still fit for its purpose?)

1.2 Maintenance Activities

Canal Maintenance: De-silting, weed removal and re-sectioning are typically done either annually or seasonally before the irrigation season, since they have a big impact on performance. For practical reasons, it is desirable to adopt a two year maintenance cycle, maintaining one half of the lengths of the main canals system each year, depending on the scale of the required work. However, if there are areas of serious bank slippages, weed growth, siltation or seepage, they should be maintained in the year of occurrence.

What are the things to look for:

- Any areas of seepage. They should be regularly inspected. If necessary, the banks may need repairs.
- Any low spots on the banks, which could be overtopped. Low spots should be filled up carefully with good soil and compacted.
- Erosion of earthen canal banks. Sediment washed into canal will create problems, either locally or further down the system. In fill areas, banks may be weakened and can fail. Reduce bank slopes and protect with planting and gabions.
- Check that any previous repairs to banks are sound.

- There is reasonable access along canal banks. Banks of the main canals are used as roads to get along the canal for inspections and maintenance and for farmers to reach homes and fields, pot holes should be repaired, bushes or vegetation should be cleared and an adequate bank width maintained. Structures should not be built on the banks.
- Water hyacinth and floating weeds, if allowed to spread, can cause major blockages to the system and should be removed as soon as possible.

Structural Maintenance: Structural maintenance needs are more difficult to predict, particularly when the system has been recently rehabilitated. It is certain that the system will gradually deteriorate. It is important to detect problems at an early stage and carry out minor repairs before major work is required. Problems to watch out for vary with the type of structure, but include: progressive cracking of walls and bases, which can allow water to undermine the structure; scour damage; jamming of gates, gate frames working loose from the fixings; settlement of weak soil; movement of parts of a structure under pressure etc.

Most structural problems are caused by the effects of flowing water: scour, erosion, seepage, and leakage. Problems tend to start in a small way and then gradually build up. Regular checking of potential problems is essential.

Scour and erosion mainly occur downstream of the structures. In many structures, such as regulators, as the water drops within the structure it accelerates, gaining energy. Protection is provided downstream of these structures to absorb the energy and slow the water back down to the canal speed again. In losing energy, the water tends to swirl around. If the protection is not long enough, the swirling action can damage the banks (erosion) and the bed (scour) of the unprotected canal. With time the damage increases.

Seepage and leakage are caused when water in the canal finds small holes around or below structures or in canal banks. Holes are usually the result of inadequate compaction of the soil. Initially the rate of leakage is small, but as water is lost it may carry away small particles of soil and earth from within the bank, so gradually increases. The erosive power also increases, progressively weakening the bank. Ultimately, a structure can be outflanked or undermined, or a bank

can be breached. Later the process can be very fast leading to sudden failure.

What are particular structural maintenance problems to look for:

Headwork's (Diversion Weir): Gates must be kept in good repair, trash and silt built up removed and the condition of downstream protection regularly checked. Problems at the head works have the highest priority.

Structural Problems: Gates can rapidly deteriorate and become useless. Bearing or sliding parts should be regularly greased. Leaking rubber seals should be repaired or replaced. Rusty parts should be rubbed down, treated, and repainted with a strong, resistant paint coating.

Erosion of banks or beds downstream of the canals: Rebuild banks to flatter slope if possible, compact soil and protect with loose pitching or gabions.

Seepage or leakage at structures: Check regularly and repair if losses are increasing The soil round the structure will need to be replaced and well compacted or protected, particularly at the upstream end. All structures should if possible be drained annually, inspected, debris removed, and any damage repaired.

Any cracks in structures should be investigated. Small surface cracks caused by shrinkage of construction materials may not be important. However, cracks which develop over time are potentially dangerous.

There will be many problems, but their importance to the proper working of the system will vary. It is important that canal and structure repairs be properly carried out, otherwise the problem may well recur.

Examples of some of the most common problems are as follows:

Component	Sub component	Possible Maintenance Problem	Type of Maintenance	Priority
Head works	Diversion Weir	Gates/repair damage	R/M	1
		Erosion of downstream protection	M	1
		Trash in front of gates	R	2
		Silt in front of Gates	R	2
Canals	Channel	Breached Bank	E	1
		Erosion of canal bank	M	2
		Seepage from canal banks	R/M/E	2
		Low banks, chance of overtopping	M	2
		Build up of sediment; Points where drainage enters main canal.	M	1/2
		Weeds in canal	R/M	2
		Need for re-sectioning	M/E	2
Canal Structures	General (applicable to most structures)	Deteriorating cracks in structure	M	1
		Deteriorating erosion downstream	M	1
		Deteriorating seepage in structure	R	2
		Trash or silt in front of structure	M	2
		Erosion downstream	M	2
		Cracks, Seepage, or damage to structure	R	3
	Intakes to Secondary canals	Damaged gate affecting control Head or wing wall damage Gate hard to operate Gate leaking Corrosion, Rusting	R/M R/M R/M M R	1 2 2 2 2

Notes: Type of Maintenance: R- Routine; M- Major (annual/seasonal); E- Emergency Priority: 1- High; 2- Medium; 3- Low; Typical priority is shown, it could be more or less depending on the severity of the problem.

1.3 Implementation and supervision

Once the scope of works has been approved and works decided upon, ICs, IWUAs and farmers should discuss and agree how the work will be implemented. There are basically two options: by direct labor or by contractor. Works such as de-silting, removal of vegetation and simple structural repairs can be carried out by organized labor provided by the farmers on a voluntary basis, as is presently being done. For more complex works, it may be necessary to let the work to a contractor or work with the assistance of Woreda Office of Agriculture experts.

How Routine Maintenance should be carried out:

Secondary canals:

The routine maintenance work should be linked into the regular inspection carried out with the O& M committee. Small repairs should be carried out such as:

- Removing trash from structures
- Removing any silt from in front of structures
- Removing any small blockages in the canal.
- Carrying out any small earthwork repairs
- Minor repairs to canal banks
- Raising any low spots on the canal banks, cutting vegetation on access ways etc.
- Greasing of gates and ensuring that the open and close efficiently.

During the weekly inspection of the system, the maintenance works to be carried out during the next week should be planned.

The ICs, Wuas should have a supply of basic stores, materials and equipment.

Works on the tertiary canals and field channels are normally the responsibility of the farmers who can form an informal group to organize any routine maintenance and operation at that level.

Main canals

For the main canals the ICs, WUAs will be responsible for carrying out most of the routine maintenance. The work will be linked to regular inspections .The work will be similar in nature to the secondary canals.

How Annual/Seasonal (major) Maintenance should be carried out:
Secondary canals: Most of the annual/seasonal maintenance work will be canal de-silting, weed removal, and earthworks, with more limited amounts of structural maintenance. For canal maintenance, the easiest way would be for the farmers to carry out the work, is as it is being done presently, by voluntarily labor mobilization under the guidance of the ICs. The secondary canal could be divided up into reaches so that groups of farmers would carry out work on parts of the canal near to their land.

Structural maintenance could be carried out by paid skilled workers. It could be useful if use can be made of the same skilled labor (masons and carpenters), with whom a partnership can be developed to ensure a good standard of workmanship.

Main Canals: The greatest part of the annual/seasonal maintenance work will be canal de-silting, weed removal and earthworks. There will be limited amount of structural maintenance. The implementation of the annual/seasonal maintenance work needs to be discussed and agreed upon by the stakeholders.

By ICs (WUAs), ICs can carry out some major maintenance works provided they have the capacity and capability to do so. It is recommended that the ICs and beneficiaries acquire basic tools to undertake at least the routine maintenance of the main canal system and any emergency works which may be required. Works should be inspected by technical staffs/ DAs at the Woreda level and relevant advice on adherence to standards and quality control should be forthcoming.

By Direct Labor:- If the works are carried out by direct labor, they will be organized and supervised by the IC, (WUAs) and technical staff of the Woreda.. Farmers with the irrigation scheme should be given the opportunity to provide some or all of the labor.

Emergency Maintenance:- Emergency maintenance needs to be carried out quickly, usually to restore the flow to downstream canal water users. ICs, WUAs and the technical staff of the Woreda should visit the site; assess what work is required and the labor and equipment requirements. The O&M budget should include an allowance for emergency repairs.

How to ensure effective management of the maintenance works. It is important that all the farmers and all stakeholders are happy with the maintenance works carried out and the way they are implemented. The implementation of the maintenance activities is site specific and will vary from area to area. Some general management principles can however be applied:

- Good planning is particularly important in maintenance work as the time and resources available are limited.
- The works should be properly supervised to ensure they are to a proper standard, and output should be monitored to ensure it is progressing in accordance to the plan.
- All farmers should be fully involved in community maintenance activities such as canal de-silting. All members should make a contribution in accordance with the agreement.
- Whenever unskilled labor is required, local farmers should, as far as possible, provide the labor.
- Subcontracting part of the maintenance work may be advisable if it is beyond the technical or labor resources available.
- There needs to be fairness and openness in the planning and implementation of the maintenance works to ensure that transparency and trust develop between the stakeholders and management.

Summary of steps in the maintenance cycle:

1. Inspection, identification, measuring and quantifying
2. Reporting
3. Processing - Compiling reports, Category type of work and who it can be done by allocating priorities to work reported, Preparation of drawings, further field survey if necessary, Preparation of quantities and bill of quantities preparation of specification preparation of time schedules and preparation of contract document
4. Implementation - Allocating work to direct labor or contractor
5. Supervision of works
6. Final inspection and measurement
7. Payment
8. Recording maintenance done and updating maintenance requirement list.

5.2.4 Community Road

5.2.4.1 General

Feeder/community roads were constructed throughout Ethiopia by various development agencies including community, government, NGOs, bilateral and multilateral agencies. However, due to lack of responsible body for its management and proper maintenance the life span in most cases is disappointingly poor. Unlike the major trunk roads feeder/community roads are not cared for by the road authority and it is only very recently that road desks were established in each woreda (though some woredas still do not have road desks and almost always poorly capacitated).

Decentralized maintenance management approaches are intimately linked with the road design adopted, the extent of the network selected and the construction technology chosen. Also it cannot be separated from the vital question as to whether a road is economically viable in the first place. Even simple roads are very expensive to maintain in remote rural areas and every effort must be made to concentrate on carefully selected core networks while relying on local resources as much as possible. Their management should involve those who participated in selecting the roads in the first place since if they have no voice they are unlikely to contribute. Training is vital since management and technical and entrepreneurial capabilities are lacking in rural areas. A local contribution is necessary, in cash or kind, but it must be augmented by stable and predictable annual grants from higher levels, since it would be unfair and futile to expect the community to bear the entire burden for roads which benefits others more than them. To ensure coherent funding at the national level, the management of rural roads, even when decentralized, must be integrated within a larger national program.

Through the PSNP resources large numbers of feeder roads are constructed using PW labor. These feeder roads need to be regularly maintained if they are to meet the intended purpose. Often length men/length person are kept along major roads to undertake the routine maintenance; performance measures being based on the quality of maintenance. However, they must be supervised, supplied

with materials, their tools replaced and quality kept up through frequent inspection. Sometimes, it may be beyond their capacity in emergency cases likes for example, if a landslide occurs. Thus, in each woreda well trained and mobile foremen may provide technical assistance to the length men/length person. It is also possible to improve their performance and boost their moral. The road authority should suggest what kinds of tools, how many or how frequently, and how many road caretakers are needed per kilo meter. But to start with we suggest two PW beneficiaries may be kept per kilo meter feeder road for the routine maintenance. In an emergency situation the caretakers should report to the Kebele development committee for additional labor.

The government must ensure that the policy and legislative environment is coherent and supportive. It must also channel financial and other forms of support within a transparent and consistent grants programme. However, maintenance must be decentralized to whatever is the most appropriate level. If solid local government structures exist, they can be used. If not, ad hoc but robust systems must be set up in collaboration with local interest groups.

In conclusion, there is no single appropriate structure for preventive maintenance management. It can involve a multiplicity of combinations involving government, local informal organizations, and construction and transport private sector enterprises. It must be negotiated during planning and programming and should ensure a smooth transition from construction to maintenance activities to ensure that the considerable effort in training and institution-building is not wasted. Preventive maintenance is thus intimately linked with labor-based construction since, if machine-based methods are favored, the opportunity to seamlessly integrate the two is lost.

Labor-based methods can be defined as the construction technology which, while maintaining cost competitiveness and acceptable engineering quality standards, maximizes opportunities for employment of labor (skilled and unskilled) together with the support of light equipment and with the utilization of locally available resources.

When considering the use of labor-based technology in road works projects, it is important to acknowledge its limitations. In some circumstances, traditional equipment-based work methods are more

effective and may provide higher quality outputs, such as large excavation works, rock excavation and haulage of materials over long distances.

Since large labor-forces have to be employed on a temporary basis, these have to be recruited from within the vicinity of the road to avoid the problems and costs of setting up large site camp. Workers should be able to walk from their homes to the site.

A high level of site supervision is required to ensure that works carried out on site are in conformity to the standards. The road supervisor should ensure that the employment process is not discriminatory.

5.2.4.2 Undertaking Maintenance Operation

As asset management is a relatively new concept authorities adopting it are likely to identify a series of desirable improvements they wish to put in place in order to advance their asset management practice. It is common for initial asset management plans to include a significant documented improvement plan. An improvement plan should detail not only the specific actions to be taken but also outline which levels of service the actions are intended to benefit. This will ensure that a focus is maintained on the outcome of the improvement and the ultimate benefit it may provide to the customer.

Reporting and Monitoring Recommendations

Develop Performance Measurement Regime	**Establish a set of performance measures for each level of service. Measures should enable reporting at all levels (e.g. strategic, tactical, operational etc.)**
Develop a Performance Reporting Regime	Establish a reporting regime that provides timely and useful performance data to appropriate personnel
Include an Improvement Plan	Include an improvement plan that covers all desired improvements (i.e. data, systems, process, skills etc.)

5.2.4.3 Road Maintenance

Suitable routine, periodic and urgent activities to keep pavement, shoulders, slopes, drainage facilities and all other structures and property within the road margins as near as possible to their as-constructed or renewed condition. Maintenance includes minor repairs and improvements to eliminate the cause of defects and avoid excessive repetition of maintenance efforts.

A. Routine Maintenance

Operations required to be carried out once or more per year on a section of road. These operations are typically small scale or simple, but widely dispersed, and require skilled or un-skilled manpower. The need for some of these can be estimated and planned on a regular basis e.g. vegetation control.

B. Periodic Maintenance

Operations those are occasionally required on a section of road after a period of a number of years. They are normally large scale and require specialist equipment and skilled resources to implement, and usually necessitate the temporary deployment of those resources on the road section. These operations are costly and require specific identification and planning for implementation, and often require design.

C. Emergency Maintenance

Emergency Maintenance is required to respond to incidents which sever or endanger road access or structures. For rural access roads these activities should include:-

i. Minor repair of bridge structures caused by erosion, flooding or vehicle damage (Steel, reinforced concrete or timber bridges), to sustain access while awaiting permanent repairs,
i. Repair or replacement of failed, collapsed or washed out culverts
ii. Repair flood inundation, erosion or major settlement damage to road
iii. Remove landslide damage
iv. Temporary repair to road potholes or craters pending permanent repair
v. Creating temporary traffic diversions routes for flooded roads, or if necessary for any of the foregoing incidents.

5.2.4.4 Maintenance Management System

The type & extent of maintenance requirement for a road depends up on the serviceability standard laid down the maintenance needs funds available &the priorities for the maintenance activities for the maintenance operations. As several interlinked factors are involved in the maintenance works of roads, a system approach is appropriate for the road maintenance management. The various factors to be included in the maintenance management system are:

i. *Minimum acceptable serviceability standards for the maintenance of different categories of roads.*
ii. *Field surveys for the evaluation of maintenance requirements.*
iii. *Various factors influencing the maintenance needs such as subgrade soil, drainage, climatic, traffic, environmental, condition, etc.*
iv. *Estimation of rate of deterioration of the pavement under the prevailing set of condition.*
v. *Type & extent of maintenance requirements & various possible alternatives &their economic evaluation Availability of funds.*

Maintenance cost, availability of materials, man power &equipment.
Need based allocation for optimum utilization of inputs &fixing maintenance properties.

5.2.4.5 Undertaking Continuous Road Inspection and Treatment

The Inspection task should be carried out periodically and extraordinarily (within and after flood or wet season). The Inspection task includes:

i. *Discover defects of structures and report to higher level, particularly drainage structures like bridges, culverts, ditches, retaining walls, drifts, and causeways. Particular attention should be paid to hidden defects, for example probing to discover underwater erosion or scour at foundations.*
ii. *Discover offences of occupation of road reservation.*
iii. *Coordinate with other units to solve problems of road reservation offences or traffic accidents.*
iv. *Check and maintain visibility*

5.2.4.6 Determination of Maintenance Requirement

The supervisor must interpret the inspection results so as to decide when and where repairs are needed and what form of maintenance activity is required. While the management system is being introduced, it is likely that the maintenance engineer will have to rely entirely on the visual assessment of defects, but he should try to introduce the use of measurement techniques as skills and resources permit.

A. Diagnosing the cause of deterioration

It is important to identify the cause of deterioration and to put this right if possible, rather than just treating the symptom. For example, there is little point in continually filling in pot-holes in a road if they keep occurring only because of poor drainage. Finding the real problem and focusing attention on its solution will produce a more cost effective use of maintenance resources.

Some problems, of course, may be outside the scope of maintenance. For example, a road across flat country with inadequate drainage outfalls may experience base failure as a result of the capillary rise of water in the wet season. The only solution to the problem is to raise the level of the road. This would be a road improvement, not a maintenance operation: as such, it may warrant a special allocation of resources in accordance with the organization's procedures for road improvement work.

B. Specifying the works required and outputs

Maintenance operations involve three types of resources materials, labor and equipment. It is easy to estimate directly the quantities of materials needed for an operation but the amounts of labor and equipment required will depend on the method used in carrying out the work. There are some activities that can only be done by manual labor; there are others where plant and machinery are essential; but many activities offer the option of either method.

Machinery normally produces a truer surface and a more consistent finish than manual labor. But this may not always be required. For example, it would be difficult to find any economic justification for giving low-volume roads the close tolerances of level and smoothness that machinery can achieve

If large-scale works are involved, labor-based methods will require precise organization and management. Labor has to be available in sufficient numbers in the right place and at the right time.

5.2.4.7 Major Maintenance Activities

A. Grading

The maintenance engineer must decide how many times during the year each road segment will need grading so as to provide the best level of traffic service possible in the local conditions. In assessing this, he will have to take account of a range of factors including the type and size of the road material, the amount of traffic using the road, the local topography, climatic regime and other physical features.

B. Re-gravelling

This is a periodic maintenance activity that will need to be performed whenever the existing layer of gravel becomes unacceptably thin. If this layer is found to be less than 50mm thick for more than 20 per cent of the length of the sub-section of road being inspected re-gravelling should take place.

5.2.4.8 Minor Defects and Routine Maintenance Activities

Defect 1 – Vegetation growth excessive on road shoulders, structures or affecting drainage system, visibility and safety for traffic and people.

Maintenance Activity 1 – Control vegetation: bush/tree clearing & grass cutting and disposal:

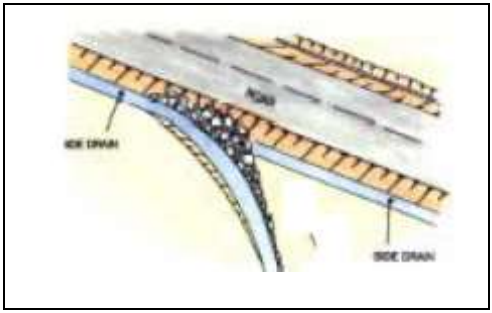
- *Cut trees and bushes if they affect drainage of shoulder or visibility.*
- *Cut grass on shoulders and in drains to 2 – 3 cm high (do not remove the roots as these prevent erosion of shoulder surface).*
- *Dispose of cuttings safely so that they do not obstruct the road, shoulder or drainage or affect other roadside structures.*

- *Do not burn them on the roadside and in areas that can affect other structures. It is not allowed to burn near any forest. There must be a person to watch over the burning and to water the ash afterwards.*

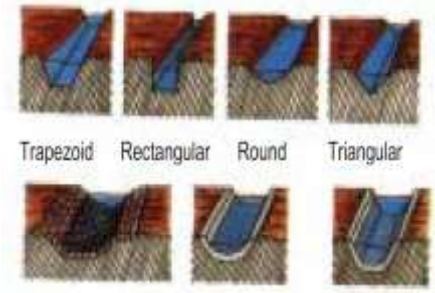
Defect 2 – Side or turn-out drains silted or blocked by debris.

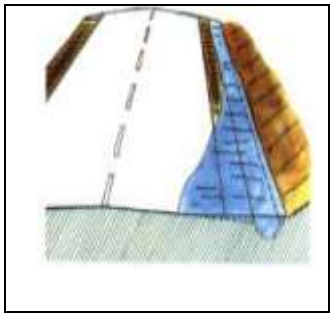
Maintenance Activity 2 – Clean debris/silt from side ditch & turnout drain Ensure that the silt and debris are removed so that they do not wash back into the drains.

This important activity should be carried out before the rains and after each storm or flood.



Defect 3 – Water ponds on road or side of road because side or turn-out drains have not been provided or side or turn-out drains are damaged.

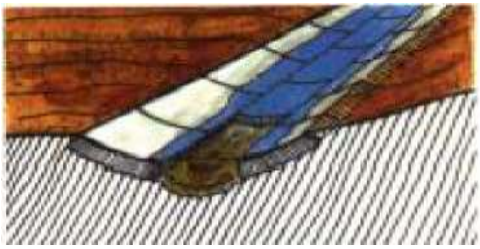




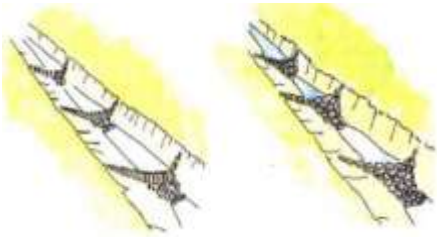
Maintenance activity 3 – Construct new drains or reconstruct side & turn-out drains

Construct new drains to dispose of the water. Line the drain with stone, brick or concrete if erosion problems are expected. In some cases the road may have to be built up to achieve good drainage (major repair).

Defect 4 – Drains damaged or eroded
Local defect in side drain



Maintenance activity 4 – Repair damaged drains.
Use suitable local materials for the repairs. Scour checks reduce water velocity on steep drains to prevent erosion. Erosion from side ditch will cause silting at ditch end, affecting water drainage. Clean silt from ditch end and rebuild scour checks on steep section to prevent further erosion.



Defect 5 – Debris or silt in or close to culvert outlet

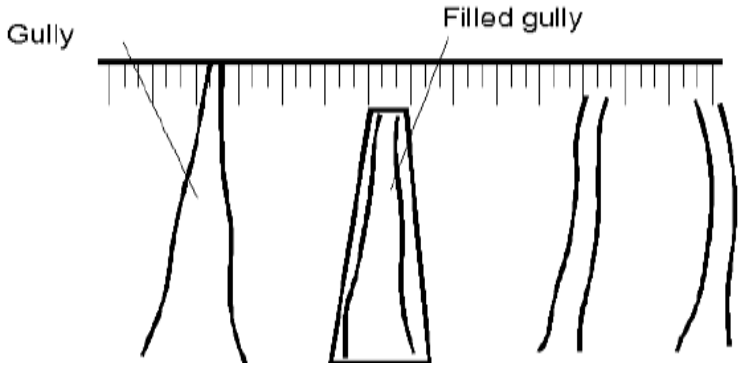
Maintenance activity 5 – Clean debris/silt from culverts
Dispose of the debris clear of the structure so that it does not cause a repeat of the problem. Try to find out where the debris comes from so that the problem can be prevented in future.

Defect 6 – Slip on embankment

Maintenance activity 6 – Refill embankment Slip

- *Use hoes and spades to carefully remove the slip and take the waste material to a safe place.*
- *Clean out wet or loose material. Drain away any standing water. If the foundation is soft, lay a 10 - 20cm layer of sand to help drainage.*
- *If a spring is discovered, lay a pipe(s) to drain the water away.*
- *Use soil of the same type as the embankment to fill by layers of not more than 30 cm loose thickness. Compact each before placing the next. If the slip material already has suitable moisture content it can be used for filling (see Terminology Item 4 on Appropriate Moisture Content).*
- *Trim the embankment to the correct slope. Plant or turf the area of repaired embankment; watering as necessary to re-establish the vegetation. Trees may be planted at the bottom of the embankment to help to stabilize the new earthworks.*

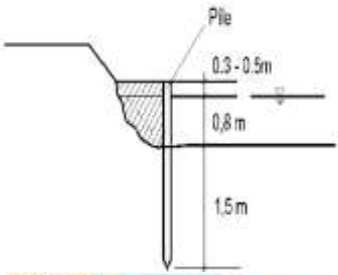
Defect 7 – Erosion on fill or cut slope



Maintenance activity 7 – Refill slope gully

- Fill slope erosion due to rain water
  - ✓ Firstly, cut the gully into a shape which is easy for working on (see the sketch), cut the gully edges to straight lines and make gully bottom flat.
  - ✓ Fill the gully with good soil and compact with a hand rammer and then plant or turf the area.
  - ✓ If there are many gullies next to each other, combine all of them into the repair
- Erosion on cut slope.
  - ✓ If the cut slope is gentle and it is possible to fill gullies and plant or turf then repair it as mentioned above.
  - ✓ If the slope is steep and erosion is serious affecting stability of the slope then it must be reported for advice on permanent repair.

Defect 8 – Embankment toe scoured by waterway or water traffic. This defect is a common occurrence in Mekong delta and in low-lying land in Red River delta.



Maintenance activity 8 – Repair waterway scour

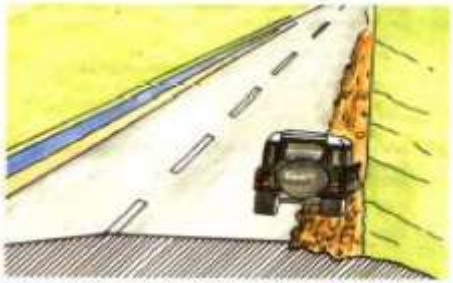
- Firstly check the depth of erosion at embankment toe to prepare soil for filling. Filling soil is soft clay or sand-clay mix. That means it can be cut into pieces by spades. Provide appropriate local materials that can be used as piles.
- Piles should be driven into place side by side if river waves are strong. Piles can be driven 20cm away from each other if the waves are not strong. Pile tops should be 30 to 50cm above normal water level to reduce river traffic action.
- Place fill material behind the driven piles

Defect 9 – Minor landslide on to the road

Maintenance activity 9 – Remove small landslide

Extreme care must be taken to avoid further slips and injury to workers.

- Carefully remove the slip material and dispose of safely so that it does not wash into drains or farm fields.



Defect 10 – Shoulder does not drain water away from road surface, or is eroded

Maintenance activity 10 - Reshape/replenish shoulder surface material

Reshape the shoulder so that it slopes away from the road at about 5% (1:20), allowing water to drain off the road surface. Use cross fall template to check the slope.

Shoulder erosion: cut back to a sound, dry foundation. Clean out loose material. Repair shoulders with lacerate or other good material in 10cm (maximum) layers. Water and compact the new material to the final cross fall slope (5%).

Note that the inner edge of shoulder must be level with outer edge of road surface.

Defect 11 – Debris or waste on road surface.

Maintenance activity 11 – Clean road surface

Remove debris and waste from road surface. Dispose of safely so that it does not wash back to road surface.

Defect 12 – Dirt or debris on bridge surface, bridge drains are blocked.

Maintenance activity 12 – Clean channel & bridge surfaces

Clean bridge surfaces, clear all bridge drains.

Defect 13 – Debris, logs or timbers blocked the channel under bridge or on causeway.

Maintenance activity 13 – Clear Bridge or causeway opening

Remove logs and other obstructions from channel.

Defect 14 – Dry and dusty surface Dust is traffic hazard. It is also a nuisance to road users and people living nearby particularly on sections going through settlements.

Maintenance activity 14 – Spray water

Spray water to dampen the road surface.

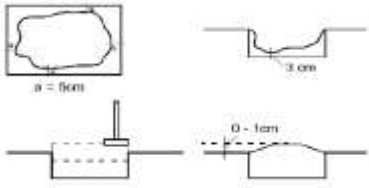
Defect 15 – Road furniture: Traffic signs are dirty or covered by vegetation

Maintenance activity 15 – Clean signs, cut trees or Plants that cover the signs

Defect 16 - Potholes (earth/gravel/stone macadam /brick road)

Maintenance activity 16 – Fill potholes (earth or gravel or stone macadam road)

- Potholes can take any shape. Dig the pothole into multi-sided shape as shown in the sketch and the bottom of the new shape must be 3cm deeper than bottom of pothole. Cut sides of pothole into vertical edges. For stone macadam surfaces the pothole repair should extend down to the base of the layer.
- Use material of the same type with existing material to fill in pothole in layers of not more than 10cm. Compact each layer before placing the next. Use hand rammer, vibrating plate or jumping compactor to compact. Filled material must have suitable moisture content.
- Final layer should be filled loose 1 to 2cm higher than surrounding level and then well compacted and trimmed level with the existing surface.



When repairing deep potholes, the finished repair may be left a little above the surrounding surface to allow for slight settlement under traffic. Overfill recommendations

For stone block or brick paving,

- Cut out the damaged area with hammers and chisels or crowbars. Use goggles to protect the eyes. Trim the size of the pothole suitable to fit the replacement paving materials.
- Excavate and replace any weak or wet material under the pothole.
- If the base of the excavation is wet, dig a channel and fill with stone chippings to drain the excavation to the side of the road.
- Compact the base of the excavation with a hand rammer.

Fill the pothole and compact each layer as necessary to match the existing pavement construction.

Defect 17 – Soft spots or local depression on gravel or stone macadam road.

Maintenance activity 17 – Repair ponding or soft spot

- This is caused by waterlogged foundation. Therefore, the area should be checked to see how water can penetrate (rain water, ponding water or spring). Drain off any standing water by providing drains, providing sand layer, re-excavating side ditch etc.

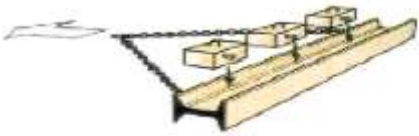
- Remove the surface and all soft material, dispose of unsuitable material safely so that it does not wash back into drains.
- Build up the roadway with suitable material with appropriate moisture content (see Terminology Item 3). Build up in 10cm layers, compact each layer before laying the next.
- Resurface the road and compact.

Defect 18 - Road surface corrugated – unpaved road

Maintenance activity 18 – Remove corrugations

- Corrugations are caused by traffic action and often occur on the surface of unbound material.
- Repair corrugations: According to international experience, drags can be made from old tires or steel beams, e.g. an "I" steel beam. The drag is towed along the road with a vehicle e.g. tractor or bulldozer.

In dry weather it may be advisable to dampen the road surface before dragging to avoid dust.



Dragging does not alter the camber or cross fall of the surface. If reshaping is required this should be carried out as a separate activity. Steel I beam (400mm depth section) drag. Can be surcharged to increase weight if necessary

Defect 19 – Road surface does not drain to the edge of the road

If the water does not drain off the road surface, it will quickly become damaged, and require expensive ***repairs.***

Maintenance activity 19 – Reshape road camber (by labor):

Use picks, hoes, rakes or shovels to

redistribute the surface material to create a camber so that it slopes and drains away from the centre of the road at about 5%.Use wooden or bamboo pegs to set out the correct surface levels and cross fall with the aid of a camber template, or straight edge, spirit level and measuring tape. If additional material is required to fill depressions, low areas or ruts, then use material of the same type. Loosen the low areas with picks before filling to create a rough surface to increase cohesion between filling material and the repaired surface. Material should be at appropriate moisture content (Terminology Item 3) before compacting. The first compaction should be done from road edge to road centre. Rut fill material should be well compacted in layers. Compaction may be carried out by using hand rammers, jumping compactor, vibrating plate compactor or roller.

This activity may also be carried out by mechanized methods (towed or motorized grader) in areas of low population or where funds and resources are available

Defect 20 - Road surface corrugated or poor camber – unpaved road

Maintenance activity 20 – Reshape road camber (by equipment):

This activity must be carefully carried out on an earth gravel, laterite or stone macadam surface as more damage then good may be caused if incorrectly carried out. Large motor graders are not suitable for this activity on narrow commune roads as they and their blades are too large. The work should be carried out by a small motor grader (< 100hp or 75kW), or by tractor towed grader.

The objective of grading is to remove corrugations and restore the camber by returning material from the sides of the road to the centre of the road to form a cross fall of about 5%.

Work is best scheduled to follow a period of rain, as the moisture in the material will greatly assist compaction by rollers or traffic.

Patching of large potholes or depressions should be carried out as a separate activity prior to grading. Areas of standing water should be drained. It may be

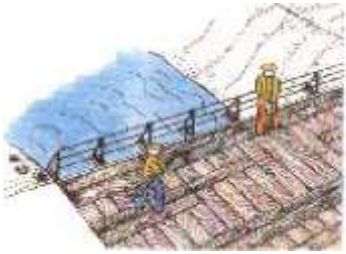
necessary to scarify the existing surface to cut to the bottom of any defects and loosen the material for reshaping.

- The grader will work on one side of the road at a time, making passes to cut and move material across the road surface. Each pass should be about 200metres or to a convenient turning point.
- Normally initial cutting passes are required to bring material from the edges of the road surface. Spreading passes redistribute the material away from the centre of the road. An even number of passes should be used to avoid a flat crown to the road.
- Light grading will require about 4 passes to bring material to the centre and spread it out to the correct camber.

Heavy grading will be required on a poor, uneven surface. Additional passes will be required to reshape the camber.

- The finished camber should be 5%, checked with a Camber board every 100metres.
- Compaction after grading at an appropriate moisture content will make the surface more durable, reduce gravel loss and extend the period of time until the next grading.

Defect 21 - Loose nails or missing nails on wooden bridge



Maintenance activity 21 - Renail or replace bridge nails The correct nails should be used and their heads should be driven to final position below the surface.

Defect 22 - Loose or decayed planks on wooden bridge

Maintenance activity 22 - Replace bridge wooden planks

Wooden planks should be protected from decay. Causes of decay should be found, and measures taken to prevent a repeat.

Defect 23 - Bridge abutment quarter cone is damaged (damaged volume not exceed 1m3).

Maintenance activity 23 **– Repair bridge quarter cone**

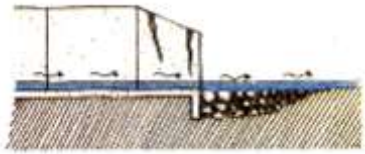
Fill in damaged area with soil and compact; place stone on the surface using cement mortar of grade higher than 100 for bedding and jointing.

Defect 24 – Loose stones on dry or mortared masonry apron (less than 2000cm2).

Maintenance activity 24 – Repair apron

Loosen surface: replace stone. For mortared masonry, use mortar grade 150.

Defect 25 - Small area of missing stone on dry or mortared masonry retaining wall (less than 2000cm2)



Maintenance activity 25 – Repair retaining wall

Replace missing stones using mortar grade 150.

1.1.1.2 Maintenance Tasks Before and During Flood Season

Context Of Transport Structure Protection And Assuring That Roads Are Clear For Passage In The Wet Season:

The basic content of these activities aims to protect transport structures and ensure roads will be kept clear for passage during the storms and floods.

Following are the details of these activities:

1. **Preparation:**

- Completing structures or each part of the structures before the storms and floods.
- In each local area, there is a need to identify roads, bridges, culverts, embankments and drifts etc endangered or at risk to damage by floods.
- Defining technical solutions such as traffic channeling, making diversions and measures to re-establish traffic operation.
- Making plans for providing materials such as coarse stones, gabions, bridge beams, culvert pipes etc in order to timely respond to the damaged structure components, ensuring normal traffic operation during and after the storms and floods. Before the flood and storm season, there is a need to inspect the transport infrastructure system. Action should be taken immediately to consolidate any important components. Management, report to the management authority of higher level. Especially, attention needs to be paid to prevention of scour of bridge supports.
- Assigning people to keep roads clear for passage. Making plans for mobilizing labor and materials when roads are damaged.
- Making a list of Road Clearance Committee members and a list of road clearance groups.
- Arranging communications from villages to communes, districts and provinces.

2. **Activities to be conducted before the monsoon:**

- Before the monsoon, clear canals, side ditches, cut grass, cut excessive branch growth to prevent trees being blown down by storms, reinstall guide posts, sign posts, flood gauges (for causeway and submerged road) that are damaged or install them where there are not enough. Repair and stabilize sections with weak, slippery and muddy surface.
- For structures: remove obstacles under the bridges, on the submerged roads and causeways, dredge accumulated mud, clear culverts and manholes. Inspect and stabilize dikes, ferries and dams etc.

- Increase patrol in the monsoon to timely discover new, vulnerable locations.
- For the sections affected by flood, immediately repair defects of the pavement, edges, and slopes before the monsoon. Prepare replacement guideposts and flood gauges so that if the existing ones are damaged or lost they can be replaced at once when the road is flooded. Make plans for traffic diversions if the road is impassable when being flooded.

5.2.5 Environmental and Safety Considerations during Construction and Maintenance Operations

5.2.5.1 Safety Measures

1. Principles

When work is being carried out on or close to the carriageway, it is the supervisor's responsibility to check that adequate measures are taken to warn and protect road users and maintenance workers including traffic control, and the use of temporary road signs.

In selecting and positioning temporary road signs, the following principles should be applied:

i. *Only standard signs should be used,*
ii. *The signs must be clean and in good condition,*
iii. *The standard signs should be displayed in a standard layout,*
iv. *The layout used must give drivers time to understand and respond to the information which the signs convey*.

Each maintenance gang should be provided with signs appropriate to the work it is carrying out and all foremen and supervisors should be trained in their use and layout. All temporary signs must be removed as soon as the work they relate to is complete.

All vehicles and equipment should be painted yellow or orange and should carry red and white striped marker boards' front and rear.

Signs must not be left on the road or at the roadside overnight. They should be removed and returned to the store.

2. Personal Safety

Hard hat:-Protects head of the worker from any falling objects dropping from high level during construction.

Over all cloths:-Protects the normal clothes from dust, grease and other spilling materials.

Rubber boot:- Protects the workers feet from colds, chemical, and mud in the working area.

Glove:-Protects the workers from oils, chemicals, and dust and other

dangerous material that affect the skin.

1Rubber hat 2 hard hat

3. First aid

A construction site should have a first aid box which as minimum contents: - Plasters; Bandages; Ointments; and disinfectant. Someone on site should be in charge of the box and know how to work with broken bones, burns and electric shocks.

4. Labor Issues

Minimum Age:
The Supervisor should ensure that no under aged persons are employed as stipulated in the labor laws.

Non-Discrimination
The Supervisor should check that recruitment is fair and transparent and that there is no discrimination on the basis of gender. In areas where strong cultural barriers exist, construction workers should be assisted by the Client with sensitization meetings to explain the nature of the work and the recruitment process.

Enforcement of Labor Standards
Labor based road works usually involve high labor recruitment and management. Special attention is expected from the Supervisor and the project management team to complying with the labor standards of employment. The Supervisor must also be acquainted with the local labor laws and standards.

Reasonableness of Task Rates
One of the responsibilities of the Supervisor is to check and propose on appropriate task rates. The rule of thumb is a reasonable task will allow the

worker to complete it within 5 to 6 hours of moderate hard work. The Supervisor should also ensure that workers are paid equal amount for work of equal value.

5.2.5.2 Environmental Considerations Backfill and leveling of quarry site

Route selection shall be carried out to minimise trees and bush clearing. During construction, care shall be taken to further minimise environmental effects of construction activities outside the right of way area.

Quarry pit shall be backfilled and levelled after usage. Before a quarry is backfilled and levelled, consultations should take place with the community regarding their specific wishes and needs. Most important is to cut steep sides to acceptable slopes in order to avoid accidents.

During maintenance operations, smaller vegetation around the slopes of embankments shall not be uprooted.

ANNEX: 1 TEMPLATE FOR CONTRACTS

Template for Contract

Date: _____

Region: _____ Woreda: _____ Kebele: _____ Village: _____

We, representatives of _____ village, declare that a portion of our land, specifically known by the name _____, bordered by:

_____ to the north
_____ to the south
_____ to the east
_____ to the west

And with an area of _____ hectares, is to be enclosed. We, as representatives of the community, agree to protect the area from an encroachment anticipating that we will get all the produce from the area. Guards will be employed, paid either in cash or in kind contributed by the community members. However, we may request assistance from the Ministry of Agriculture during some years. The Government, on its part, shall respect and assist in implementing the norms and bylaws established by the community. We prove this by our signature:

Representative: Name: _____ Signature: _____ Date: _____

Village administrator:_____

Proven by: _____

Representatives: Name: _____ Signature: _____ Date: _____

Kebele administrator: _____

Village administrator: _____

The Woreda NRM Expert responsible or DA: _____

This agreement remains in force until the parties agree to modify the same.

ANNEX: 2 SAMPLE WUA PROTOTYPE BY-LAWS

[*Source:Mati, B.M. 2012. Participatory Operation and Maintenance of Irrigation Schemes. Training Manual 10. Nile Basin Initiative (NBI), Nile Equatorial Lakes Subsidiary Action Programme (NELSAP) - Regional Agricultural and Trade Programme (RATP), Bujumbura, Burundi.*]

The Preface

This prototype By-laws/Constitution is for guidance only. However, whatever By-laws/Constitution the smallholder irrigation scheme may adopt, should in principle provide sufficient for the equity of rights and responsibilities among members, accountability and transparency in its operation.

Declaration

We are members of _____ clearly declare followings

- Egalitarianism: Equity of rights and responsibilities among the members is our management principle.
- We have agreed that we come together to make our community as a land with milk and honey for all the members can enjoy their life
- We have agreed that we remove off our petty selfishness to make our community prospers for the sake of our descendants
- We have agreed that our community has to be developed by ourselves by any means, because it is our own community
- We have agreed that we learn anything we need in order to develop our community
- A member is for whole members, whole members for one member
- We have agreed that all the members of the _____are important persons for the community
- We have agreed that dialog is the most important means to solve any problems among members
- We have agreed that we create following By-Laws/Constitution to make us one
- We have agreed that we pay all our effort to follow the By-Laws
- We have agreed that we transfer some of the rights and powers to the committee and executive committee to follow and to prosecute the By-Laws

By-Laws

1-0 PART 1 - NAME

1-1 Article I - Name of the Organization

The name of the Organization; _____

Address; _____

The area the Organization is operating; _____

2-0 PART II - OBJECTIVES

2-1 Article II - Main Objectives

The main purpose of the Organization is to implement the irrigation system and to operate, maintain and manage the system for the betterment for the members of the Organization.

2-2 Article III - Specific Objectives

The Organization should have the following principal objects:

(a) To raise, mobilize and disburse funds and other resources for the promotion of the objects of the Organization;
(b) To implement the irrigation system
(c) To rehabilitate the irrigation system
(d) To upgrade the irrigation system
(e) To operate the irrigation system
(f) To maintain the irrigation system
(g) To determine and collect the water fee for OMM of the irrigation system
(h) To determine and collect the charge for operation, maintenance and management of the irrigation system when it needs
(i) To authorize the fair water distribution
(j) To authorize the area to be irrigated and the kind of crops
(k) To inspect of the irrigation and drainage system to establish a water distribution process to ensure prevention of wastage, misuse or unauthorized use of water

Maintenance will include:

- Silt clearance
- Weed clearance
- Repairs to structures
- Environmental protection

3-0 PART III - MEMBERSHIP

3-1 Article IV - Membership

- Land owners in the group operating area
- Tenancy rights holders
- Who pays membership fee
- Who pays water fee
- Full-time basis in farming

3-2 Article V - Duties of the member

- To pay the membership fee
- To pay the water fee
- To pay the water charge

- To have a idea that water is a life line
- To use the irrigation water efficiently
- To join the maintenance work and repair work of the irrigation and drainage system when requested by Management Committee

3-3 Article VI - Right of the members

- To have a right to get a equal water allocation
- To have a right to vote in General Meeting
- To have a right to stand the election for Management Committee

3-4 Article VII - Disqualification of the Membership

- Any member who defaults on his/her water fee or charge payment for a certain period should cease to be a member of the Organization. However, the membership may be restored on payment of all the standing fees and an additional re-enrolment fee.
- Any member who misuse the water or unauthorized water use after two times recorded warning within two years period since the date of the first recorded warning shall be lost the membership for decided period by the Organization.
- Any member who harm or break or destroy the irrigation and drainage system or water quality intentionally shall be disqualified immediately.
- If any member of the group sells his/her land, his/her membership will be automatically cancelled, and new owner will be eligible for the group membership

4-0 PART IV - FUNCTION AND POWER OF THE ORGANIZATION

4-1 Article VI - Function

- Implementation, operation, maintenance and management of the irrigation and drainage system
- Demonstration and practice of farm water management methods for improving field application efficiency in the individual farmer's field
- Utilise natural rain and ground water in the best way possible
- Ensure responsible use of water among the members
- Coordinate with various relevant Government Departments
- Ensure collective and community responsibility of collection of water fee and charge from all the members

4-2 Article VII - Power

- The Organization has a right to raise, mobilize and disburse funds and other resources for the promotion of the objects of the Organization
- The Organization has the right to decide the water fee and charge payable by members.
- The Organization has a right to collect the water fee and charge.
- The Organization will resolve disputes among members in respect of water distribution and allied matters.
- The Organization has the right to decide the fine or disqualification of the membership against the violation of misuse of water or

unauthorized use of water or harming, breaking or destroying the irrigation and drainage system and water quality.

5-0 PART V - GOVERNANCE OF THE ORGANIZATION

5-1 Article VIII - The Management Structure

General Body

- The general body of the Organization will consist of all registered members whose due payments are up date.

Management Committee

The Management Committee will consist of the following members:

- One Chairperson
- One Vice-chairperson
- One Secretary
- One Treasurer
- Committee members

5-2 Article IX - Function and Power of the Management Committee

The management committee shall govern the day-to-day affairs of the Organization.

The Management Committee shall have the powers and duties necessary for the administration of the Organization and ensuring that the Organization's By-Laws are not violated. The following are some of their duties:

Decide the cropping pattern and area to be irrigated under each crop within the Organization area of operation.

- Decide the irrigation schedule and water distribution.
- Take care, upkeep and surveillance of the irrigation system in the area of operation of the Organization.
- Designate, employ on remuneration and dismiss personnel necessary for the operation, maintenance and repairs of irrigation and drainage system.
- Collect water fee and other contributions from the members.
- Collect charges from the members for operation, maintenance and repairs of irrigation and drainage system
- Raise/obtain funds from various sources for the smooth functioning of the Organization.
- Ensure that the cashbook is well written and duly signed by the treasurer
- Facilitate a smooth system for bookkeeping and auditing the Organization accounts.
- Inspect irrigation and drainage system, distribution of water and ensure prevention of wastage, misuse or unauthorized use of water.
- Take any necessary action to ensure and help fulfill the objectives of the Organization. In case of default in fee payment, they may suspend supply of water to the defaulting member and resume it on fulfillment of the terms and conditions.

5-3 Article X - Duties of the Members of the Management Committee
Chairperson

- The Chairperson shall be the Chief Executive Officer of the Organization.
- He/she shall have the general powers and duties which are vested in the office of the Chairperson of Organization including but not limited to the powers to appoint various committee and sub-committee from among the members of the Organization from time to time as he/she may in his discretion decide to be appropriate to assist in the day to day affairs of the Organization.
- He/she shall preside over the meetings of the General Body and Management Committee and all other meetings of the Organization and conduct the proceedings.
- In case of any legal dispute, the Chairperson will handle such cases on behalf of the Organization.

Vice-Chairperson

- The Vice-Chairperson shall take the place of the Chairperson and perform his/her duties wherever the Chairperson is absent or unable to act under valid grounds.
- If neither the Chairperson nor the Vice-Chairperson is able to act, then the Management Committee shall appoint some other member of the Management Committee to act on an interim basis.
- The Vice-Chairperson shall also perform other duties as shall from time to General Body/Management Committee entrusts time to him/her.

Secretary

- He/she shall keep the daily of the Organization, in which events, happenings and complaints in the area of operation are recorded.
- He/she shall convene all meetings of the Organization and shall maintain the minutes of all meetings. He/she shall issue general circulars and notices and carry on all correspondences on behalf of the Organization.
- He/she shall remain in charge of such books and papers as the General Body/Management Committee may direct and shall in general perform all duties incidental to the office of Secretary, i.e. execution of orders and resolutions of Management Committee.
- All suits and matters instituted by or on behalf of the Organization shall be instituted in the name of the Secretary and all pleadings, warrants, power of attorney, petitions statements etc. shall be signed by the Secretary and likewise in all and matters against the Organization, the Secretary shall represent the Organization.

Treasurer

- The Treasurer shall be responsible for receipt of all subscriptions, fees, charges, donations, grants and money, etc. from the various sources as provided in the By-Laws and issue receipts for the same.
- He/she shall receive, disburse and maintain daily accounts and shall at the end of the financial year get the same audited by the authorized Auditor and furnishes an audited statement of all receipts and expenditures to the Management Committee.

6-0 PART VI - BUSINESS TRANSACTION

6-1 Article XI

Through the mandate by the General Body, the Management Committee by means of resolutions passed at duly convened meetings shall transact the business of the Organization.

7-0 PART VII - ELECTION AND TENURE OF MANAGEMENT COMMITTEE MEMBERS

7-1 Article XII - Election

In case the Organization has a several branches of irrigation and drainage system;

The Committee Member/Members will be elected by the members of the respective branch to represent the branch.

Option One

- The Chairperson, Vice-Chairperson, Secretary, Treasurer and Committee Members will be elected by the members of the Organization.

Option Two

Step 1

- The Committee Members will be elected by the members of the Organization.

Step 2

- The Chairperson, Vice-Chairperson, Secretary and Treasurer will be elected among the Committee Members by the Committee Members.

The posts will not carry any remuneration.

The members shall decide the tenure of the office of the elected Management Committee.

The Management Committee will consist of the following members:

- Chairperson
- Vice-chairperson
- Secretary
- Treasurer
- Committee members

FUNCTIONS AND POWERS OF THE MANAGEMENT COMMITTEE

The Management Committee shall have the powers and duties necessary for the administration of the Organization and ensuring that the By-Laws is not violated. The following are some of their duties:

- Decide the irrigation schedule and water distribution.
- Take care, upkeep and surveillance of the irrigation system in the area of operation of the Organization.
- Designate, employ on remuneration and dismiss personnel necessary for the operation, maintenance and repairs of irrigation and drainage system.
- Levy charges from the members for operation, maintenance and repairs of irrigation and drainage system.
- Collect water fee and other contributions from the members.
- Raise/obtain funds from various sources for the smooth functioning of the Organization.
- Ensure that the cashbook is well written and duly signed by the treasurer
- Facilitate a smooth system for bookkeeping and auditing the Organization accounts.
- Inspect irrigation and drainage system, distribution of water and ensure prevention of wastage, misuse or unauthorized use of water.
- Scrutinize accounts kept by Secretary and/or Treasurer and ensure the registers and account books are well kept and take steps for the recovery of all sums due to the WUA.
- Prepare annual budget and get approval from the General Body.
- Listen and deal with complaints of the members and resolve disputes.
- Liaise with Relevant Government Departments.
- Utilize natural rain and ground water in the best way possible together with irrigation water
- Educate farmers in cropping pattern, water management, optimal and efficient use of water and inputs for increasing agricultural production, yields and their profits.
- Take any necessary action to ensure and help fulfill the objectives of the Organization. In case of default in fee payment, the Organization may suspend supply of water to the defaulting member and resume it on fulfillment of the terms and conditions.

DUTIES OF MEMBERS OF THE MANAGEMENT COMMITTEE

CHAIRPERSON

- The Chairperson shall be the Chief Executive Officer of the Organization.
- He/she shall have the general powers and duties which are vested in the office of the Chairperson of Organization including but not limited to the powers to appoint various committee and sub-committee from among the members of the Organization from time to time as he/she

may in his discretion decide to be appropriate to assist in the day to day affairs of the Organization.

- He/she shall preside over the meetings of the General Body and Management Committee and all other meetings of the Organization and conduct the proceedings.
- In case of any legal dispute, the Chairperson will handle such cases on behalf of the WUA.

VICE-CHAIRPERSON

- The Vice-Chairperson shall take the place of the Chairperson and perform his/her duties wherever the Chairperson is absent or unable to act under valid grounds.
- If neither the Chairperson nor the Vice-Chairperson is able to act, then the Management Committee shall appoint some other member of the Management Committee to act on an interim basis.
- The Vice-Chairperson shall also perform other duties as shall from time to General Body/Management Committee entrusts time to him/her.

SECRETARY

He/she shall convene all meetings of the WUA and shall maintain the minutes of all meetings. He/she shall issue general circulars and notices and carry on all correspondences on behalf of the WUA. E/she shall remain in charge of such books and papers as the General Body/Management Committee may direct and shall in general perform all duties incidental to the office of Secretary, i.e. execution of orders and resolutions of Management Committee.

All suits and matters instituted by or on behalf of the WUA shall be instituted in the name of the Secretary and all pleadings, warrants, power of attorney, petitions statements etc. shall be signed by the Secretary and likewise in all and matters against the WUA, the Secretary shall represent the Organization.

TREASURER

The Treasurer shall be responsible for receipt of all subscriptions, fees, charges, donations, grants and money, etc. from the various sources as provided in the by-laws and issue receipts for the same. E/she shall receive, disburse and maintain daily accounts and shall at the end of the financial year get the same audited by the authorized Auditor and furnishes an audited statement of all receipts and expenditures to the Management Committee.

BUSINESS TRANSACTIONS

Through the mandate by the General Body, the Management Committee by means of resolutions passed at duly convened meetings shall transact the business of the Organization.

VACANCIES

- Any of the Management Committee members may at any time by notification in writing to the Management Committee retires from office.

- Any Management Committee member, who fails to attend three consecutive meetings of the Management Committee without sufficient reason given in writing to the Management Committee, will automatically cease to be a member of the Management Committee.
- The members of the Management Committee shall be eligible for reappointment.

REMOVAL OF OFFICE BEARERS:

- Upon an affirmative vote by a majority of more than 50% of members of the General Body of the Organization any of the office bearers may be removed with cause and his/her successor elected as per procedure laid down.

DUTIES OF OFFICE BEARERS:

MEETINGS:

- Meetings of the Management Committee of the Organization shall be held in the office of the Organization or at any other suitable place convenient to the members from time to time, but at least once in a month during the irrigation season. The first meeting of the newly constituted Management Committee shall be held within ten days of election of office bearers.
- The Organization General Body annual meeting will be held in the month of June every year. The elected Management Committee members shall be present at such meetings in accordance with the by-laws. The General Body will decide on policy matters and allocate funds for operation and maintenance. The members may also transact such other business of the Organization as may deemed necessary. The will also approve the annual Budget and contribution from members. The audited accounts of the annual report will be read out in the meeting.
- Special meetings of the Organization shall be called by the Chairperson as decided by the Management Committee or upon a petition signed by at least ten percent of members having been presented to the Secretary. The notice of any special meeting shall state the time and place of such meeting and the purpose/agenda thereof.
- The minutes of the meetings shall be recorded, prepared and kept by the Secretary and shall be signed by the person presiding over the meetings. The minutes shall be read out and confirmed at the respective subsequent meetings**.**

NOTICE OF MEETINGS

- It shall be the duty of the Secretary to inform or send notice of each General/Special meetings stating the purpose/agenda thereof as well as the time and venue of meetings to each member at least seven days prior to such meetings.

ADJOURNED MEETINGS

- A meeting may be adjourned for lack of quorum or any other unavoidable reason by the members present to a time not less than 24 hours from the time of the original meeting was called.

ORDERS OF BUSINESS MEETINGS

The orders of Business at all meetings of the WUA shall be as follows:

- Name and signature/thumb impression of all members present.
- Proof of notice of meeting.
- Reading out the minutes of the preceding meeting and ratification thereof.
- Report, if any, of committee set up.Unfinished business, if any.
- New business as per agenda and passing resolution.
- Vote of thanks.

QUORUM

For a meeting to take off, one third of the total members shall make a quorum for the transaction of business. A meeting that falls short of quorum shall be adjourned from time to time and at any such adjourned meeting any business which might have been transacted as originally called may be transacted without further notice, provided there is a quorum present.

VOTE

Every member shall have the right to vote and shall have only one vote. The Chairperson shall have a casting vote in case of a tie.

RIGHT OF ENTRY

Every member shall get the right of entry to the Chairperson, the Vice-Chairperson, the Secretary, the Treasurer and Members of the Management Committee or to any other person authorized by the Management Committee for inspection, supervision or for any inquiry in respect of disputes regarding sharing of water, maintenance and repairs of the irrigation and drainage networks.

FUNDS

An Operation and Maintenance Fund by the WUA in all or any of the following ways will be raised:

- By shares.
- by contribution from members
- by donations from the members, other institutions, Government or any
- by receiving subsidies, grant-in-aid from the Government or other Donors

ACCOUNTS

The accounting years will be from 1st July to 30th June of the next year. The WUA shall on or before 31st December in each year publish and audit annual financial statements containing the following accounts:

The profit and loss accounts

The receipts and expenditure of the previous year

A summary of the property and assets and liabilities giving such particulars as will disclose the general nature of the liabilities and assets and how the value of fixed assets has been arrived at. The following registers are to be maintained and presented to the members of the WUA.

- Members register
- Irrigation schedule
- Daily cash transaction account
- Receipt book
- Monthly cash transaction amount
- Permanent term deposit account
- Assets account
- Minutes book
- Complaint register
- Visitors' book

The Accounts for maintenance and repair of irrigation and drainage network should be kept.

PUBLICATION OF ACCOUNTS AND REPORTS

Copies of the following should be kept in a conspicuous place in the office of the WUA:

- The last financial statement
- The Auditor's report

Receipt and expenditure accounts, balance sheet, together with a report shall be placed before the General Meeting after the expiration of each financial year.

APPOINTMENT OF AUDITORS

At a general meeting, the WUA shall appoint an auditor. The auditor's duties are:

- to audit the WUA accounts prepared by the management committee
- to examine the annual returns and verify the same with the related accounts
- Write a special report to the WUA on the accounts indicating whether they are correct and in case they are incorrect, report in what respect he finds the reports incorrect or not in accordance to the law.

POWER OF AUDITOR

The Auditor has the right to call for an examination of any papers or documents belonging to the WUA and shall make a special report to the WUA upon any matter connected with the accounts which appears necessary for such reporting.

SUITS AND LEGAL PROCEEDINGS

The WUA shall sue and shall be sued in the name of the Secretary of the WUA.

AMENDMENTS OF THE BY-LAWS

The by-laws may be amended by the WUA in a meeting duly called for such purpose. No amendment can be effected unless approved by two thirds of the WUA`s members.

LIQUIDATION/DISSOLUTION

The WUA may be dissolved by a special resolution passed by two thirds of the members and shall be confirmed in writing.

ANNEX: 3 PSNP PUBLIC WORK SUBPROJECT/LAND HANDING OVER FORM

Region: …… Wereda: …… Kebele: ……
Community/watershed: ……
PW Subproject Name: …….. ……
I/we , …… [name(s)] hereby declare that we are handing over the following subprojects/asset for the benefit of the community.

Description of land/asset) or access to asset): Location:	Sketch Plan showing donation (attach separate sketch if necessary):

I/We also confirm that:

1. The land or asset being donated does not exceed 10% of my/our asset holdings.
2. The community has identified, and is satisfied that this land/asset donation is required by the subproject.
3. The land being donated is free of squatters, encroachers, or other claims or encumbrances.
4. The subproject is not site-specific; I/we had a free choice as to whether to make this donation or not.
5. I am satisfied, and hereby confirm, that any loss suffered by me/us as a result of this donation is compensated for by:
   (i) The benefits I/we will receive from the subproject (tick:…..), or
   (ii) Land that I/we have received in compensation, Land Use Cert. No: (tick:….).
6. This donation is being made entirely on a voluntary basis.
7. I hereby grant community access rights to the land donated for the use of the subproject.

Signed (donor) …….. Name: …… Date: ….....
Signed (spouse) ……..Name: ……..Date: ……
Signed ……..Name: ……..Date: ……
(Witness: Woreda Natural Resources Expert)

Signed ……..Name: ……..Date: ……
(Witness: Development Agent)

I hereby witness the above declaration, confirm the contents thereof, and hereby further confirm that the community has land use rights to the land donated, and that guarantees of public access has been given by the donor, as required.Chair, Kebele Land Administration Committee …---------Kebele

ANNEX: 4 PSNP PW SUBPROJECT/ASSET HANDING OVER CERTIFICATE

Region: …… Wereda: …… Kebele: ……

Community/watershed:
……

PW Subproject Name: …….. ……

Name of the Person represented by task force: ..... Position.....

Name of the recipient: .....
Represented by: (Community/Line office)..... have agreed that the following subproject(s) are completed and hereby declare that we are handing over the following subprojects/asset for the benefit of the community.

Sr. No	Subproject name	Unit	Quantity	Estimated value (if applicable)	Remark

The above asset(s) have been handed over to ..... to the benefit of the .....community for the following purposes.
.....
.....
Duties & Responsibilities of the recipient:

-
-
-

Duties & Responsibilities of the beneficiaries:

-
-
-

We the under signed ensure that the above asset(s) is/are handed from the FSTF for the purpose of the community/beneficiaries and agreed to execute the duties and responsibilities with effect from these days.
Signed (recipient) …….. Name: ……..…… Date:…....
(Name of representing Office/community).....

Signed (TF represented) ……..Name: ……...Date:…… (Position).....

Signed ……..Name: ……..Date: ……..…..
(Witness: Woreda Natural Resources Expert)

Signed ……..Name: …….Date: …….....
(Witness: Development Agent)
Approved by:
Chair, Kebele Administration: Name: .....
Signature: .....
Date: .....
(kebele seal)

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