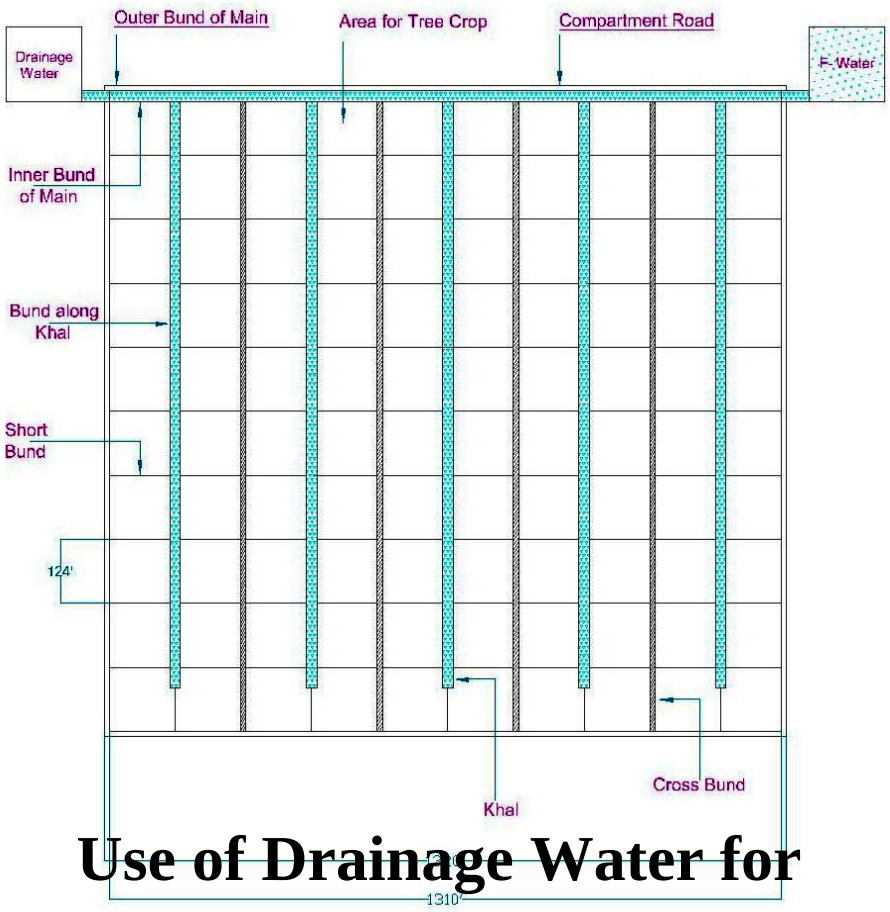
SINDH IRRIGATION AND DRAINAGE AUTHORITY

WATER SECTOR IMPROVEMENT PROJECT PHASE – I (WSIP-I)

Preparation of Regional Plan for Left Bank of River Indus, Delta and Coastal Zone

Proposed Project on



Use of Drainage Water for Forestation in the LBOD Area

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In Association with
Indus Associated Consultants
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Executive Summary

Background/Rationale

Analysis of the forests during the process of consultation in phase – I and literature review revealed that these forests and farmland plantations have been degraded/depleted due to variety of social, economic and environmental problems. The degradation is pronounced in the form of their area, species composition, productivity, ecosystem functions and environmental services. The crux of degradation of tree resource in the area is pronounced

i) Deforestation/overcutting /depletion of trees from forest and farmlands.

ii) Degradation of forest and agro ecosystems iii) Decline in productivity & composition of forest and farmlands.

iii) Shortage of tree resource and associated services.

iv) Lack of participatory approach and coordination

v) Decline in per ha vegetation cover

A common issue/problem for establishing new forests, maintenance of existing ones and farm plantations is the scarcity of irrigation water from river, canals, distributaries and water courses due to overall shortage of water in the systems. The drainage water of drainage systems outfalls into Arabian Sea either directly or through LBOD and Kotri drainage systems. The quality of this water is such that it could be used for tree plantations by diverting from nearby drains to nearby forests and farmlands. Researches carried out indicate that drainage water is useful for tree species.

The option for improving the above scenario is to explore the sources of irrigation water to supplement the shortages of canal irrigation. One of the options is to use the drainage water of drainage systems in conjunctive or cyclic forms. Accordingly, a pre-feasibility titled, "Conjunctive/Cyclic use of drainage water for forestation on government forest lands and private farmlands in LBOD and Kotri surface drainage command area" was prepared. The drainage water will either be mixed with available irrigation water for the particular area or used in cyclic form i.e. supply canal water for certain number of irrigations and then supply drainage water of acceptable quality for other irrigations.

After technical evaluation and stakeholders' inputs during phase II this project has been considered feasible thus, a feasibili**ty/project** titled, "Use of Drainage Water for Forestation in LBOD Area" has been proposed and discussed with the stakeholders in workshops, meetings, and field visits.

The proposed intervention is Non-structural. No any structure is proposed in this intervention. Option pertains to tree plantation on forest lands and private farmlands by supplementing fresh water with drainage water for combating deforestation, improve environment, provide alternate use of drainage/storm water, enhance green infrastructure, proper land use, and improve tree/forest resource.

Project location and boundaries

The proposed project is located in two geographic areas namely i) LBOD command area located in Shaheed Benazirabad, Sanghar and Mirpurkhas districts and ii) Kotri Surface Drainage System located in Thatta and Badin districts.

Project Scope and objectives

The scope of the proposed project is to address the issues and problems responsible for degradation of forests through potential options and solutions so as to improve the vegetative cover in the inland forests owned by the government and on the private farmlands by supplementing drainage water of LBOD and Kotri drainage areas with canal irrigation water. The objectives of the project are: To combat deforestation through tree plantation, To explore alternate use of drainage/storm water for growing forests and reduce water shortage, To improve productivity of degraded lands, To improve tree resource on government forest lands and private farmlands, To supplement irrigation water

shortage, To enhance green infrastructure to promote biological drainage and To improve environment through carbon sequestration

Specific outputs of project

The expected outcome, outputs and deliverables of the proposed intervention will be in the form of

i) Best alternate use of drainage water.

ii) Utilize drainage water for improving natural resources.

iii) Reduce pressure from LBOD drainage system at the tail end by reducing downward flow of drainage water.

iv) Reduce water logging and salinity in degraded lands.

v) Help improve the irrigation water shortages.

vi) Improve livelihood of farming community.

vii) Arrest desertification process.

The physical targets of the proposed project are as under

Raising of nurseries for forestation	15.0 million seedlings
Forest Plantations	5,000 ha
Forestry on farmlands through Social Forestry	3,000 ha

Project Cost

The project will be executed by the Sindh Forest Department over a period of 5 years. The total cost of the project is estimated as Rs. 250.90 million.

Implementation Arrangements

The approach for implementation of proposed project will primarily be participatory. The government land owners (Forest Department), Sindh Irrigation Department, Sindh Irrigation and Drainage Authority, private farming community and local civil society organizations/ communities are the major stakeholders for this intervention. All of them will be taken on board from planning, execution, monitoring and evaluation and operation and maintenance.

The project will use the social forestry/farm forestry tools in its approach and methodology for implementation.

Implementation Approach

1) Site identification and Selection

Prior to implement the proposed implementation the sites will be selected in consultation with the stakeholders i.e. Forest Department for forest lands and concerned farmers/landowners for private farmlands. Following broad criteria will be followed:

- The area to be planted should be located closer to drainage system.
- The area to be planted should be located closer to irrigation channel and should have a water share from that water channel.
- In order to utilize the water from both the sources in conjunctive or cyclic form the concerned stakeholders should show his willingness to afforest that area.
- The proposed area should be degraded but not completely waterlogged.
- It will be better to afforest the areas clusters of farmlands will be identified and the farmers jointly show their willingness to use drainage water and irrigation water allocated for that land.

- The farmers shall formulate a CO to execute the proposed intervention, decide roles and responsibilities and other aspects of intervention.
- The CO should be willing to spend some money for excavation of water courses separately for drainage and irrigation waters and their O & M.
- The project will only pay for supply of drainage water at source through construction of an outlet and if required lift machines to release drainage water from drains.
- Land development, planting, restocking, irrigation within farm, protection and aftercare will be the responsibility of individual farmers.
- Technical assistance and extension services will be provided by the concerned departments namely Forests, Irrigation, and SIDA.
- For forestation on forest lands almost same criteria for site selection will be observed except that the department is the sole owner of the area to be afforested through proposed techniques. The area closer to drainage systems will be identified.

2) Method of irrigation

a) **Conjunctive Use**

Conjunctive refers to mixing of irrigation and drainage waters to the areas for tree plantations. The irrigation water will be sweet water and the drainage water will be saline quality. In order to utilize drainage water for forestation both the waters will be mixed in required quantities to reduce salinity level of brackish water to sustain tree growth.

b) Cyclic Use

Cyclic use refers to use of irrigation and drainage waters to the areas for tree plantations in separate irrigations i.e. applications of one or two irrigations of sweet water from irrigation channels and another one or two irrigations of saline water from drains. The irrigation water and the drainage water will be applied in alternative form for forestation. In order to utilize drainage water for forestation both the waters will be used in required quantities to sustain tree growth and mitigate environmental problems.

c) Choice of Species

The tree species proposed for forestation in the project are: *Acacia nilotica, Albizzia lebbek, Casuarina equisitifolia, Eucalyptus camaldulensis, Leucaena leucocephala, Parkinsonia aculeate, Prosopis cineraria, Prosopis juliflora, Sesbania bispinosa, Sesbinia sesban, and Tamarix aphyll.a.*

Project Benefits

The proposed methods of irrigation will best utilize the drainage effluent for forestation and also meet the shortage of irrigation water from canals. Above all, the environment of the area will improve and the degraded and unproductive lands will be brought back to productive lands which will ultimately increase tree resource, combat deforestation, improve livelihood and alleviate poverty.

Environmental Benefits

The proposed project is environment friendly on the grounds that it will not have any adverse impacts on any green infrastructure of the areas, will utilize the drainage water for growing trees and crops, will improve degraded lands and increase their productivity and will improve the physical and chemical structures of the degraded soils.

Economic Evaluation

The overall IERR for the project is 24.3%, hence the project is economically viable. The NPV at 12% is Rs.209.8 million. The sensitivity analysis presented in the following table shows that with 10% decrease in the benefits the IERR is 14.9% while with 10% increase in the cost the IERR is about 15.1%. Both of these are above 12%. The simultaneous 10% decrease in benefits and increase in cost suggests the IERR is still above 12%, hence is robust.

The switching value indicate that if the benefits decrease by 58.3%, and costs increase by 139.2%, while even if both may change by 41.0% the project will still be viable.

Social Benefits

The proposed project will have several socio-economic benefits for the society as under:

- Enhance productivity of lands in the form of food, wood, fodder and fuel.
- Provide livelihood opportunities to farm holders and associated workers through employment opportunities.
- Increase overall economy of the area by improving the productive capacity of degraded and unproductive lands.
- Livestock and wildlife will get improved grazing areas and habitats, respectively.
- Agricultural and livestock outputs will improve socio-economic status of farming community and associated stakeholders.
- The knowledge of use of drainage and sweet water in conjunctive/cyclic form will transfer the technology from scientific community to rural agrarian society.

Resettlement Issue

The project will be implemented on the private farm lands with the consent of the farm owners, thus will not require any resettlement.

1 Introduction

Irrigated plantations are located in the command area of Guddu, Sukkur and Kotri barrages and getting allocated irrigation supplies from the network of above barrage irrigation systems. Hence, like other private land owners/farmers, the forest department is a shareholder in irrigation supplies. In major irrigated plantations forest minors are constructed and irrigation water is supplied from irrigation canals/distributaries through these minors and water courses as per design of control structures (*Moghas*) at each irrigation channel.

Trees on the farmlands are integral part of agricultural systems in Sindh. They are grown on the agricultural farms as individual scattered trees, in the form of woodlots locally known as "Hurry" (a block plantation of Babul trees grown on close spacing for short rotations), block plantations of other species especially Eucalyptus and, trees in linear form along farm boundaries, irrigation channels and paths and, windbreaks/shelterbelts. These farm land trees are source of energy, mining timber for coal mines, local consumptions for construction and raw material for wood-based industries. They also protect environment and conserve biological diversity.

Analysis of the forests during the process of consultation in phase – I and literature review revealed that these forests and farmland plantations have been degraded/depleted due to variety of social, economic and environmental problems. The degradation is pronounced in the form of their area, species composition, productivity, ecosystem functions and environmental services.

A common issue/problem for establishing new forests, maintenance of existing ones and farm plantations is the scarcity of irrigation water from river, canals, distributaries and water courses due to overall shortage of water in the systems. The drainage water of drainage systems outfalls into Arabian Sea either directly or through LBOD and Kotri drainage systems. The quality of this water is such that it could be used for tree plantations by diverting from nearby drains to nearby forests and farmlands. Researches carried out indicate that drainage water is useful for tree species. It is proposed to divert drainage effluent from drains without industrial effluents for tree planting in irrigated plantations and farmland areas either in conjunctive or cyclic forms. This will in part meet the shortage of irrigation water from irrigation sources allocated for these forests and farmlands and also increase tree cover in the above areas for the betterment of the environment and enhancing the productivity of these areas.

1.1 Problem Statement

Task I-5 of the Regional Plan study pertains to document and review causes of deforestation and strategies for reforestation in forests of left bank of Indus and delta. During study a detailed review of existing conditions of riverine and inland forests was undertaken, present strategies of the concerned department have been analyzed and major causes of deforestation and degradation of forests have also been identified. The outcomes of the above analysis have been documented and the major issues have also been identified by the stakeholders during local, district and regional level consultative workshops. The analysis and outcome reveals that the overall condition of forests of the project area is not satisfactory due to several technical, social, environmental and natural issues. The major/issue identified by the stakeholders is the shortage of allocated irrigation water resulting in deforestation, increase in blank areas and land degradation.

The major land use in the project area is the agriculture and in the past the trees used to be an essential part of agricultural systems and major source of wood supplies for various uses and livelihood of the farming communities. This resource on the farmlands is also deteriorating due to variety of factors in the project area.

Following is the crux of degradation of tree resource in the project area:

- Deforestation/overcutting /depletion of trees from forest and farmlands
- Degradation of forest and agro ecosystems
- Decline in productivity & composition of forest and farmlands
- Shortage of tree resource and associated services
- Lack of participatory approach and coordination
- Decline in per ha vegetation cover

The option for improving the above scenario is to explore the sources of irrigation water to supplement the shortages of canal irrigation. One of the options is to use the drainage water of drainage systems in conjunctive or cyclic forms. Under the proposed intervention titled, "Conjunctive/Cyclic use of drainage water for forestation on government forest lands and private farmlands in LBOD and Kotri surface drainage command area" the drainage water will either be mixed with available irrigation water for the particular area or used in cyclic form i.e. supply canal water for certain number of irrigations and then supply drainage water of acceptable quality for few number of irrigations.

1.2 Description of Project area

1.2.1 Physiography and topography

The project area is located in command area of LBOD Stage-I constituting Shaheed Benazirabad (Nawabshah), Sanghar and Mirpurkhas components and left bank of Kotri surface drainage command area. The districts covered are Shaheed Benazirabad, Sanghar, Mirpurkhas, Badin and left bank of Thatta. LBOD Stage I area is an irrigated area fed by Sukkur barrage irrigation system through Rohri and Nara canals command area. The soils are generally fertile and productive where agriculture is the main economy of the area. Due to inadequate drainage at some areas the twin problems of waterlogging and salinity have adversely affected the quality of soils. The underground water of most of the project area is sweet but there are large pockets/layers of brackish water. The topography of the LBOD stage I area is generally flat sloping from north to south. A drainage network have been installed under LBOD Stage I area through 1203 km long surface drains, 2391 km long disposal channels (saline), 1668 drainage tubewells, 365 Scavenger tubewells, 582 km long interceptor drains, 250 pumping stations, 55,000 acres tile drains and 1581 storm water inlets.

Kotri Surface drainage is located on both left and right bank of Indus but the area for this intervention is located on left bank of Indus located in Tando Muhammad Khan and Thatta districts. The area is fed by Kotri barrage irrigation system through Phuleli. Pinyari and Akram Wah canal network. The area is generally productive having agriculture as main economy. Waterlogging and salinity is increasing due to in-efficient irrigation system and sea intrusion in coastal area. Lower part of project area is influenced by coastal climate and ecosystem. Underground water is brackish.

1.2.2 Socio-economic scenario

The project area is predominantly an agricultural area where variety of food, fodder, fruit, oilseed and cash crops are grown. Also trees are also the important component of the area grown in the form of agro-forestry. The economy and livelihood of the people of the area is dependent on the above resource. This area is thickly populated having density ranging between 300-500 people per sq. km.

2 Description of the Project

2.1 Project Name

Use of Drainage Water for Forestation in the LBOD Area

2.2 Project Type

The proposed intervention is Non-structural. No any structure is proposed in this intervention. Option pertains to tree plantation on forest lands and private farmlands by supplementing fresh water with drainage water for combating deforestation, improve environment, provide alternate use of drainage/storm water, enhance green infrastructure, proper land use, and improve tree/forest resource.

2.3 Project location and boundaries

The proposed project is located in two geographic areas namely i) LBOD command area located in Shaheed Benazirabad, Sanghar and Mirpurkhas districts and ii) Kotri Surface Drainage System located in Thatta and Badin districts.

2.4 Project Scope and objectives

The scope of the proposed project is to address the issues and problems responsible for degradation of forests through potential options and solutions so as to improve the vegetative cover in the inland forests owned by the government and on the private farmlands by supplementing drainage water of LBOD and Kotri drainage areas with canal irrigation water.

2.5 Objectives of Project

The objectives of the project are:

- To combat deforestation through tree plantation
- To explore alternate use of drainage/storm water for growing forests and reduce water shortage
- To improve productivity of degraded lands
- To improve tree resource on government forest lands and private farmlands
- To supplement irrigation water shortage
- To enhance green infrastructure to promote biological drainage
- To improve environment through carbon sequestration

2.5.1 Specific quantitative outputs of project

The project area for this intervention is the government forest lands known as “Irrigated Plantations” and private farmlands located in the command of Sukkur and Kotri barrages. Irrigation water supplies for these areas have been allocated from nearby irrigation channels. Due to overall water shortages in the irrigation systems and other social/technical problems

the allocated water supplies are not received resulting in deforestation and reduced tree cover in the government forest lands and productivity of farmlands. In order to meet irrigation water shortages and make these forest and private farmlands productive it is proposed to divert and use drainage water of LBOD and Kotri surface drainage systems to adjacent forest lands and farmlands with allocated fresh irrigation water in conjunctive or cyclic forms.

On forest lands this water will be used for growing of trees and on farmlands this water will be used both for growing trees and crops in the form of agro-forestry. Research has proved that there are several tree species and agricultural crops that could be grown successfully on saline water by reducing its salinity levels by mixing with sweet irrigation water or cyclic use.

The expected outcome, outputs and deliverables of the proposed intervention will be in the form of following:

- Best alternate use of drainage water.
- Utilize drainage water for improving natural resources
- Reduce pressure from LBOD drainage system at the tail end by reducing downward flow of drainage water.
- Reduce water logging and salinity in degraded lands
- Help improve the irrigation water shortages
- Improve livelihood of farming community
- Arrest desertification process

3 Issues and problems addressed by the project

Task I-5 of the Regional Plan study pertained to document and review causes of deforestation and strategies for reforestation in forests of left bank of Indus and delta.

3.1 Phase II Tasks covered by this project

The proposed project will directly and indirectly cover the following tasks of phase II of the study:

Task II.1: Develop possible options and solutions to identified issues based on pre-feasibility level studies, surveys and designs

Task II.2: For preparation of possible solutions collect physical, technical, social and environmental information

Task II.11: Assess the conditions of dhandhs, water bodies, wetlands, ecosystems and mangroves in the coastal zone

Task II.22: Develop ranking of the solutions, costs, benefits, population benefitting, environmental and social benefits

4 Approach and Methodology

The approach for implementation of proposed intervention will primarily be participatory. The government land owners (Forest Department), Sindh Irrigation Department, Sindh Irrigation and Drainage Authority, private farming community and local civil society organizations/communities are the major stakeholders for this intervention. All of them will be taken on board from planning, execution, monitoring and evaluation and operation and maintenance.

The project will use the social forestry/farm forestry tools in its approach and methodology for implementation.

The methodology for conducting feasibility is proposed as follows:

- Identification of irrigated plantations located in the command area / vicinity of drains.
- Explore possibilities of diverting drainage water to irrigated plantations.
- Analyze the quality of drain water and forest/farmland soils.
- Calculate the quantity of drainage water that could be diverted for the proposed project.
- Calculate the area that could be irrigated through the project intervention.
- Identify the tree and crop species and calculate their water requirements.
- Based upon the water quantity and quality propose the species to be grown.
- Determine the layout, methods of land development and irrigation, planting techniques and managerial and financial resources required on per unit of area.
- Mapping of proposed areas through GIS technique.
- Have willingness of major stakeholders (foresters, environmentalists, conservationists and farmers/land owners to participate in proposed intervention.

4.1 Stakeholder Involvement

In development of forest resources the approach used has mostly been top down. The planning, execution, M & E and O & M has been done by the forest department without informing, consulting, involving in decision making and benefit sharing the other stakeholders. The stakeholders during the process of identification of issues and problems identified the option of use of drainage water with mixing it with available irrigation water for tree plantation both on government forest lands and farmlands. In the proposed intervention it is ensured to take the stakeholders on board and include their inputs at every stage in the development of the proposed intervention. The proposed intervention has been discussed in the phase II consultative workshops conducted at all district, regional and national levels. The stakeholders expressed their concurrence to the proposed intervention and ranked it as a priority solution to enhance tree cover through use of drainage and fresh waters in conjunctive or cyclic forms especially in the problematic areas having waterlogging and shortage of irrigation water.

The proposed project will be executed through the Social/Farm Forestry program of Forest Department. In this concept the participation of farmers/landowners and concerned departments will be mandatory during planning, development and execution phases of the project. The roles and responsibilities of each participating partner will be decided.

5 Due Diligence

5.1 Description of technical aspects of project

5.1.1 Site identification and Selection

Prior to implement the proposed implementation the sites will be selected in consultation with the stakeholders i.e. Forest Department for forest lands and concerned farmers/landowners for private farmlands. Following broad criteria will be followed:

- The area to be planted should be located closer to drainage system.
- The area to be planted should be located closer to irrigation channel and should have a water share from that water channel.
- In order to utilize the water from both the sources in conjunctive or cyclic form the concerned stakeholders should show his willingness to afforest that area.

- The proposed area should be degraded but not completely waterlogged.
- It will be better to afforest the areas clusters of farmlands will be identified and the farmers jointly show their willingness to use drainage water and irrigation water allocated for that land.
- The farmers shall formulate a CO to execute the proposed intervention, decide roles and responsibilities and other aspects of intervention.
- The CO should be willing to spend some money for excavation of water courses separately for drainage and irrigation waters and their O & M.
- The project will only pay for supply of drainage water at source through construction of an outlet and if required lift machines to release drainage water from drains.
- Land development, planting, restocking, irrigation within farm, protection and aftercare will be the responsibility of individual farmers.
- Technical assistance and extension services will be provided by the concerned departments namely Forests, Irrigation and SIDA.
- For forestation on forest lands almost same criteria for site selection will be observed except that the department is the sole owner of the area to be afforested through proposed techniques. The area closer to drainage systems will be identified.

5.1.2 Raising of Nurseries

Sources of seed: This is an important aspect to be considered by the farmers/organizations choose to grow salt tolerant species to make their degraded/problematic lands productive. Farmers wishing to obtain seed of salt tolerant plants must find out a reliable source to provide the quality seed of exact species he wants to plant. There is a profound difference in salt tolerance between different species hence, depending upon the quality of land where this scheme is to be implemented, the plants are to be selected accordingly. It is better to discuss the selection of right source with technical person to guide him the right source of seed for particular species.

Nursery techniques: Trees and shrubs can be established in the field by planting seed, planting cuttings, transplanting nursery raised seedlings in polythene bags and transplanting nursery-raised bare-rooted seedlings. The optional method of propagation depends on the soil salinity of the field and the species to be planted. For salt-affected soils, the chances of establishment are best using nursery-raised seedlings in polythene bags. For polythene bag nurseries following operations are required:

Location: Nurseries should be easily accessible, assured irrigation water supplies and preferably non-saline and well-drained soils.

Layout: A typical layout of polythene bag nursery will be adopted in consultation with local Forest Department/NGO staff.

Preparation of soil mixture: Silt from canals or water a course is completely mixed in equal amounts with good quality loamy soil> Well rotten organic matter should be added to soil in 1:3 ratios to improve soil moisture retention.

Preparation of polythene bags: The bags of 8”X 12” should be used. In order to remove excess water the bags should be punched with punching machines and each bag should have 12-16 holes of 3 mm size each. After filling with soil mixture the bags should be placed in upright position in the nursery beds.

Seed sowing and thinning: Seeds should be sown onto surface of the soil in the bags in a way that they are not exposed to sun. The best season of sowing is either autumn (September-October) or spring (February-March) when temperatures range between 20-30 degrees C. Fine seeds are covered with a thin layer of soil. The bags should be irrigated by seepage through nursery beds or light sprinkling. Once germination occurs seedlings should be thinned so that there is no more than one seedling per bag.

Weeding, shifting and root cutting: Bags should be kept free of weeds and shifted regularly to prevent the seedlings rooting into nursery beds. The roots outside the bags should be cut and established seedlings should be sorted into different beds according to size and growth.

Hardening: If seedlings are to be transported into salt affected soils, it is advisable to harden the plants by applying some salt or salt solution to each bag having 5 grams of table salt per liter of water. It is suggested that 100 ml of this solution be added to each bag in two applications of 50 ml per application per week.

Transportation/carriage: The plants should be well irrigated one day before they are transported into the field. They are staked upright in crates before loading into trucks.

5.1.3 Land preparation and Planting

The steps involved in preparing land for the planting of trees and shrubs are summarized below:

- Leveling of land
- Plan the tree lines and distances between plant to plant and row to row
- Overcome problems of dense soils/hard pans
- Apply gypsum and farm yard manure
- Plant the trees or shrubs
- Plan the irrigation strategy
- Control the grazing

Trees and shrubs to be planted will be done either through seedling or by direct sowing with seed. Healthy seedlings will be procured from the nurseries and planted in the plots in lines at the spacing of 3 feet between plant to plant and 6 feet between line to line. Immediately after planting, the plot shall be irrigated so as to overcome the shock due to shifting from nursery to planting site. Initially the irrigation shall be given with sweet water till the plants establish their root system. Later on the plants shall be irrigated either in cyclic or conjunctive form.

5.1.4 Choice of species

Following tree species are proposed for forestation in the project. The short description of each species, salinity level tolerance and productivity are also given.

Acacia nilotica: This tree species is known as gum Arabica and locally it is known as *Kikar or Babul*. It has a 40% reduction in growth at an EC of about 8 decisiemens per meter and is relatively tolerant to waterlogging. It is grown in cultivated and wild stands in forests, farmlands and wastelands as block plantations, Hurries, individual trees and lines. This tree is aggressive and is easily established, reproduced from seed and is well adapted to variety of soil and climate conditions**.** Wood production varies between 4 and 15 cubic meters per ha in 20 year rotation.

Albizzia lebbek: This tree species is locally known as *Shirin or siris*. Siris is fast growing large deciduous ornamental tree. It tolerates moderate salinity, sodicity and high pH (8.7-9.4) and grows in variety of soils and climates. It is reproduced from seed and propagated through direct seeding. Yields of this species have been estimated at about 5 cubic meters per ha per year.

Casuarina equisitifolia: This tree is known as coastal sheoak and locally as *Jangli saru.* It is large erect evergreen tree with conifer-like appearance. Usually grown on sea coasts in calcareous and slightly alkaline soils and survives in wide range of EC values of 5-40 decisiemens per meter. Grows in variety of soils but grows poorly on clay soils. This species is reproduced from seed and yield of 7-10 cubic meters is obtained at 15-20 year rotation

Eucalyptus camaldulensis: Eucalyptus is native to Australia but is now grown extensively in Pakistan in plains. It is locally known as Sufeda. It grows in slightly saline soils where it can withstand some salinity and waterlogging. Studies in Pakistan and elsewhere it has been reported to EC levels of 9-10 decisiemens per meter. It is propagated by seed and there are about 600,000 seeds per kg. Nursery grown seedlings are used for field planting. It is a good farm forestry tree but compete strongly with crops for moisture and nutrients. Generally 2 meter X 2 meter configuration is used. This species is fast growing and average yields vary from 10-25 cubic meters per ha per year.

Leucaena leucocephala: In English this species is known as *Leucaena* and locally called as I*pple Ipple* and *American shirin.* It is multipurpose, nitrogen fixing evergreen shrub or tree that is fast growing. It is an aggressive species that grows on variety of soils but grows well in light textured saline soils and is sensitive to waterlogging. It is propagated through direct seeding or the planting of container seedlings, bare-rooted seedlings or stump cuttings. People prefer to grow this species as fuelwood/forage plantations of short rotation of 2-3 years.

Parkinsonia aculeate: This species is known as Parkinsonia or prickly boom in English and locally as *Vilaiti kikar.* It is native to America and was introduced in Pakistan as ornamental and avenue plant. It grows well under conditions of high salinity but is sensitive to waterlogged conditions. Parkinsonia is easily established by direct seeding or through vegetative measures. It is relatively fast growing tree and produces 38 kgs per tree in saline sodic soils.

Prosopis cineraria: This species is locally known as *Kandi or Jand* and is thorny evergreen tree with spreading crown. *K*andi grows in highly saline and alkaline soils (pH values upto 9.8). This species is reproduced easily from seeds or by shoot cuttings and after harvest the tree coppices readily. Yields of wood of 3-5 cubic meters per ha per year are common.

Prosopis juliflora: In English this species is called *Mesquite* and locally as *Devi or Jangli Kikar*. It is a large shrub or a small evergreen thorny tree. This is an aggressive species and grows under conditions of moderate to high salinity and sodicity, high alkanity (pH values upto 9.8) and intermittent flooding. Plantations of Mesquite can be established and/or grown using irrigation with saline ground water or sea water. It can be quite suitable in lowering water tables on dense saline sodic soils with shallow ground water. This is a multipurpose tree for dry lands and an important source of fuelwood, timber and forage and other benefits. It is propagated by seeds or nursery raised seedlings. It has capacity to re-grow after coppicing and yields about 5 kgs per plant per year.

Sesbania bispinosa: This is an erect annual or biennial legume and is commonly grown for the reclamation of salt-affected soils and variety of soil conditions from waterlogged to saline

and from sands to clay. It is generally used for green manuring, roofing of mud houses, fuelwood and fodder production. It is sown by direct seeding.

Sesbinia sesban: This species is locally known as Jantar and is small to medium sized leguminous tree. It is adapted to a range of climatic conditions and can tolerate waterlogging, salinity and alkalinity (pH values as high as 10). It is used as fodder, source of wood for village huts/low cost house construction and wood based industries and windbreaks as land care. Jantar can be planted through direct seeding and produces 15-20 tons dry weight per ha per year.

Tamarix aphylla: This is heavily branched large coniferous looking tree and locally known as Farash and Lawa. It tolerates high levels of salinity and sodicity and highly tolerant salinity waterlogging. There is high survival when irrigated with water of EC of decisiemens per meter. This species can be easily propagated through nursery grown seedlings, stem cuttings and root suckers and used as wood and fuelwood. It is harvested in 20 year rotation under natural conditions and 10-12 years in irrigated conditions. Wood production of 5-10 cubic meters per ha per year has been reported.

5.1.5 Availability of Irrigation water

It is essential for the proposed project that the areas identified should have legal irrigation supplies from nearby irrigation channel/source.

5.1.6 Availability of drainage water

The proposed area for planting should be located closer to the drains of drainage system from where the drainage water could be supplied in adequate quantity and in all the year round.

5.1.6.1 Determination of Quality of drainage water

This is an essential parameter to be assessed for the intervention. The drainage effluent of each drain will be collected at different stations and analyzed from closer water testing laboratories to assess their quality. The parameters to be assessed will be water pH and EC to assess the salinity level.

5.1.6.2 Determination of Quality of soils

This is an essential parameter to be assessed for the intervention. The soils where this intervention is to be implemented will be assessed by collecting soil samples at appropriate depths and analyzed from closer soil testing laboratories to assess soil quality. The parameters to be assessed will be water pH and EC to assess the salinity level.

Assessment of soil and water quality will provide a guideline to apply required water to raise the plantations.

5.1.6.3 Method of irrigation

The proposed project pertains to use canal water and drainage water for irrigation to forests/trees on degraded/blank private farmlands and forest lands in two ways i.e. in conjunctive and/or cyclic uses/forms described as under:

Conjunctive Use: Conjunctive refers to mixing of irrigation and drainage waters to the areas for tree plantations. The irrigation water will be sweet water and the drainage water will be saline quality. In order to utilize drainage water for forestation both the waters will be mixed in required quantities to reduce salinity level of brackish water to sustain tree growth.

Cyclic Use: Cyclic use refers to use of irrigation and drainage waters to the areas for tree plantations in separate irrigations i.e. applications of one or two irrigations of sweet water from irrigation channels and another one or two irrigations of saline water from drains. The irrigation water and the drainage water will be applied in alternative form for forestation. In order to utilize drainage water for forestation both the waters will be used in required quantities to sustain tree growth and mitigate environmental problems.

5.1.6.4 Mechanism of supply of irrigation water

Supplies from irrigation source: All the cultivated and culturable lands have irrigation water allocation from nearby distributor through watercourse. The landowners are using this water for irrigation to their crops. Some lands have been so affected by the salinity that they are not economically viable hence remain uncultivated. The irrigation water allocated for these lands is used either for other farmlands owned by the sale landowner or given to adjoining landowners. There is no need to construct a new water course as all lands are settled on some watercourse. In some cases the irrigation water supply is short /inadequate in the system and the landowners having located at the tail end either do not receive irrigation water or it is insufficient to cultivate the lands and they remain uncultivated and unproductive. Such lands will be selected and irrigation supplies will be met from irrigation and drainage source to make the lands productive by growing salt/salinity tolerant trees/crops.

5.1.6.5 Mechanism of supply of drainage water

Drainage network is passing through the cultivated/culturable lands through surface drains, saline water disposal channels and interceptor drains. The underground water is pumped through drainage tubewells and scavenger wells. Drainage facilities of LBOD Stage I project in Nawabshah, Sanghar and Mirpurkhas components are shown in Table 1

Table 1: Drainage facilities of LBOD Stage I project

Component	CCA 000 acres	Length of Surface Drains (Km)	Length of saline disposal Channels (km)	Drainage Tubewells (No.)	Scavenger Wells (No.)	Length of Inceptor drains (km)	Pumping Stations (No.)
Nawabshah	555	323	602	274	191	225	53
Sanghar	632	554	913	642	175	122	122
Mirpurkhas	359	326	876	752	-	235	75
Total	**1,276**	**1,203**	**2,391**	**1,668**	**365**	**582**	**250**

Water quality of drains will be assessed and the project areas will be selected on the drains having acceptable quality of salinity. Instead of putting the entire quantity of drainage water to drains the quantity required for cultivation of tree crops will be allowed to be diverted to the areas to be forested. The landowners willing to afforest their lands will be allowed to construct water channels from the tubewell to the planting site. Incase there are several number of landowners they may share the construction cost of watercourses and the running and maintenance costs of tubewells.

5.1.6 Layout of irrigation system

There are two sources of irrigation water for this intervention i) drainage water supply through adjoining drains and ii) fresh water supply from irrigation channel on which the area is settled. Figure 1 shows the proposed typical layout of irrigation system for 16 ha. This layout indicates the sources of water, irrigation system having main watercourse, 5 khals, 4 cross bunds, 100 plots of 80 X 124 feet, short bunds and a compartment road around the 16 ha area. This standard layout has been adopted from Sindh Forest Department for forest plantations and sources of irrigation adjusted on this layout plan.

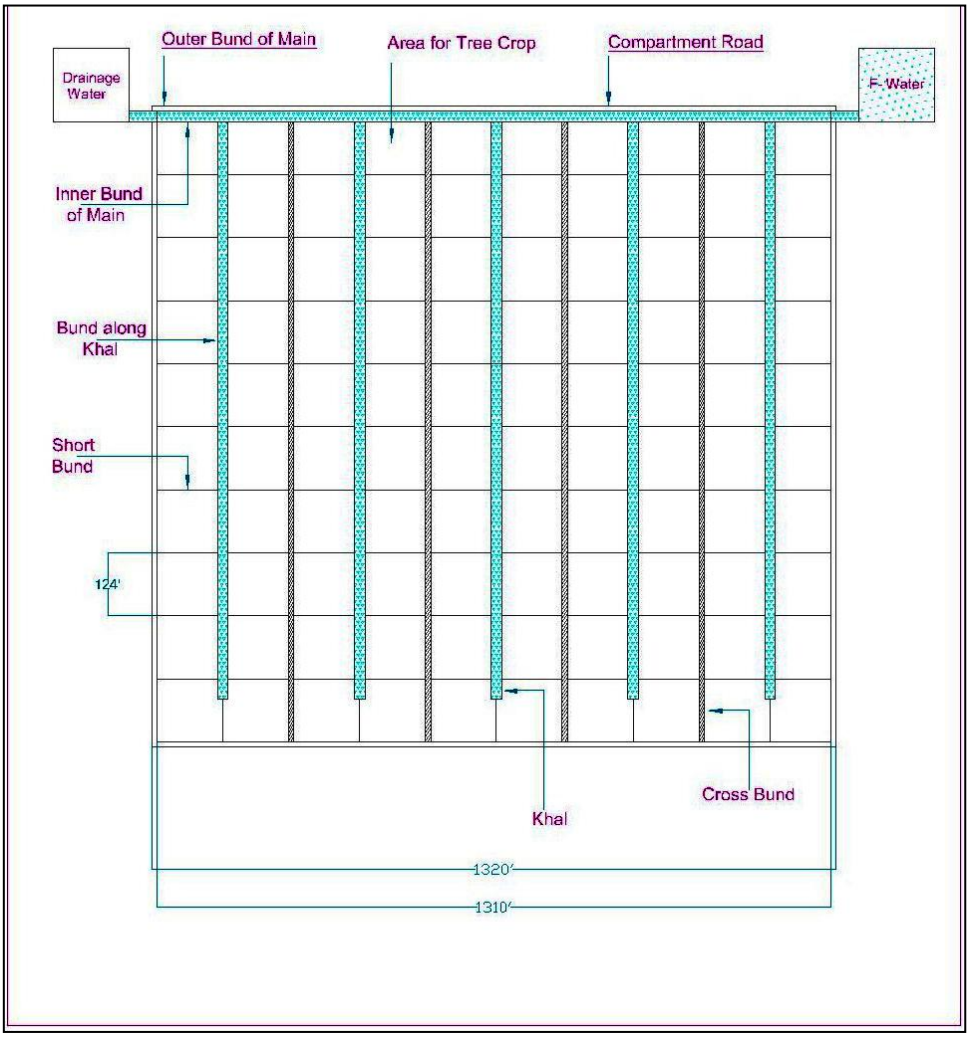

Figure 1: Layout of irrigation system for 16 hectares area

5.1.7 Post plantation activities

After the planting work is completed the essential activity is its post plantation care to ensure success. Following operations are to be taken in this context:

5.1.7.1 Revisiting of the area

Frequent visits of the technical staff be arranged to identify the gaps in the planted area where the plants have sot survived and also note the causes of failure.

5.1.7.2 Restocking in gaps

The re-planting operation is to be organized for the large failure areas and staff should arrange planting stock and carry out re-planting operation either with seed or seedlings.

5.1.7.3 Protection from livestock

Within and around the planted areas there is problem of grazing and browsing and trampling by the livestock. The area has to be protected from grazing by engaging local people who move around the area and ensure that no grazing takes place. The most effective way to ensure protection of planted areas is to formulate protection committees of local people who should take the responsibility of protection.

6 Implementation Arrangements

The executing agency will be Sindh Forest Department (SFD) responsible for implementation. The interventions will be implemented through community based participatory approach. On state lands SFD will be responsible for all operational and management aspects, while on communal/farm lands the private land owners will be responsible. Similarly, nurseries will be established and maintained by the SFD. NGOs, farmers and civil society organizations will be engaged for community mobilization.

The experience so far gained reveals that due to ecological, environmental, social and economic importance of forests, the foresters, social scientists, environmentalists, economists and ecologists are the stakeholders to be involved in implementation of the project. The implementation of the project is proposed to be participatory including government department, NGOs, local communities and farmland owners. In case the property of project area is private the owner of the land will also be included as a main stakeholder. Since Forest Department and international NGOs (IUCN and WWF) have technical knowledge will play an important role as they have experience of tree planting in the forest and farmlands**.**

6.1 Project Management

As indicated in the project implementation arrangements the project will be executed by the Sindh Forest Department through its afforestation and social forestry wings. The department and its wings are experienced and capacity to implement and manage this project. The plantations on the forest lands will be executed by the afforestation wing and on the private farmlands by the social forestry wing. Both of them have trained staff but few technical staff of lower cadre and funding will be provided under this proposed project as per details in table-2.

The department has a separate management and execution system including staff for executing social forestry projects. The main functions of social forestry staff are to grow nurseries at district and selected talukas, provide extension services to the farmers for tree planting, distribute technical literature regarding different aspects of tree planting throughout the province and provide advice to the stakeholders.

Table 2 below provides the essential technical staff, support staff for the field and office work and expenses required to pay the above staff during execution of the proposed project.

Table 2: Establishment charges for Project Execution and Management

Rs. million

Particulars of Staff	No.	Year-wise Number of Staff					Unit cost 000	Total Cost					Total Cost
		1	2	3	4	5		Year1	Year 2	Year 3	Year 4	Year 5	
Range Officer	4	4	4	4	4	4	40	1.920	1.920	1.920	1.920	1.920	9.600
Forester	8	8	8	8	8	8	25	2.400	2.400	2.400	2.400	2.400	12.000
Forest Guard	16	16	16	16	16	16	20	3.840	3.840	3.840	3.840	3.840	19.200
Computer Operator	2	2	2	2	2	2	20	0.480	0.480	0.480	0.480	0.480	2.400
Security Guards	2	2	2	2	2	2	15	0.360	0.360	0.360	0.360	0.360	1.800
Office Attendants	2	2	2	2	2	2	15	0.360	0.360	0.360	0.360	0.360	1.800
Total staff	**34**							**9.360**	**9.360**	**9.360**	**9.360**	**9.360**	**46.800**
Travel/TA	LS						LS	0.800	0.800	0.800	0.800	0.800	4.000
Other Cost	**-**						**LS**	**0.400**	**0.600**	**0.800**	**1.000**	**1.200**	**4.000**
Total Estt. Cost								**10.560**	**10.760**	**10.960**	**11.160**	**11.360**	**54.800**

7 Monitoring and Evaluation mechanism

7.1 Indicators for monitoring

Participatory plantation forest investigation exercises are to be conducted during investigation and execution stages of proposed intervention. Participatory field exercises attain two main objectives i) it demonstrates the considerable knowledge that communities have and ii) the communities and forest managers begin to know each other leading to trust building.

Following tools will be used to compare the condition of natural resources after implementation of the proposed project.

Forest area mapping: Information gathered during the investigation step of program and mapping done at that time shall be compared with periodical mapping after its execution. All the relevant information of natural resources shall be collected by the communities and mapped on the forest maps. The difference between the two mappings will indicate the impact of Program.

Forest species matrix: Like area mapping the pre and post scenarios shall be compared periodically by preparing species matrixes showing their type, density, growth, health, uses and related information. This information will later be used by the forest managers and communities to plant and protect particular species.

Forest condition trend analysis: This tool is used to focus on changes over time through historical trend analysis. Under this tool assessment of natural resource condition or products is carried out initially and later on periodically to know the resource's condition over time. The abundance and short supplies of resources products and services will be determined through this tool.

Forest survival rate: This important tool is used as an indicator for analyzing the success of the project. Periodical visits of technical staff and stakeholders will conduct this exercise to estimate the success of the program.

7.1 Types of Indicators

Indicators for Monitoring and review revolve around immediate visible results (**outputs**) of natural resource, actions taken to achieve the desired results **(processes),** medium term results of plan execution **(outcomes)** and long term results of outputs and outcomes **(impact).**

Output - Immediate visible result.

Process – Actions taken by beneficiaries to achieve desired outcome.

Outcome – Medium-term result.

Impact – Long-term result that comes from achieving outputs and outcomes.

Participating actors could establish detailed indicators depending upon the type natural resource.

7.2 Monitoring roles and responsibilities

It is essential to define the roles and responsibilities of monitoring and review of Participatory M & E. Since the process of project identification and preparation has been participatory in which all the stakeholders have been involved, the monitoring shall also have to be participatory. The tools described above for participatory monitoring also describes the roles and responsibilities for monitoring and review of the plan. In addition, committees of stakeholders should be formulated for monitoring of the project.

7.3 Review process of Participatory Approach

Like monitoring, the review process shall have to be participatory involving representatives of all stakeholders. The success of Project will be judged from the achievements of indicators set during investigation exercises of project. Communities taking the responsibilities of participatory management in collaboration and participation of other stakeholders shall also set review process. Review process shall be continuous, critical and result oriented. Initially the project area shall be reviewed frequently and the corrective measures taken accordingly but the period of review could be increased as the participating actors gain experience and expertise of participatory management.

8 Environmental issues

The proposed project will not create any environmental issue in the project area but will address the existing environmental issues pertaining to land degradation, soil and water quality, productivity of lands, soil and water pollution and overall environment of the area.

9 Re-settlement Issues

The proposed project will not warrant any resettlement issue.

10 Project targets and phasing

Following are the tentative targets of the proposed project.

Nursery	15.00 million plants
Forest Planting	5,000 ha
Social Forestry Planting	3,000 ha

10.1 Project period

The proposed project will be implemented in 5 years.

10.2 Project Cost

The total estimated cost of the proposed project cost is Rs.250.90 million (Table 3)

Table 3: Physical and financial targets of the project

S. No	Particulars	Target	Rate (Rs.)	Amount (Rs)
1	Raising of Nursery	15 million	8 per plant	120 million
2	Initial land preparation operations	5,000 ha	3000 per ha	15 million
3	Earthwork and layout of irrigation system	5,000 ha	6,000 per ha	30 million
4	Tree Planting	5,000 ha	3,000 per ha	15 million
5	Social Forestry	3,000 ha	3,000 per ha	9 million
5	Restocking	1,250 ha	2,000 per ha	2.5 million
6	Operation cost of machinery (lift pumps)	5,000 ha	800 per ha	4.0 million
7	Establishment cost	34 No.	LS	54.80 million
	Total			**250.0 Million**

Table 4: Year wise physical targets

		Year 1	Year 2	Year 3	Year 4	Year 5	Overall
1	Nursery (million plants)	5	5	5	0	0	15
2	Initial land preparation (ha)	0	1250	1250	1250	1250	5000
3	Earthwork and layout of irrigation system (ha)	0	1250	1250	1250	1250	5000
4	Tree Planting (ha)	0	1250	1250	1250	1250	5000
5	Social Forestry (ha)	400	700	1000	600	300	3000
6	Restocking (ha)	0	312.5	312.5	312.5	312.5	1250

10.3 Financial Plan

The year wise financial plan of the proposed project Table 5

Table 5: Year wise Financial Plan for the project (Rs. M)

		Year 1	Year 2	Year 3	Year 4	Year 5	Overall
1	Nursery	40	40	40	0	0	120
2	Initial land preparation	0	3.75	3.75	3.75	3.75	15
3	Earthwork and layout of irrigation system	0	7.5	7.5	7.5	7.5	30
4	Tree Planting	0	3.75	3.75	3.75	3.75	15
5	Social Forestry	1.20	2.10	3.00	1.80	0.90	9.00
6	Restocking	0	0.625	0.625	0.625	0.625	2.5
7	Operation cost of machinery (lift pumps)	0	1.0	1.0	1.0	1.0	4
8	Establishment cost	10.56	10.76	10.96	11.16	11.36	54.80
	Total	**51.76**	**69.485**	**70.585**	**29.585**	**28.885**	**250.00**

10.2.1 Sources of funding

The proposed project is a pilot project which will be executed through a participatory approach by involving interested stakeholders specially the landowners whose agricultural lands have been degraded but still there is potential to enhance their productivity by changing

land use according to the availability and use of water for such land use. Hence, the funding sources will also be participatory i.e. the project authorities and the landowners will share the inputs in agreed ratio.

11 Project Justification

11.1 Economic Analysis

The economic analysis was undertaken for all the production parameters i.e. grasses, fuel wood, small construction wood and industrial wood, at an aggregated output level. The project viability was assessed for the project as whole.

The overall IERR for the project is 24.3%, hence the project is economically viable. The NPV at 12% is Rs.209.8 million. The sensitivity analysis presented in the following table shows that with 10% decrease in the benefits the IERR is 14.9% while with 10% increase in the cost the IERR is about 15.1%. Both of these are above 12%. The simultaneous 10% decrease in benefits and increase in cost suggests the IERR is still above 12%, hence is robust.

The switching value indicate that if the benefits decrease by 58.3%, and costs increase by 139.2%, while even if both may change by 41.0% the project will still be viable.

Table 6: Economic and Sensitivity Analysis

#	Scenario	NPV @12%	IERR	Switching Value
1	Base Case	209.8	24.3%	
2	Decrease in Benefits (10%)		14.9%	58.3%
3	Increase in Costs (10%)		15.1%	139.2%
4	Simultaneous Change by 10%		13.2%	41.0%

11.2 Benefits of intervention

These methods of irrigation will best utilize the drainage effluent for forestation and also meet the shortage of irrigation water from canals. Above all, the environment of the area will improve and the degraded and unproductive lands will be brought back to productive lands which will ultimately increase tree resource, combat deforestation, improve livelihood and alleviate poverty.

11.3 Environmental services/benefits

The proposed project is environment friendly on the following grounds:

- It will not have any adverse impacts on any green infrastructure of the areas.
- It will utilize the drainage water for growing trees and crops.
- It will improve degraded lands and increase their productivity.
- It will improve the physical and chemical structures of the degraded soils.

11.4 Social benefits

The proposed project will have several socio-economic benefits for the society as under:

- Enhance productivity of lands in the form of food, wood, fodder and fuel.

- Provide livelihood opportunities to farm holders and associated workers through employment opportunities.
- Increase overall economy of the area by improving the productive capacity of degraded and unproductive lands.
- Livestock and wildlife will get improved grazing areas and habitats, respectively.
- Agricultural and livestock outputs will improve socio-economic status of farming community and associated stakeholders.
- The knowledge of use of drainage and sweet water in conjunctive/cyclic form will transfer the technology from scientific community to rural agrarian society.

11.5 ICID Evaluation

The proposed project has been evaluated as per International Commission on Irrigation and Drainage (ICID) criteria. It reveals that **t**he proposed intervention will help utilize the drainage effluent together with irrigation water for growing forests in conjunctive or cyclic forms. A number of tree species utilize saline water for their growth and development and also take up salinity of the water or soil thus reducing the overall salinity of the area. The water of the surface drains is moderately saline and is not hazardous to growing trees. This intervention provides an alternate use of drainage water and also makes the unproductive as productive by growing trees.

Table 1: Economic Analysis of Intervention on Forestation

A	**Without Project**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**15**	**20**
	Total Value of Output	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
B	**With Project**												
	Tree Plantation on Project Area												
1	Area Planted in Ha	0.0	1,250.0	2,500.0	3,750.0	5,000.0	5,000.0	5,000.0	5,000.0	5,000.0	5,000.0	5,000.0	5,000.0
2	Wood Production in c.m	0.0	0.0	0.0	3,750.0	7,500.0	11,250.0	20,000.0	20,000.0	20,000.0	20,000.0	35,000.0	40,000.0
3	Value of production in (Rs. M)	0.0	0.0	0.0	10.1	20.3	30.4	54.0	54.0	54.0	54.0	94.5	108.0
	Tree Plantation on Farm Lands												
1	Area Planted in Ha	400.0	1,100.0	2,100.0	2,700.0	3,000.0	3,000.0	3,000.0	3,000.0	3,000.0	3,000.0	3,000.0	3,000.0
2	Wood Production in c.m	0.0	0.0	0.0	800.0	2,200.0	4,200.0	5,400.0	6,000.0	9,000.0	9,000.0	12,000.0	12,000.0
3	Value of production in (Rs. M)	0.0	0.0	0.0	2.2	5.9	11.3	14.6	16.2	24.3	24.3	32.4	32.4
C	Incremental Benefits (Rs. M)	0.0	0.0	0.0	12.3	26.2	41.7	68.6	70.2	78.3	78.3	126.9	140.4
D	Cost of Intervention (Rs M)	42.3	55.1	55.8	23.9	23.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E	Incremental Cash Flow (Rs. M)	-42.3	-55.1	-55.8	-11.6	3.0	41.7	68.6	70.2	78.3	78.3	126.9	140.4

Table 2: ICID Environmental Checklist for the Proposed Intervention

For each environmental effect place a cross (X) in one of the columns		Positive or very likely	Positive impact possible	No impact likely	Negative impact possible	Negative impact very likely	No judgment possible at present	Comments
Hydrology	1.1 Low flow regime	X						
	1.2 Flood regime			X				
	1.3 Operation of dams						X	
	1.4 Fall of water table	X						
	1.5 Rise of water table			X				
Pollution	2.1 Solute dispersion			X				
	2.2 Toxic substances			X				
	2.3 Organic pollution			X				
	2.4 Anaerobic effects			X				
	2.5 Gas emissions						X	
Soils	3.1 Soil salinity	X						
	3.2 Soil properties	X						
	3.3 Saline groundwater	X						
	3.4 Saline drainage	X						
	3.5 Saline intrusion			X				
Sediments	4.1 Local erosion			X				
	4.2 Hinterland effects			X				
	4.3 River morphology						X	
	4.4 Channel regime			X				
	4.5 Sedimentation			X				
	4.6 Estuary erosion						X	
Ecology	5.1 Project lands	X						
	5.2 Water bodies	X						
	5.3 Surrounding area	X						
	5.4 Valleys and shores						X	
	5.5 Wetlands and plains	X						
	5.6 Rare species	X						
	5.7 Animal migration			X				
	5.8 Natural Industry	X						
Socio-economic	6.1 Population change	X						
	6.2 Income and amenity	X						
	6.3 Human migration			X				
	6.4 Resettlement			X				
	6.5 Women's role	X						

For each environmental effect place a cross (X) in one of the columns		Positive or very likely	Positive impact possible	No impact likely	Negative impact possible	Negative impact very likely	No judgment possible at present	Comments
	6.6 Minority groups	X						
	6.7 Sites of value	X						
	6.8 Regional effects	X						
	6.9 User involvement	X						
	6.10 Recreation			X				
Health	7.1 Water and sanitation			X				
	7.2 Habitation			X				
	7.3 Health services			X				
	7.4 Nutrition		X					
	7.5 Relocation effect			X				
	7.6 Disease ecology			X				
	7.7 Disease hosts			X				
	7.8 Disease control			X				
	7.9 Other hazards			X				
Imbalances	8.1 Pests and weeds			X				
	8.2 Animal diseases			X				
	8.3 Aquatic weeds		X					
	8.4 Structural damage			X				
	8.5 Animal imbalances			X				
Number of crosses								

Concluding Remarks: Trees are the important component of the environment. The proposed intervention will help utilize the drainage effluent together with irrigation water for growing forests in conjunctive or cyclic forms. A number of tree species utilize saline water for their growth and development and also take up salinity of the water or soil thus reducing the overall salinity of the area. The water of the surface drains is moderately saline and is not hazardous to growing trees. This intervention provides an alternate use of drainage water and also makes the unproductive as productive by growing trees.