Government of Assam

Assam Rural Infrastructure and Agricultural Service Project Society

F984

Volume 1

Assam Agriculture Competitiveness Project (World Bank Funded)

FINAL REPORT

Impact Assessment Report

EA Associates South Asia Pvt. Ltd.

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1. Introduction

- Demand driven research activities and improvement of linkage between research and extension.
- Capacity building of farmers, FMCs and the department of agriculture to ensure more effective extension network.

Irrigation

- Expansion of the area under irrigation through exploring ground water potential by installation of more shallow tubewells (STWs), tapping surface water in those areas where STWs are not feasible; and rehabilitation of deep tubewells (DTWs), and river-pumping stations (RPS).
- Watershed management schemes for areas where other irrigation facilities like STW/ DTW/RPS are not feasible due to low ground water table or other reasons.
- Community mobilization,
- Capacity building of water user associations (WUAs) and the departments.

Animal Husbandry and Veterinary Sector

- Livestock development through artificial insemination (AI), focus on animal health extension.
- Promotion of dairy, poultry including duckery and piggery activities with participation of woman in the rural arrears.
- Strengthening of veterinary dispensaries/hospitals through out the state by rehabilitating the infrastructure facilities & equipments.
- Strengthening central diagnostic laboratory to cater to all the requirement of the state.
- Strategy for utilizing the service of the in terns of the veterinary college in rural veterinary dispensaries/hospitals.
- Marketing of diary, poultry produce.
- Capacity building of farmers, beneficiaries and the department.
- Introduction of decentralized, demand-driven extension system using Agricultural Technology Management Agency (ATMA) model in the line of ongoing National Agricultural Technology Project (NATP) to improve the agricultural extension system and coordination among Agriculture, Fisheries, Dairy Development and A H & Veterinary Departments.

Fisheries Sector

- Increase in the coverage of community tank and farmers' pond under fisheries development programme.
- Development of beels (open water fisheries) and their professional management.
- Improving beel leasing mechanism- recovery of investments.
- Promotion of private seed growers for development of formulated fish seed, quality fish seed, eco-friendly prawn culture, development of ornamental/ exotic fish, promote indigenous fishes like *magur, singhi, kaoi, Sal, Soal* etc.
- Development of marketing network for the above.
- Capacity building of farmers, beneficiaries and the departments.

Rural Roads

- Road construction -black topped, gravel roads.
- Construction of bridges, pipe culverts, pre- fabricated box culverts, vented causeways.
- Strengthening of the road research laboratory.
- Provision for supporting services like vehicles, consultancy, roads equipment and training.
- Maintenance of roads and road construction equipment procured during ARIASP.

Forestry

- Capacity building of the officials of the Department of Environment to act as facilitator enable more effective service delivery of integrated JFM/rural development programs in forest fringe communities
- Transform current micro-planning into a broader and more integrated rural livelihoods approach, to help communities find solutions to their own development needs.
- Provide access markets for various forest and non-forest products (such as cane, bamboo, medicinal plants, aromatic oils, and fruits).
- Implementation of sustainable forest-based livelihood activities identified in the micro-plan for pilot communities

1.3 STUDY OBJECTIVES

The interventions proposed in the project are expected to have "low environmental impacts" and no interventions are being suggested in protected areas as forests or areas designated as hotspots in the Biodiversity action plan for Assam. Though the magnitude of impacts is expected to be low, there is a likelihood of the cumulative impacts of these sub-projects to be significant. In the absence of any specific guidance on management of environmental impacts due to these interventions, the ARIASP society has initiated the preparation of the Environmental Management Framework to streamline environmental considerations in project planning, design and implementation. The Framework shall help the PIU and the implementing agencies enhance the assessment and management of environmental issues due to the AACP. The specific objectives of the study are to:

- To assess the positive and negative environmental impacts (direct, indirect, induced and cumulative) of each of the proposed project interventions.
- To recommend how the preparation (planning and design), implementation and supervision arrangement might be enhanced, and how any identified environmental risk might be mitigated including recommending capacity augmentation within the PIU and the implementing department to manage the environmental issues adequately.

1.4 STUDY OUTPUTS AND DELIVERABLES

The study output will be a framework for management of environmental impacts, supplemented by the preparation of Environmental Code of Practice (ECP) and Specimen Environmental Management Plans (EMPs) for sub-projects of AACP during the preparation, implementation and operation phases.

This Environment Assessment Report presents the outputs of:

- Review of the similar studies implemented internationally and nationally.
- Analysis of the secondary data on the state profile and status of the agriculture and allied sectors.
- Review of study on the safe yield of ground water and fertilizer consumption.
- Observations of the Consultants from the site visits
- Outcomes of the Consultations with beneficiaries
- Consultations with line Departments (Department of Agriculture, Department of Fisheries, Department of Animal Husbandry and Vertinary, Department of Dairy Development, Public Work Department (PWD))

- Consultation with research institutes namely NERIWALM, Assam Agricultural University, Jorhat.

1.5 EA METHODOLOGY

Literature Review

Review of available literature as well as the studies carried out by ARIASP for assessment of safe yield of groundwater and fertilizer consumption in four districts of the state.

Visits to the sub-projects and consultations

- To identify environmental impacts for the proposed interventions site visits has been conducted to the six districts[1] namely Barpeta District (Lower Bhramaputra Valley), Darrang District (Karbi Anglong Plateau), Jorhat (Upper Bhramaputra Valley) and Cachar (Barak Valley), and Golaghat and Naogaon. There were selected such that observations from visits would be representative of all regions in the state and were finalized in consultation with the Project implementation Unit (PIU) and the line departments.

- The site visits includes
  - Field visits, wherein consultations with the line agency officials at the site, beneficiaries and community.
  - Meeting with the Deputy Commissioners of the districts and the district heads of the line agencies involved in ARIASP, including District Agricultural Officer, District Fisheries Development officer, District Animal Husbandry officer and Representatives from Irrigation department.
  - Detailed discussions with officials of each of the line agencies on the environmental issues pertaining to the sector, and identification of sample interventions to be visited.

In addition, interactions with institutes/NGOs/FMCs with prior implementation experiences provided inputs to enhance our understanding of the likely environmental issues. The summary of the consultations with various stakeholders is presented as an Annexure 1.1. The lists of stakeholders consulted are presented in Box 1.1.

Box 1-1: Stakeholders Consulted

Directorate at State Level: Directorate of Agriculture, Directorate of Irrigation, Directorate of Animal Husbandry and Veterinary, Directorate of Dairy Development, and Directorate of Fisheries, Assam State Pollution Control Board, GWSSB,

Institutes at State Level: Institutes of Veterinary biological, Central Diagnostic laboratory, Frozen Semen Centre, College of Veterinary Sciences, Assam Science Society, College of Fisheries, Raha, Assam Agriculture University, Jorhat, North Eastern Regional institute of Land and Water Management, TezpurTezpur

District Level: District Agriculture Office, District Irrigation Office, District Animal Husbandry and Veterinary office, District Fishery Development Office and District Dairy Development Office.

1 Based on the review of environmental setting, the state has been divided into four regions namely i) Lower Brahamaputra valley ii) Upper Brahamaputra Valley, iii) Karbi Anglong Plateau, and iv) Barak Valley. Accordingly Barpeta District in lower Bhramaputra Valley, Darrang District in Karbi Anlong Plateau, Jorhat in Upper Bhramaputra Valley and Cachar in Barak Valley has been selected to review the environmental implications of interventions of ARIASP. In order to have a representative sampling of all interventions in each region additional districts, were selected in consultation with PMU and Line Departments. As in the case of Upper Brahmaputra valley where apart from the Jorhat district, the Golahat District was be visited to assess the impacts on fisheries sector. In addition to these sample districts, consultations with fish seed producers were conducted in the District of Nagaon.

The checklist for site visits has been presented in Annexure 1.2.

In addition to the site visits, we propose to conduct an assessment of the bio-diversity of six beels in different regions and having different anthropogenic aspects detailed later in the report. Towards additional information on biodiversity in beels we propose to draw in information gathered in the Inland Wetland Project funded by UNDP[2] wherein biodiversity assessment of 52 beels have been carried out.

Capacity Assessment of Implementing Agencies

An assessment of the capacity of implementing agencies with emphasis on management of environmental concerns in project planning and implementation has been carried out. In addition, the curriculum of training programs would be reviewed to evaluate the extent to which environmental concerns are addressed, and possible areas of improvement suggested.

Identification of Impacts

The risk associated with the interventions has been assessed based on experiences from site visits, consultations and review of secondary information.

In addition to consultations with different stakeholders and site visits primary survey of milk and vegetable samples were conducted to assess presence of pesticide residue and arsenic and iron. In this regard 10 samples of milk and 5 different locally produced vegetables were tested.

1.6 REPORT STRUCTURE

The Report, besides this first Chapter includes the following chapters:

Chapter 2: Environment Setting

Chapter3: Policy, Legal and Institutional Framework – Environmental Management

Chapter 4: Proposed Interventions & Environmental Implications

Chapter 5: Wetland Bio-diversity and its Issues

[2] Carried out by Salim Ali Centre for Ornithology, Coimbatore.

2. Environment Setting

2. Environment Setting

This chapter presents the existing baseline environmental status of the state. The current status of various environmental components was reviewed to predict the impacts that the project is likely to have on each environmental component.

2.1 STATE PROFILE

Assam known as Pragjyotishpura (Land of eastern lights) in ancient times, and Kamrupa in medieval times, that lies between 89.5^0 to 96.1^0 East longitude and 24.3^0 to 28.0^0 North latitude Assam is the second largest State in the northeastern region that spread over an area of 78,438 square kilometers. Seven Indian states and two foreign countries, Bhutan and Bangladesh, characterized by highlands and plateaus on three sides except the western one where the Brahmaputra Valley merges with the Gangetic Plain, surround the state.

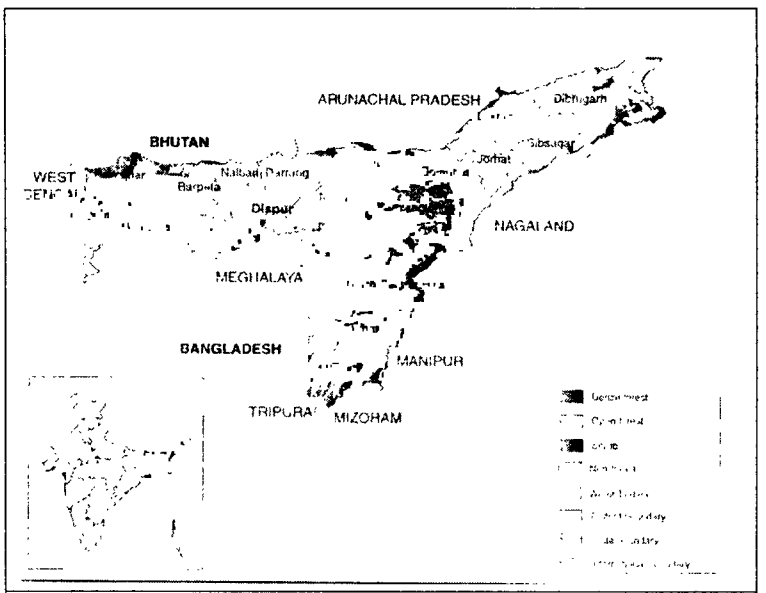


Figure 2-1: Geographical Map of Assam

As per the Census Report of 2001, Assam has a total population of 26,638,407. It constitutes 2.59 percent of the total population of India and 68.24 per cent of the entire North East and has a density of 340 persons per square kilometer. The literacy rate of Assam is 64.28 and it holds the 24th position among the Indian States. Assam ranks 26th in human resource development index and 21st in poverty index in India as per the Human Development Report 2001.

The economy of Assam is overwhelmingly agricultural. According to the provisional population total of Census 2001, 52.65 per cent of the total workforce in the state (58.40 per cent in India) is engaged in agricultural and allied activities. The per capita income of the state, at constant prices (1993-94) stands at Rs 6157 and at current prices, Rs 10198 in 2000-2001 (Quick Estimates).

2.2 CLIMATE

The climate of Assam is tropical with maximum temperature ranging between 30°C and 35°C between July and September and the minimum winter temperature varying between 8°C and 10°C between November and March. Sunshine hours of the state vary from 13 hours in the

summer season to 8 hours in the winter season. The humidity in the state of Assam is very high ranging from 70 to 85 percent.

Assam experiences very high rainfall between June and September by southwest monsoon. During the non-monsoon season also convective rainfall with thunderstorm mostly during the months of March to May and sporadic during the months of October to February occurs.

The annual rainfall varies from 130 to 390 cm with minimum on the western side (Rangia) and maximum in the northeastern side (Lakhimpur). The southern part of the Nagaon district is a rain shadow area experiencing low annual rainfall of 52 to 140 cm. On an average sixty five percent of the total annual rainfall in Assam occurs in monsoon season and remaining 35 percent occurs in the non-monsoon season. The humidity in the state of Assam is very high ranging from 70 to 85 percent.

The study carried out by NERIWALM reveals that the western region of the state, covering Goalpara, Dhubri, Barpeta and Kamrup districts, have a probability of occurrence of good rainfall after one drought year varies from 13 – 17% and probability of occurrence of good rainfall after two, three or four successive drought years varies from 3-7% wheas in easternpart of the state it varies between 13-26% and 3-10% respectively

In Darrang, Sonitpur, Nagaon and Golaghat districts; probability of occurrence of good rainfall after one drought year varies from 7-13% and probability of occurrence of good rainfall after two or three successive drought years varies from 3-7%.

The districts of Cachar, Hailakandi and Karimganj located in Barak valley received good rainfall during both monsoon and non-monsoon rainfall, probability of occurrence of good rainfall after one year having below average monsoon rainfall is 20% and good rainfall after two consecutive drought years it is 3%.

The state is divided into three broad geographic units:

The lower and central Assam hills, known as the Shillong Plateau

The lower and central Assam range which includes, from west to east, the Garo, Khasi, Jaintia and the outlying Mikir hills are in reality a plateau or table-land. The general height of the plateau ranges between 3,000ft and 6,000ft. The Khasi and Jaintai hill portion of the plateau are comparatively higher and flatter than the Garo and Mikir hills on the west and northeast. The highest peak of the plateau is the Shillong peak (6450 ft).

The Barail ranges and the low hilly terrains of Mizo hills

The Barail ranges, also known as the North Cachar hills, are separated from the Shillong plateau on the Northwest by a system of narrow valleys. Tectonically, the Barails form a southwesterly extension of the mountain chain of Nagaland and western Burma. It is this chain of mountain that separates the valley of Irrawaddy and Chindwin of Burma from the valley of Brahmaputra and the Meghna. The Patkai, Naga and Manipur hills and the Mizo hills, form part of this great mountain system. The Mizo hills consist of a belt of North-South trending ridges with intricate valleys, with an average height of 3,000ft.

The Alluvial valley of Brahmaputra, Dhansiri and the Barak River

The alluvial plains of Assam consist of two distinct parts:

(a) The valley of the Brahmaputra and its tributaries and (b) The Barak Valley.

The watershed of the Shillong plateau and the Barail ranges separates both these valleys from each other.

The **Brahmaputra valley** separates the sub-himalayan foothills from the Shilong plateau and the Patakai-Naga hill ranges. The almond shaped valley is built mostly by the aggregation work of the Brahmaputra and its tributaries. Most of the prominent towns and cities are situated in this valley whose length and breadth are 725 kms and 80 -100 respectively.

The second natural division of Assam is the **Barak Valley,** which is surrounded by North Cachar, Manipur and Mizoram. The valley is dominated by the Barak River that flows through the valley and finally empties in the old bed of Brahmaputra in Bangladesh.

2.3 SOIL

Assam's soil been classified into the following three types –

Forest and hilly lateritic soil: deep reddish in colour, developed over the geological formations belonging to Archaean, Precambrian and Upper Tertiary age. The soil is characterized by low nitrogen, low phosphate and medium to high potash and pH is acidic. A small part of Cachar, large areas of Khasi and Jaintia hills, part of Sibsagar and Naogoan are covered by lateritic soil.

Low level terrace, red and yellow soil, formed due to laterisation process of Upper Pleistocene fluvial sediments under favourable climatic conditions. Soil pH is acidic due to intensive leaching of bases and formation of clay minerals and ferric hydroxides.The entire Mizo hills, part of Cachar, Garo, Khasi-Jaintia hills and Sibsagar are capped by this type of soil.

Alluvial plain soil, light grey to dark grey of recent age occurring along the major river valleys. The entire Lakhimpur, Darrang, Kamrup, Goalpara, part of Garo hills and Sibsagar are made up of alluvial soil cover.

2.4 GEOLOGY AND GEOMORPHOLOGY

Geologically the region is diverse in structure and age from Archaean /Precambrian to Tertiary origin. Large formations of different types for rocks are present in the region. The rock formations of the region also contains deposits of many minerals, especially coal, petroleum, limestone, clay, uranium, etc. The region is also full of structural features like folds, faults, lineaments, thrusts, etc. The geological succession of Assam comprise of rocks belonging to the Archaean, Precambrian, Tertiary and Quaternary ages The Archaean and Precambrian rocks present in hills from the Shillong Plateau into Assam, northern and Central parts of Karbi Anglong. The lower Tertiary shelf of the Jaintia group extends along the southern flanks of the Karbi Hills. The Upper tertiary shelf covers the southern flanks of Karbi Hills, the North Cachar Hills and the hills of the Naga Patkai range bordering the southern margins of Golaghat, Jorhat, Sibsagar, Dibrugarh and Tinsukia Districts. A rare narrow fringe of unclassified Siwaliks occurs along the southern foothills of the eastern Himalayas facing the northern border of Assam. The

Quaternary sediments from the older and newer alluviums comprising high level terraces, the red bank soil and the recent alluvial deposits of the Brahmaputra and Surma valleys.

Hydro-geologically, the geological formations in the Brahmaputra valley of the state can be divided into three distinct groups:

Bhabhar Belt: The higher part of the complex alluvial fans of the snow fed streams originating from Himalayas. This belt is called the 'Bhabhar belt' and is about 11 to 15 km wide on the northern part of the state along the foothills of Himalayas.

Terrai Zone: Exists immediately down slope of the Bhabar belt and is made up of lower parts of the alluvial fans and low terraces of permeable water bearing gravel and sand intercalated with silt and silty clay.

Flood plain: Areas constitute major part of Brahmaputra valley. The aquifers range from admixtures of sand, silt, clay and gravel. In general 50% of the aquifer material comprises medium to coarse sand. Ground water occurs both under confined and unconfined conditions.

2.5 DRAINAGE BASIN

Assam is endowed with extensive river system consisting of the Brahmaputra, the Kusiyara and the Barak and their tributaries. The Brahmaputra River is one of the largest rivers of the world. The total length of river Brahmaputra from its origin in Tibet to its outfall in the Bay of Bengal is about 2880 km. It traverses its first 1625km in Tibet, the next 918km in India and the rest in Bangladesh. River Brahmaputra is joined by 40 tributaries on its north bank and 20 on its south bank. All the north bank tributaries originate in the sub - Himalayan ranges except Subansiri, Jiabharali and Manas, which are Trans Himalayan. The Subansiri, the Badeng- Pubnai, the Kameng- Jiabharali, the Dhansiri, the Manas and the Champamati are some of the important rivers on the north bank that are known as sub-basins. On the south bank, the Dholai, the Burhi Dihing, the Disang, the Dhansiri, the Kopili -Kalang and the Kulsi- Jinjiram rivers from separate sub- basins. These southern tributaries out crop from Khasi Hills and are generally not perennial nature. Most of these rivers maintain meager base flow during dry winter months.

Due to heavy rainfall in the Himalayan and other watersheds of the eastern India region, all the rivers in Assam are liable to floods, mainly because they receive heavy rainfall within a short time. Since these rivers are in their early stage of maturity and are very active agents of erosion, they collect tremendous amount of silt and other debris and raise the level of the riverbeds that make it difficult to cope with the vast volume of water received during the rains.

2.6 GROUND WATER

The potential of ground water resources in entire Brahmaputra valley, covering more than 70% of the total area of the state, contains prolific aquifer system. The water table in the Barak valley of Cachar district are influenced by the physiography, therefore in the synclinal valleys of Silchar, Hailakandi and Karimganj the movement of ground water is to the north towards the Barak River, but the master slope of ground water is to the west. The Barak River and its tributaries is all effluent in nature and their base flow during the lean period is almost entirely due to the ground water discharge.

Ground water development in the state generally takes place from two types of zones viz. Shallow zone within the depth of 50m and deeper zone from 50 to 200m. The areas adjoining

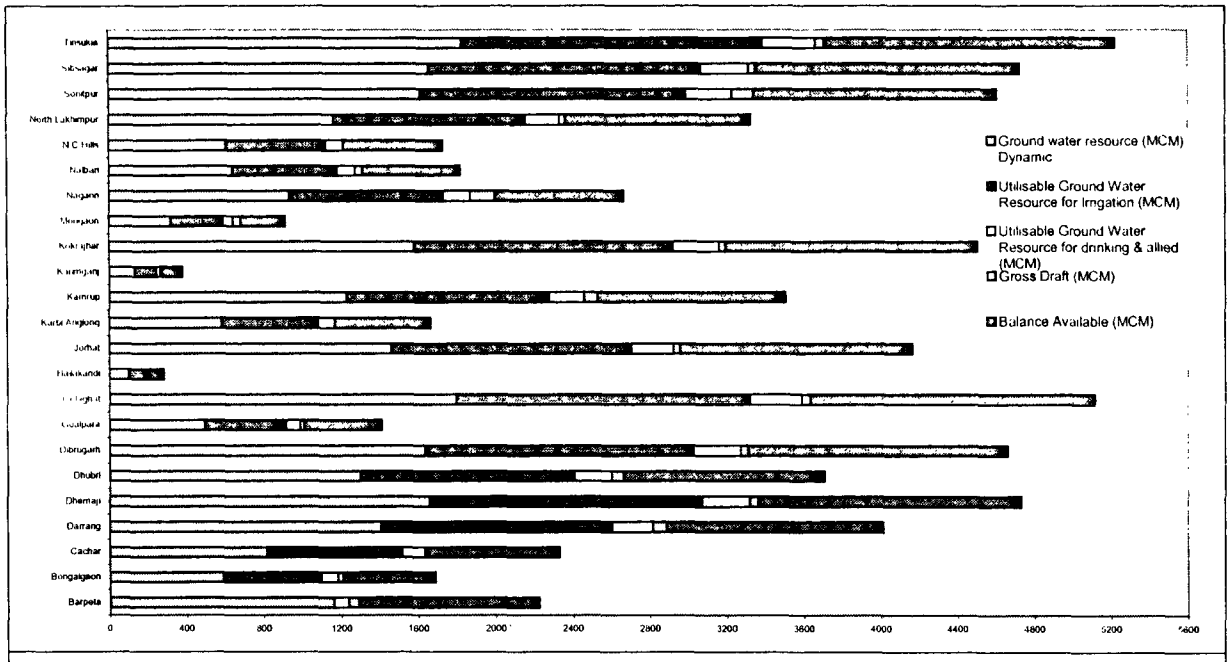
the Shillong plateau and Mikir hills, particularly in Kamrup, Goalpara, Nagaon and Darrang districts the alluvial aquifers are moderately thick and discontinuous. The yield prospects of aquifers in this zone are fairly high and vary from 50 to 100 m^3/ hr for draw downs up to 9m. The water level in the hilly central Assam areas range from 0.22 to 7.45 m. Extraction of ground water in the hard rock areas is mainly through large diameter open wells. The yield prospects of such open wells are generally 5 to 10 m^3/ hr. The prospects of ground waters in the North Cachar Hills are very limited and confined to small narrow intermountain valleys.

In Cachar, Hailakandi and Karimganj districts, ground water occur under both confined and unconfined conditions. The depth to water table varies from 1.00 to 4.5 m bgl. The water level in these area ranges from 0.55 to 3.0. The bore-well constructed at Hailakandi encountered only 34 m of saturated granular zone and yielded 36m3/ hr for draw down upto 15 m. Figure 2.2 represent the ground water distribution in the state of Assam.

Ground Water Quality

The quality of irrigation water depends on number of individual hydrological, physical, chemical, geological and biological factors. The parameters like pH, electrical conductivity, TSS, Dissolved Oxygen, temperature, etc are of special importance and deserve frequent attention and observation.

The problem of contamination through heavy metals such as iron, arsenic, cadmium, copper, nickel, zinc and selenium in water bodies / ground water is the most dangerous. The excess fluoride and hydrocarbons is also harmful for the plants and deteriorate the soil quality. Groundwater contamination with iron and fluoride in some area of Assam has already been reported and arsenic and hydrocarbon is also being suspected to be present in the aquifer. These alarming pictures of the water quality in the region and continuous consumption of this water for irrigation as well as drinking purpose has the potential of posing a health hazard to the local population. The ground water quality analysis highlights presence of (i) Cations viz. calcium, magnesium - the alkaline earth metals and sodium, potassium - the alkali metals (The concentration of magnesium, sodium and potassium detected is low) (ii) Anions viz. Sulphate, chloride, bicarbonate and carbonate. Among anions, sulphate is generally very low while the concentration of calcium bicarbonate is high with low mineralisation.



MCM: Million cubic metre

Source: Central Ground Water Board, Report-1981

Figure 2-2: Ground Water Distribution In Assam

2.7 AGRICULTURE[3]

The state has a total cropped area of about 39.26 lakhs hectare and is producing about 35 lakh MT per annum of food grain against the requirement of 40 lakh MT per annum. The percentage contributions of food grains are: (i) Rice 93 % (ii) Pulse 2% (iii) Wheat 1% and (iv) Maize and others 4%. Most of the area of the state suffers from irrigation water scarcity during Rabi and summer season. Hence, optimal crop planning helped to increase the area under pulses, vegetables and oilseed crops because they require relatively less water and good in production efficiency. Cultivation of rabi vegetables is found to be both highly remunerative as well as production efficient. In the process of optimal crop planning, irrigation water is essential and should be made available for life saving irrigation in rabi and summer season.

2.8 BIO-DIVERSITY

The vegetation of Assam is of tropical type covering areas of evergreen, semi-evergreen, deciduous forests and grasslands. The state of Assam have about 3017 species of flowering plants include variety of medicinal plants including rare, endangered and endemic species and about 192 species of orchids that are distributed in plains and hilly areas.

The sate of Assam represents the transitional zone between the Indian, Indo-Malayan and Indo-Chinese bio-geographical regions. It is the area in the whole of the South Asia with extremely rich forests serving as a habitat of a variety of primate, carnivore, herbivore and birds. There are about 193 species of mammals and more than 958 species and subspecies of birds throughout the state. And also there exists 16 numbers of wildlife areas that serves' house for 44 types of endangered and rare species of mammals and 14 types of reptiles and amphibia.

[3] Study on Safe Yeild of Ground Water,NERIWALAM.

There are 14 species of primates in Assam, which constitute 1/6th of the total primate species of the world. There are as many as 19 cat families observed in the state. Assam holds the entire known world population of Pigmy hog, 75% of the world population of the Indian rhinoceros and Wild water buffalo and a sizable population of Asian elephants and tigers. Annexure 2-1 details out the sensitive areas in the state of Assam.

2.9 FOREST ECOSYSTEM

The vegetation cover map of Assam prepared on the basis of satellite imageries shows that the forest area in Assam, inclusive of grassland, is only 25.01 percent (19,633 sq km) of the total geographical area and excluding grassland is only 21.99 percent (17264 sq km). Figure 2.3 shows the composition of different classes of forests in the state. List of National Parks and sanctuaries are presented in Annexure 2.2

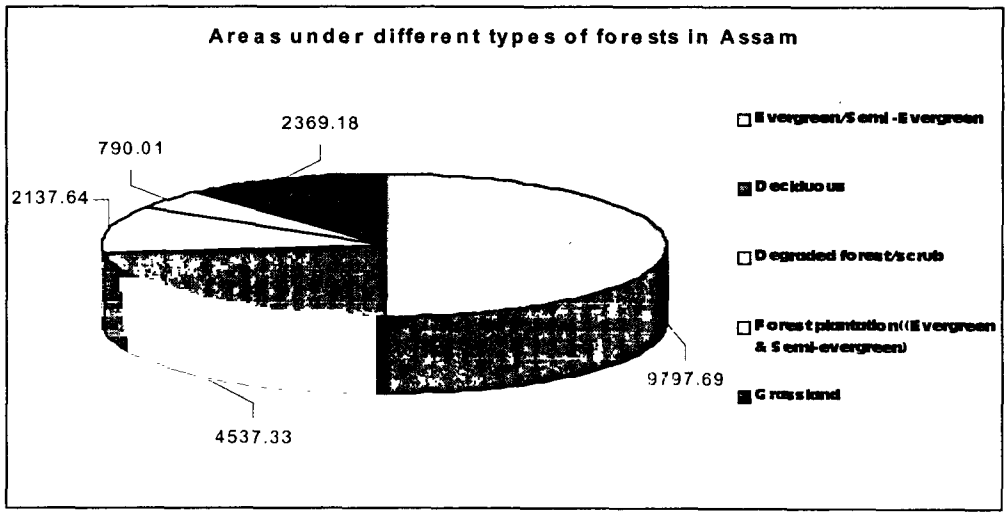


Figure 2-3: Composition of different classes of forests in the state

2.10 PLANT DIVERSITY

Medicinal Plant

There are over 1500 species of medicinal plants reported so far from India and more than 350 species from Assam. They not only cure ailments but can also be a potential source of economic development. Annexure 2.3 presents list of medicinal plants and rare and endangered plant species in the state of Assam

Orchids

Orchids are one of the largest groups of Angiosperms belonging to the family Orchidaceae. The state of Assam harbours 193 species out of which as many as 26 spices are under threat due to Destruction of habitats, over exploitation, construction of new roads and buildings, agriculture expansion, jhum cultivation and other developmental activities. There is an urgent need to conserve these attractive blooms of orchids in various colours and shapes through situ and ex situ conservation for future generation.

2.11 WET LANDS

Assam has only inland wetlands, which include natural or man- made. Among the natural wetlands found in Assam are lakes/ponds, ox-bow lakes/cut-off meanders, waterlogged (seasonal) and swampy/marshy areas. The tanks and reservoirs are included under man-made wetlands. There are 3513 wetlands covering an area of 101231.60 ha in Assam during pre-monsoon season, which constitutes 1.29% of the total geographical area of the state. Swamp/marsh are 712 in number covering an area of 43433.50 ha followed by waterlogged (seasonal) are 1125 in number covering an area 23431.50 ha. The ox-bow lakes/cut-off meanders also constitute the wetlands, which are 861 covering 15460.60 ha. Turbidity wise, there are 2877 wetlands, which have low turbidity, 346 wetlands having moderate turbidity while 178 wetlands have a very high turbidity. High turbidity is more often found in water logged and swampy or marshy areas while low turbidity is seen in waterlogged as well as lakes/ponds. Among natural and man-made wetlands, turbidity is high in most of the natural wetlands. A total of 1367 inland wastelands suffer due to the problem of invasion by aquatic weeds and need ameliorative steps for conservation. Out of this, 656 are swampy/marshy areas, 366 ox-bow lakes/cut-off meanders, 193 lakes/ponds, 133 waterlogged, 13 tanks and 6 reservoirs. Table 2.1 represents details of wetland in Assam. Figure 2.4 gives districtwise distribution of wetland in the state of Assam.

Table 2-1: Details Of Wetland In The State Of Assam

Wetland type	No.	Area (ha)	Percent
Natural			
Lake/Pond	690	15494	15.3
Ox-bow Lake/ cut-off meander	861	15460.6	15.27
Waterlogged (Seasonal)	1125	23431.5	23.15
Swamp/marsh	712	43433.5	42.91
Total	3388	97819.6	96.66
Man-made			
Reservoirs	10	2662.5	2.6
Tanks	115	749.5	0.74
Total	125	3412	3.34
Grand Total	3513	101232	100

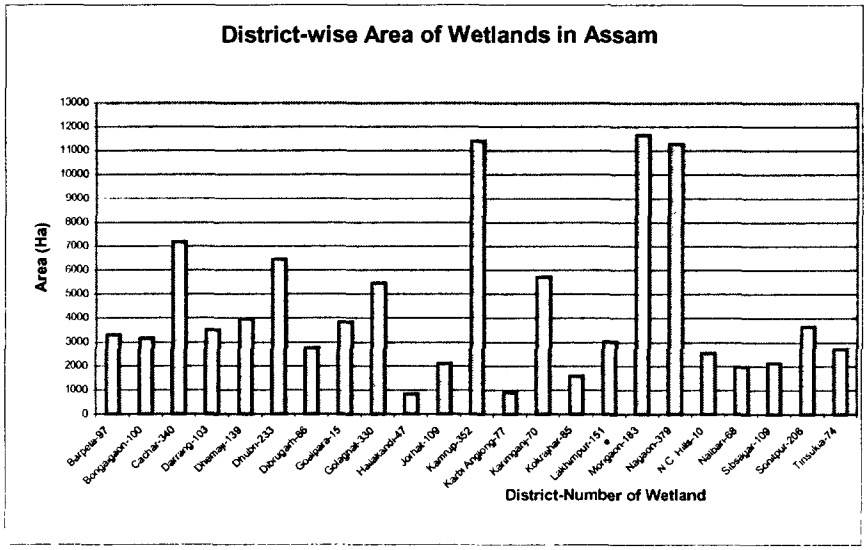


Figure 2-4: Districtwise distribution of wetland in the state of Assam

3. Policy, Legal & Institutional Framework-Environmental Management

3. Policy, Legal & Institutional Framework – Environmental Management

This chapter reviews the policies and the Environment legislations at the National and State level to understand the legal requirements and implications of the project interventions. Further, a review of the safeguard policies of the World Bank and its relevance to the project has been presented.

3.1 LEGAL FRAMEWORK

A review of the legislations of Government of India (GoI) and Government of Assam pertaining to environmental management in the light of the AACP interventions has been carried out. The applicability of these legislations to the project is presented in the following sections.

Environment (Protection) Act 1986

The Environment (Protection) Act, 1986 has been enacted to provide for the protection and improvement of environment by preparation of manuals, codes or guides relating to prevention, control and abatement of environment pollution.

The Act further makes it mandatory that discharges from any industry or operation are not in excess of the standards and hazardous substances handling comply with the procedural safeguards.

Environment Impact Assessment (EIA) notification 1994

The EIA notification 1994 provides criteria and procedures for imposing restriction and prohibition on expansion and modernisation of any activity or new projects being undertaken in any part of the country. Any activity included in schedule–I shall require environmental clearance from Ministry of Environment and Forest.

Relevance to AACP: Agriculture and allied activities per se have not been incorporated under the ambit of the Act.

Water (Prevention and Control of Pollution) Act 1974, amended in 1988

The Water (Prevention and Control of Pollution) Act 1974 has been enacted to implement measures devised for effective prevention and control of water pollution. It empowers the state pollution control board to prepare manuals, codes or guides relating to treatment and disposal of sewage and trade effluents and information dissemination for maintaining or restoring wholesomeness of water.

Relevance to AACP: Project includes setting up of Dairy processing & chilling Plant, which have the potential to generate effluents. Consent to establish and operate shall be required from the State Pollution Control Board for the discharge of effluents.

Air (Prevention and Control of Pollution) Act 1981

The Air (Prevention and Control of Pollution) Act 1981 has been enacted to implement measures devised for its effective prevention, control or abatement of air pollution. It empowers the statutory body to prepare manuals, codes or guides relating to prevention, control or abatement of air pollution.

Relevance to AACP: Project includes setting up of processing plant including boiler for Dairy industry and setting up of hot-mix plant, crushers and construction camp site for road construction.. Consent to establish and operate shall be required from the State Pollution Control Board for the discharge of emissions.

The Assam Irrigation Act, 1983

The Assam Irrigation act 1983 provides for the application of water and regulation of the use, supply and storage of water for purposes of irrigation.

Relevance to AACP: Project emphasizes on crop diversification and intensification to increase the crop production and variation in crops. The act empowers the state government to regulate the crops to be grown within the cultural command area of any irrigation work.

Forest Conservation Act 1980

The Forest (Conservation) Act 1980 (as amended 1998) pertains to the cases of diversion of forest area and felling of roadside plantation.

Relevance to AACP: Project does not have any intervention, which involves the forestland for the development. Therefore forest conservation act does not apply to the project. However in case of rural road component, restrictions and clearance procedure proposed in the Forest (Conservation) Act applies to roads requiring diversion of natural forest areas, even in case the protected/designated forest areas that does not have any vegetation cover.

Biological Diversity Act 2002

The Biological Diversity Act 2002 was enacted as a follow up to the UN convention on biological diversity signed at Rio de Janeiro, which reaffirms the sovereign right of the states over their biological resources. The act provides for conservation of biological diversity, sustainable use of its components and fair and equitable sharing of the benefits arising out of the use of biological resources, knowledge and for matters related to biodiversity.

Relevance to AACP: Project includes development of beels/wetlands for commercialization of fishery. The project interventions in these beels shall be required to be worked out with due cognizance of the biological diversity in these beels.

Bio-Medical Waste (Management and Handling) Rules, 1998

The Bio-Medical Waste (Management and Handling) Rules, 1998 applies to all waste generated during treatment or immunization of human beings or animals and production or testing of organism or microorganisms. The rules envisage treatment of human anatomical waste, animal waste, microbiology and biotechnology wastes, waste sharps, discarded medicines and cytotoxic drugs, soiled wastes, solid waste, liquid wastes, incineration ash and chemical waste. The rule also provides for the category wise procedures for segregation, packaging, transportation, storage, treatment and disposal of waste.

Relevance to AACP: Project includes setting up and strengthening of Artificial Insemination Centres, Veterinary Hospitals, Vaccine production centres and meat processing and production centres. The generation, collection, storing, transportation, treatment and disposal of different categories of wastes (as specified in Schedule I), would be governed by the above act.

Municipal Solid Wastes (Management and Handling) Rules, 2000

The Municipal Solid Wastes (Management and Handling) Rules, 2000 provides for procedures for collection, segregation, storage, transportation, processing and disposal of municipal solid waste.

Relevance to AACP: Project includes setting up and strengthening of Marketing and storage infrastructure. The waste generated from these activities shall be collected, stored, transported and disposed off as per the guidelines of aforesaid rule.

The Assam Private Fisheries Protection Act 1935

The Assam Private Fisheries Protection Act 1935 has been enacted to encourage taking up of piscicultural activities by private farmers and also help in increasing government revenue.

Relevance to AACP: Project emphasizes on the fish production in community tank and farmers pond through culture fishery. The act empowers the state government to issue licenses and collect rent from fish/seed producers.

The Assam Draft Fishery Rules 2002

The Assam Draft Fishery Rules 2002 has been enacted to regulate and control the capture fisheries for augmentation of natural fish production in the state.

Relevance to AACP: Project emphasizes on the Beels development, which is a natural stocking of the fishes in the enclosed water bodies. The act empowers the state government to enforce restriction on the use of net and fishing during the breeding season and catching and selling of undersized fishes from the natural water channels.

Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)

This international convention to which India is a signatory categories endangered flora and fauna and regulates trade of these species.

Relevance to AACP: The project envisages collection of medicinal plants from wild for commercial extraction. Trade in plant enlisted in the CITES shall be restricted.

The Assam Irrigation Act 1983

The act provides for the application of water and regulation of the use, supply and storage of water for purposes of irrigation.

Relevance to AACP: AACP tends to provide assured irrigation water supply. It envisages establishment of STW, DTW, LLP and RLP for irrigation purposes. Regulation of these activities shall be done by enforcement of these regulations.

Municipal Solid Waste (Management and Handling) Rules, 2002

The provisions of the act prevent littering and mandates proper segregation, collection, storage and disposal of municipal solid waste[4].

Relevance to AACP: Waste generated from processing facilities and special wastes generated from other facilities to be constructed as part of different interventions shall have to be disposed as per the provisions of the laws

Milk and Milk Products Order 1992 S.O. 405 (E) dated 09-06-1992

Under the provision of the act, no person or manufacturer shall set up a new plant or expand the capacity of the existing plant without obtaining registration/permission as the case may be from the concerned Registering Authority.

Relevance to AACP: The provisions of the law will regulate the environmental, hygienic and quality aspects of both milk production and processing intervention envisaged as part of the AACP.

MEAT FOOD PRODUCTS ORDER,1973 Under Essential Commodities Act, 1955 (10 Of 1955)

Under the provisions of this order no person shall carry on business as a manufacturer except under and in accordance with the terms and conditions of a license granted to him under this Order.

Relevance to AACP: The provisions of the law will regulate the environmental, hygienic and quality aspects of meat processing intervention envisaged as part of AACP.

Fertilizer Control Order 1985

The law provides that no person including wholesale and retail dealer shall not carry on business of handling of fertilizers at any place unless being registered.

Relevance to AACP: Intensification of agriculture will increase fertilizer demand. Storage and handling of fertilizers and chemicals thus assumes importance.

Freedom of Information Act, 2002

An Act to provide for freedom to every citizen to secure access to information under the control of public authorities, consistent with public interest, in order to promote openness, transparency and accountability in administration and in relation to matters connected therewith or incidental thereto.

Relevance to AACP: Environment Management Framework and codes of Practice for AACP shall be disseminated and the implementation shall be made transparent.

3.2 APPLICABILITY OF WORLD BANK SAFEGUARD POLICIES

The Banks safeguard policies /directives that would be triggered by the proposed project are detailed in the following section.

[4] **Municipal Solid Waste** includes commercial and residential waste generated in a municipal or notified area in either solid or semi-solid form excluding industrial hazardous waste but including treated biomedical waste

Environment Assessment (OP/BP/GP 4.01)

The key features[5] of OP/BP/GP 4.01 Environmental Assessment are:

- Potential environmental consequences of projects are identified early in project cycle
- Environment Assessments (EAs) and mitigation plans required for projects with significant environmental impacts or involuntary resettlement
- EAs should include analysis of alternative designs and sites, or consideration of "no option"
- requires public participation and information disclosure before Board approval

Relevance to AACP: Though major impacts are not envisaged but the temporal and cumulative impacts are likely to occur as a result of interventions proposed.

Documentation for AACP: Environment Management Framework (EMF), Environment Code of Practice (ECP), Specimen Environment Management Plan (EMP) would be prepared.

Natural Habitats (OP/BP 4.04)

The key features of OP 4.04 Natural Habitats are:

- prohibits financing of projects involving "significant conversion of natural habitats unless there are no feasible alternatives"
- requires environmental cost/ benefit analysis
- requires EA with mitigation measures

Relevance to AACP: No intervention is envisaged inside National Parks, Sanctuaries but there are approximately 3500 wetlands in Assam. Interventions have been planned in some of these wetlands additionally the diversity in these wetland may be impacted due to other activities.

Documentation for AACP: Bio diversity assessment of six wetlands is being undertaken in each of the study regions. A screening framework for bio-diversity assessment would be suggested, and the Codes of Practice developed for the various interventions shall include measures to be taken up for conservation of biodiversity as well as the management measures to minimise any impacts on biodiversity.

Forestry (OP 4.36)

The key features of **OP 4.36 Forestry** are:

- Management, conservation, and sustainable development of forest ecosystems and their associated resources.
- To harness the potential of forests to reduce poverty in a sustainable manner, integrate forests effectively into sustainable economic development.
- Protect the vital local and global environmental services and values of forests

Relevance to AACP: The project envisage implementation on a pilot basis, sustainable forest based livelihood activities in forest-fringed areas. **Documentation for AACP:** Since project is taken up on pilot basis, management plan is not required.

[5] The key features of W B polices has been incorporated from Bank Information Centre website www.bicusa.org

Pest Management (OP 4.09)

The key features of OP 4.09 Pest Management are:

- supports environmentally sound pest management, including integrated pest management, but does not prohibit the use of highly hazardous pesticides.
- pest management is the borrower's responsibility in the context of a project's EA

Relevance to AACP: The intensification and diversification of agriculture is likely to see occurrence of new pests.

Documentation for AACP: An Integrated Pest Management plan is being prepared by the ARIASP society. The ECPs and EMF will include environmental management measures that need to be planned towards addressing impacts on natural environment due to the usage of pesticides.

Projects in Disputed Areas (OP/BP/GP 7.06)

The key features of OP/BP 7.60 Projects in Disputed Areas are:

- applies to projects where there are territorial disputes present
- allows Bank to proceed if governments agree to go forward without prejudice to claims
- requires early identification of territorial disputes and descriptions in all Bank documentation

Relevance to AACP: The project interventions would be limited within the territorial limits of Assam state of India.

Documentation for AACP: Not Applicable

Project in International Waterways (OP/BP/GP 7.50)

The key features of OP/GP/BP 7.50 Projects on International Waterways are:

- covers riparian waterways that form boundary between two or more states, as well as any bay, gulf, strait or channel bordered by two or more states
- applies to dams, irrigation, flood control, navigation, water, sewage and industrial projects
- requires notification, agreement between states, detailed maps, feasibility surveys

Relevance to AACP: No intervention has been planned on the rivers.

Documentation for AACP: Not Applicable

Cultural Property (GP 4.11)

The key features of OP 4.11 Cultural Property are:

- Protection, enhancement and wherever necessary relocation of cultural properties

Relevance to AACP: None of the interventions have been proposed in properties owned by community such as grazing land sacred groves and ponds.

Documentation for AACP: Community properties have been incorporated in list of exclusion areas. Incase of any impact due to road construction, ECP is developed to mitigate impacts on cultural properties.

Safety of Dams (OP 4.37)

The key features of OP 4.37 Safety of Dams are:

- To ensure appropriate measures are taken and sufficient resources provided for the safety of the dam.

Relevance to AACP: No dam is to be constructed or repaired as apart of AACP.

Documentation for AACP: Not Applicable.

3.3 INSTITUTIONAL ARRANGEMENTS

For coordinating the project activities, the ARIASP Society[6] has been formed. The project interventions are planned and implemented by the directorates of the respective departments. The district level officials in association with the Nodal NGOs[7] are responsible for consultations with beneficiaries and implementing the interventions. The directorates involved for implementation of the project are:

- Directorate of Agriculture
- Directorate of Irrigation
- Directorate of Animal Husbandry and Veterinary
- Directorate of Dairy Development
- Directorate of Fisheries
- Public Works Department

The roles and responsibilities of the line departments are presented in Table 3.1. The organisation structures of each of the directorate are presented in Annexure 3.1.

Table 3-1: Role And Responsibilities of Various Institutions In Rural Sector Of Assam

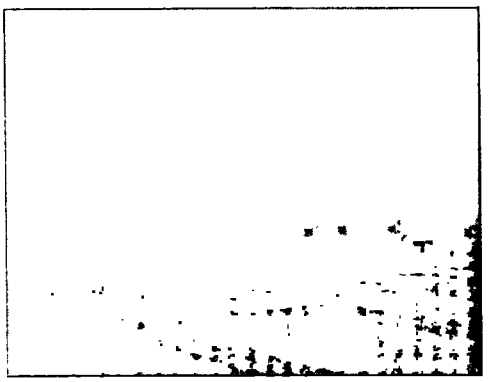
INSTITUTION	FEATURES	FUNCTIONS	GAPS
Directorate of Agriculture	1. Headed by Director 2. Exercise powers related to management of Zonal and District level Agriculture Offices. 3. Act as an advisor to the Secretary agriculture Department and also monitors & controls matter related to financial planning, management and control	1. Supervise the functioning of all the zonal and district level agriculture offices. 2. Disbursement of project funds to Zonal and District level Agriculture offices. 3. District Level information & database management system. 4. Implementation of the Agriculture policy.	1. Environment Responsibilities not entrusted to any officials. 2. Training module does not focus on the Environment Management Practices. 3. Hurdles in project clearance. 4. Lack of Interdepartmental Coordination.
Directorate of Animal Husbandry and Veterinary	1. Headed by Director 2. Exercise powers related to management of District level Veterinary Offices and AI Centres. 3. Act as an advisor to the Secretary Animal Husbandry and Veterinary Department and also monitors & controls matter related to financial planning, management and control.	1. Supervise the functioning of all the district level Veterinary offices and AI centres. 2. Inspection and monitoring of Development works and activities. 3. Mass vaccination /Ring vaccination of susceptible birds and animals. 4. Training of farmers/NGOs/cooperative societies.	1. Environment Responsibilities not entrusted to any officials. 2. Training module does not focus on the Environment Management Practices 3. Lack of Interdepartmental Coordination.

[6] The ARIASP Society is a registered Society of the Government of Assam. It functions as the Project Directorate and coordinates the activities of the project and disburses the financial assistance under the World Bank Project.

[7] The ARIASP Society has appointed a NGO for each of the district as the Nodal NGO to assist the PMU in implementation of the interventions under ARIASP.

INSTITUTION	FEATURES	FUNCTIONS	GAPS
		5. Periodical refresher training to farmers and milk cooperative societies.	
Directorate of Fishery	1. Headed by Director 2. Planning and Implementation of Development Works 3. Act as an advisor to the Secretary Fishery Department and also monitors & controls matter related to financial planning, management and control	1. Inspection, Supervision and monitoring of Development works and activities. 2. Training and Technical guidance of farmers. 3. Preparation of project proposals for development works.	Organization is under staffed at district level. Lack of Inter departmental coordination. Training module does not focus on the Environment Management Practices.
Directorate of Dairy Development	1. Headed by Director 2. Planning and Implementation of Development Works	1. Inspection, Supervision and monitoring of Development works and activities. 2. Preparation of project proposals for dairy development and cooperative formation. 3. Imparting need based training to farmers 4. Providing farms inputs to farmers to bring down cost of the production.	1. Lack of interdepartmental coordination. Training module does not focus on Waste minimisation and management. High infrastructure installation and management cost.
Publics Works Department			

4. Proposed Interventions-their Environmental Implications



Box 4-1: Concentration of Shallow Tubewells

In Darrang District 4800 STWs have been installed under ARIASP. The Depth of the tubewells is between 20-30feet.

A concentration of shallow tubewells has been observed in village Bandiya near Mangaldai town.

In Malukat village of Jorhat District it has been reported that around 40 tubewells are drilled within 500 acres of area. It has been further observed that in 2.5 acres (1ha) of land there are two tubewells.

b. High Iron Content and Fluoride Content:

High iron content has been observed and reported by farmers[9] on site in irrigation water. The problem of iron and fluoride has also been reported during discussions with Assam Agriculture University, Jorhat and NERIWALM, Tezpur. Concerns were raised at both these forums about the Arsenic content in ground water exceeding the permissible limits. (Refer Box 4-2).

Box 4-2: Level of Iron, Fluoride, Arsenic and Hydrocarbon in Ground Water

40-75 % of the water samples, which were collected during monsoon season, were found to be exceeding the permissible limit of iron for irrigation purposes in District of Sonitpur, Sibsagar, Dhemaji, Jorhat and Karimganj in Upper Assam; Dhubri, Nalbari, and Barpeta in Lower Assam and Hailakhandi in South Assam. The water samples analyzed from districts of Karbi Anglong, Nagaon, Tinsukia, Goalpara, Cahchar and Sibsagar has indicated fluoride contents above permissible limit.

30-40 % of water samples analyzed for arsenic were in range of 0.025 to 0.50 mL/L (below the permissible level of 0.1mL/L but above desired level) in Districts of Nalbari, Barpeta, Jorhat, Dhemaji, Golaghat, Nagaon and Karbi Angalong. The maximum arsenic content in the range of 0.05 to 0.1mL/L was observed in Dhemaji and Golaghat districts.

Source: Report on Level of Iron, Fluoride, Arsenic and Hydrocarbon in Ground water of Assam, NERIWALM, Tezpur Tezpur, Assam, 2003

c. Soil contamination due to Oil Spillage:

It has been observed that the diesel operated pump sets are placed on open ground. The local contamination of the soil has occurred due to spillage during (i) operation of the pumps (ii) handling of oil around these pumps. The spillage, though not likely to be significant, flows through irrigation channels to the fields as is evident in Figure 4.1

[9] Consultations with the farmers during the site visits revealed iron sediment deposition.

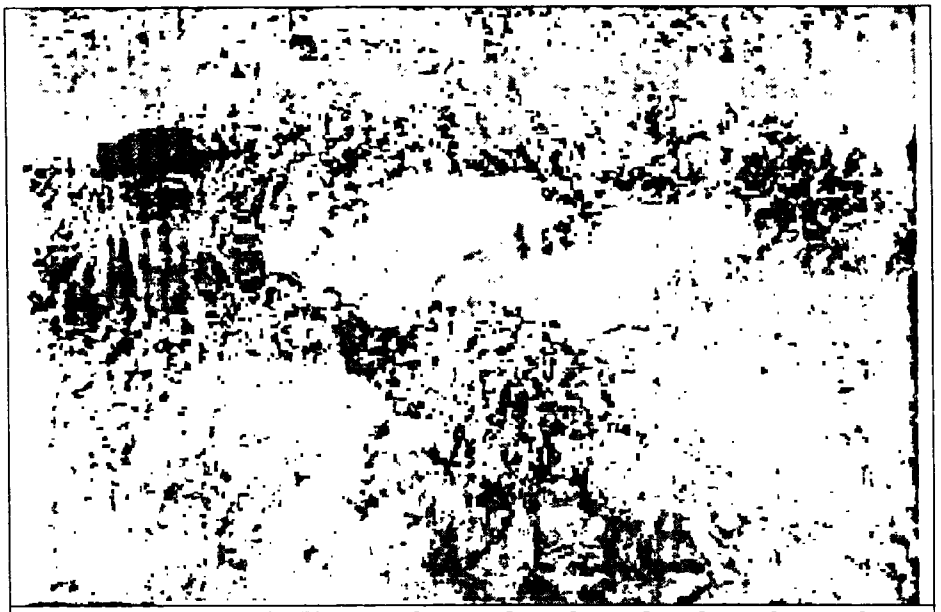


Figure 4-1 :Oil film on the surface in Irrigation Channel

d. Hydro carbons in Ground Water

In addition, "Assessment of Safe Yield of Ground Water" revealed more than permissible limits of hydrocarbons in sample in some districts (Refer Box 4.3).

Box 4-3: Hydro carbon Content in Ground Water

60-75% of the water samples tested in the districts of Karbi Anglong, Sivsagar, Hailakandi, Jorhata and Dhemaji had hydrocarbons more than the permissible levels whereas 25% -40% of the samples Naogoan, Tinsukia and Bongaigoan have higher levels of Hydro carbon. Variation in hydrocarbon levels in monsoon and non-monsoon seasons in 15 districts of Assam was significantly on the lower side whereas a slight increase was observed in the districts of Goalpara, Nalbari, Morigoan, Kamrup and Kokrajhar. 35 blocks in 13 Districts are identified as hotspots and require continuous monitoring.

Crop Diversification

Rice dominates agriculture production in Assam, which at present is grown mainly during Kharif season though it is also taken during autumn and summer seasons. Gross area under rice cultivation is estimated at 2.54 million ha, of which about 1.74 million ha of rice cultivation is accounted during winter season. The area under Summer Rice has shown an increasing trend with advancement of irrigation facilities by way of Shallow Tube Wells (STW). The other food crops like Wheat (0.07million ha). Pulses (0.01million ha) and Maize etc (0.02 million ha) occupy sizeable areas. The important commercial crops are Oilseeds (0.4 million ha), Sugarcane (0..03 million ha) and Jute (0.1 million ha).

However certain issues pertaining to the crop diversification need careful consideration. Observations of the site visits and consultations with stakeholders are presented below:

a. Increase in use of Chemical Fertilizer:

The trend in fertilizer consumption in Assam in terms of nutrients (N, P_2O_5, K_2O) per ha rose from 14.2 kg in 1996-97 to as high as 46.50 kg during 2002-2003 indicating a quantum jump (Refer Box 4.4).

It has been reported during consultation that fertilizer usage has increased in past one decade. Moreover due to lack of information about composition of fertilizer usage the farmers are applying only urea as source of chemical fertilizer. The general trend is that N fertilizers are applied in high doses; P and K fertilizers were applied in lower doses, thereby creating an imbalance in the nutrient status of soils.

Box 4-4: Increase in Fertilizer Consumption in Lower and Central Assam

In Darrang District the application of urea and DAP is not as per the recommended doses. There is remarkable variation in year-to-year usage of Urea and DAP. There has been no significant variation in year-to-year usage of MOP and SSP in the district.

In Barpeta District, urea has been applied in similar doses every year. The same trend persists in SSP, DAP and MOP.

In Nagaon District, majority of farmers used high doses of Urea and DAP in their crop such as Rice, Potato and Other Rabi and Summer Vegetables. Moreover, doses are not uniform and farmers do not apply fertilizers as per the need of the crops.

In Kamrup District, urea and DAP are applied in higher doses in crops namely, Boro rice, Pumpkin, Brinjal and Potato.

Source: Report on Study on the Increasing Pattern of uses of Fertilizers, Pesticides and other chemicals the Field of Agriculture in Darrang, Barpeta, Nagaon and Kamrup Districts of Assam, NEOLAND Technologies, Guwahati, Assam, 2003.

In the absence of awareness towards application of recommended doses, it is observed that the farmers use fertilizer at their will. High doses of fertilizer are applied every year without testing the soil to know its fertility status and requirement of crops. It has been reported that the fertilizer consumption has increased from 3-4kg per bigha[10] in 1995 to 5-6kg per bigha in 2003

b) Indiscriminate use of Pesticide: It has been reported during consultations on site and with institutions[11] that agriculture, in areas in proximity to urban areas, have been commercialized and farmers mostly prefer vegetable crops because of their short cropping cycle. Vegetables are prone to attack by pests as a result pesticide is used randomly on these crops without assessment of the pesticide formulation and quantity. Farmers usually seek the advice of traders for the pesticide to be used. It has even been observed in Barpeta that traders have recommended pesticide targeted for Cotton crop for use in vegetables. The pesticides commonly used by the farmers are Rogor, Tarzan, Decis, Ustad, Dimecron, Malathion, Tricel and Thiodan.

Resistance of pest to certain pesticide has also been reported. At Darrang and Barpeta, it was reported that farmers are using mixtures of different pesticides to kill resistant pests. Consumers in Jorhat have reported that farmers inject growth hormones in vegetables to increase the growth rate.

[10] 1 Bigha =1/7hectare

[11] During the site visits the study team has visited and had discussion in the Assam Agriculture University, Jorhat and North Eastern Regional Institute of Water and Land Management (NERIWALM)

The farmers use high doses of pesticides only with a profit-making motive. They are not aware of the possible environmental hazards that are likely to result from their excessive usage

To asses the impacts for use of pesticides in vegetables, 6 different vegetables were tested for pesticide residue and presence of metals namely, iron and arsenic. The results of the chemical tests are presented in Table 4-1.

Table 4-1: Residual Pesticide and metals in vegetables

PARAMETERS	Cucumber	Brinjal	Tomato	Lady's Finger	Bitter Gourd	Gourd
Aldrin	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
BHC (ALFA)	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
BHC (BETA)	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
BHC (GAMMA)	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
DDT (OP)	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
DDT (PP)	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Parathion Methyl	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Arsenic (as As)	<0.05 mg/Kg	<0.05 mg/Kg	<0.05 mg/Kg	<0.05 mg/Kg	<0.05 mg/Kg	<0.05mg/kg
Iron	8.32mg/kg	7.66mg/kg	8.13mg/kg	9.34 mg/kg	10. Mg/kg	10.74mg/Kg

c) **Biomass Burning:** It has been reported during site visits that straw is generally left on the field. Generally burning of crop residue on field is practiced through out state[12]. Approximately 20% of the straw yield is burned and the remaining is left to decompose on the ground. An estimate of the greenhouse gasses emitted is presented in Table 4-2. Though the burning of the crop residue in field is not a problem at present but the practice will be of the serious concern, as the cropping intensity will increase in the near future.

Table 4-2: Carbon Emission from Biomass burning in Assam

Year	Grain Yield(kg/ha	Straw yield	Residue (kg/ha)	C cotent in residue fraction	Total C(kg/ha)	CO2 emission (kg/ha)	CO emission	CH4 (kg/ha)	N2O-N (kg/ha)
1999-2000	1,500	1833	367	0.3	110	77	8	1	0.0
2000-2001	1,600	1956	391	0.3	117	82	8	1	0.0

Source: Statistical Handbook of Assam

Horticulture Development

Horticulture processing industry in the State is forty years old but it has not registered any significant growth. There are 22 medium size fruit processing units in the State with an annual cumulative production of 650-tonnes. There are 285 numbers of cottage level horticulture processing units across the State with concentration in Kamrup, Nagaon, Sibsagar and Karimganj districts. These include 9 cashew-processing units in the district of Dhubri.

The overall horticulture scenario in the State is expected to be highly commercial and market oriented with a wide ranging infrastructure development Programmes like cold storages, transport and other facilities being created under centrally and State sponsored Programmes.

The observations of the site visits and consultations with stakeholders on potential environmental issues are presented below:

a) **Site Clearance for Horticulture:** If properly practiced, this activity will not have any negative environmental impact. But facilitates growth of multiple crops and increase in

[12] During the site visits it has been observed by the study team that crop residues were being burned on the fields.

Farmers' income. Right kind of technology (seed, saplings, irrigation) need to be made available to the farmers. And at the same time credit availability, storage facilities, post harvest technologies, special on-farm training for farmers, proper environmental control in the fruit processing units need to taken care off.

The project envisages cultivation of horticultural crops on agricultural fields; therefore loss of biological diversity is not envisaged. However if carried out in forest areas, environmental impacts need to be studied.

Commercialization and Promotion of Medicinal Plants

Though commercialization of the cultivation of medicinal and aromatic plants and their extraction would not have major adverse impacts but the following issues needs due consideration. The observations of the site visits and consultations with stakeholders are presented in Box 4.8:

Box 4-5: Brahmaputra Valley Aromatic Oil Industries at Kaliabor Tinrali in Nagaon

Aromatic plant farms are plant nurseries where special types of plants are grown. Products from such farms are meant for pharmaceutical and perfume industries. The main products are both in liquid as well as solid forms.

One of such farms near Tezpur (Brahmaputra Valley Aromatic Oil Industries at Kaliabor Tinrali in Nagaon) produces different varieties of oils. These oils are sold (also exported) for use in pharmaceutical and perfume industries. The process consists of application of steam under pressure and distillation of leaves and thin branches of plants. The oil produced from distillation unit is mixed with water and supernatant oil layer is separated. Some of the common plants grown and processed include, Patchouli, Lemon grass and Citronella, all producing oils and Sugandh mantri, producing incense powders.

Collection of medicinal plants from wild: It was reported during discussion at Tezpur that citronella is collected from the wild and aromatic oils are extracted. The extraction form wild should not be encouraged as this lead to over exploitation endangering the existence of this plant species.

Wastewater from extraction units: Though every effort is made to recover maximum quantity of oil from the processing unit, small quantities of oil are however wasted with water even after an additional recovery vessel. Constituents of liquid waste generated from the process unit are oil and water. It is claimed that this wastewater containing a small percentage of oil, is used again for irrigation within the farm.

Liquid wastes generated from a large number of units and at a number of points are likely to cause problems.

Solid wastes from extraction units: Solid wastes obtained from the process include leaves and branches from which oils have been extracted. Although the present practice is to dump them nearby, but they can easily be converted in to manure by composting and used within the farm. The solid wastes are by products from the processing unit that should be composted and used as manure. Some quantities of solid wastes from the factory installation such as boiler wastes, machine oils, leftover plastic bags and wooden and paper wastes from packing will have

to be properly treated before disposal because if indiscreet dumping of these substances is resorted to, clogging of soil, contamination of surface and ground water will result.

Agriculture Service Centers

ASCs will be very useful for spreading the new technologies and increased adoption by the farmers. However, the centers should have all modern facilities like computer and Internet and the young people should be trained with modern agri-techniques. Special training for farmers to make them aware of modern information technologies will also be required. However, siting of such centres and site development is a concern, which need to be considered.

Marketing and Storage Facilities

At present, there are 1294 rural markets for horticulture products comprising 117 primary village markets, 133 primary wholesale markets and 34 secondary wholesale markets. These are not linked to the other markets resulting in periodical gluts and shortages. The price variations are wide due to this missing link.

In the light of increase in trade of commodities from rural haats and rural wholesale markets, following efforts has been envisaged in AACP for strengthening these marketing and storage infrastructure:

- Upgradation of Infrastructure in the rural markets: The infrastructure development will include construction of permanent covered selling platforms, sanitation and drainage, storage space, link road, parking area, telephone etc.
- Willingness of the Gram Panchayats to share in the capital costs of upgrading infrastructure and to meet all responsibilities and expenditure for operation and maintenance of the 'haat' after it was upgraded and handed over to the GP will be a prerequisite for the development of a particular' haat'. Ideal size of market would be 0.5 hectare or more.

The observations of the site visits and consultations with stakeholders on potential environmental issues are presented below:

a. Site Selection for Establishment:

The existing markets in the Urban Centers are located in the congested areas. It has been observed that in Kabuganj in Cachar District the vegetable market has been located in the core area, which has been destroyed due to fire. Further site assessment especially with respect to the Bio-diversity assessment shall attain importance especially if such facilities are located close to wetlands

b. Waste Management

Fruits and Vegetables Centres: Quantities handled by the shopkeepers are small, enough to cater to daily needs of the local population. Organized buying and selling on larger scales is done in villages of bigger sizes and those situated along major roads and highways.

Although trading in fruits and vegetables does not warrant use of water, small quantities of wastewater could always be found resulting from sprinkling on items for sale or for washing of shop floors. In fact lined floors may be found at a very few places. Arrangements for disposal of wastewaters from such centres are rare.

Solid wastes in such centres are obtained from dressing of fruits and vegetables. Major constituents of fruits and vegetables markets are organic in nature and decomposable. Items for sale in the market are brought in paper or wooden packing cases or plastic and jute gunny bags. Some portions of these are always wasted. No proper arrangements exist for disposal of solid wastes. In one of such rural centres visited, it was observed that a collection system did exist but garbage was disposed off by dumping in to depressions on the riverbank nearby. In the hot climate of Assam, where rainfall is high and lasts long, rainwater enhances decomposition of leaves and other parts of fruits and vegetables.

Cold Storages: Cold storages are generally situated in the urban areas and these hardly have any bearing on the village environment. Cold storage of fruits and vegetables does not warrant use of water. The wastes generated from cold storages contain rotten fruits and vegetables and some leftovers. Small quantities of portions of paper and wooden packing cases and plastic and jute bags may also be wasted which are not separated and disposed off along with organic matter. When plastic bags and other substances get mixed with these and indiscreet dumping practised, clogging of soil, contamination of surface and ground water result.

Research and Capacity Enhancement

The AACP focuses on the research and capacity building of the trainers and the farmers in following manner:

- The Assam Agriculture University (AAU) has conducted farmer's workshops to identify demand driven research needs.
- The AAU has identified a number of high yield varieties in rice, oilseeds, sugarcane and other spice crops.
- Demonstrations on advanced techniques of vegetable cultivation.
- It has been proposed that consultation in identifying research needs should be between the farmers and departments with the AAU as an active participant.
- The construction of the training centers, and training halls cum farmers hostels.
- Training of officials within and outside state.
- Training module being developed with involvement of NGOs for capacity building of the Farm Management Committee (FMC).

The observations of the site visits and consultations with stakeholders are presented below:

a) Mode and Module of Training

The mode of training mainly focuses on the theoretical information dissemination. The training module did not contain the training related to the environmental implication of the unorganized farm practices.

b) Genetic Pool Loss

Continuous use of fertilizers and pesticides, mechanization, monoculture, adoption of limited number of high yielding crop varieties and hybrids, limited crop and farm-animal diversification in last few decades gradually leads to the genetic and species erosion in agricultural lands. There are also reports of a decline in the population of several indigenous cattle and goat, organic matter decomposers (soil biota), and land races of aromatic and scented traditional rice, minor millets, and several kinds of indigenous vegetables.

4.2 ANIMAL HUSBANDRY AND VETERINARY SECTOR

Livestock Development and Veterinary Infrastructure

At the inception stage, poor genetic potential along with inadequate quality fodder supply was identified as two important impediments for poor animal productivity in the state. Therefore under ARIASP the main activity of Artificial Insemination has been under taken for improving the breed of the cattle's. This included establishment of 3 Frozen Semen Production Stations[13] along with creation of 7 Frozen Semen Banks and 532 Artificial insemination (AI) centres. AACP focuses on the further intensification of the AI activities. Moreover the steps will be under taken to extend all possible services at their doorsteps.

Further in AACP, for smooth functioning of the A.I. and health care activities, the department has proposed to train 400 nos. of village level workers in phased manner in the 10 (ten) selected districts of Assam having experience in cattle rearing. After completion of training, these workers will be utilized for A.I. and health care link person by providing A.I Kit bags, A. I gun and one litre liquid nitrogen container to facilitate them for doorstep services. However increasing the AI and veterinary health services will lead to increase the generation of waste. The issues related to the AI and Veterinary health Centres are presented below.

a. Waste Generated from Vertinary Infrastructure

Veterinary Hospitals: Treatments of minor ailments and diseases are carried out at the farm by visiting staff of nearest veterinary hospital. Usually, animals are brought to veterinary hospitals only for treatment of major ailments requiring surgeries or indoor treatment.

Both liquid and Bio-medical wastes are generated from this facility. Liquid wastes are mostly in the form of animal excretions. Common solid wastes obtained amputed animal parts obtained from surgery, syringes, bottles and cotton gauges. Since delivery of the calf is usually carried out in the farm so placenta are rarely a constituent of the waste.

Liquid wastes in the form of excretions at the time of delivery are disposed off in the backyard like normal waste. Disposal of solid wastes like placenta are traditionally done through burial, which is not satisfactory as burial is not deep enough and no pre-treatment is provided. Amputed animal parts obtained from surgery, syringes, bottles, cotton gauges are dumped with other municipal refuse as a common practice. The following key issues emerged based on site visits and consultations:

- Collection and disposal of excretions from animals during delivery is difficult due to the reasons that (a) they are obtained once in a while (b) their volumes are small and (c) activity is scattered.
- Burial of solid wastes like placenta is not done deep enough and is without pre-treatment which takes long to decompose. Besides it may adversely affect ground water quality, as the water table is high.
- Particular attention is not paid during disposal of amputed animal parts obtained from surgery, which is a potential source of health hazard.

[13] There are 3 Frozen Semen Production Centres are located at Khanapara in Kamrup District in Lower Brahmaputra Valley; Kaliapani in Jorhat District in Upper Brahmaputra Valley and Ghungnoor in Cachar District in Barak Valley.

- Due care is not taken while disposing off veterinary wastes consisting of syringes, bottles, cotton gauges which are dumped with other municipal refuse. These are also source of major health hazard for human population.

Veterinary laboratories: The scope of veterinary laboratories is limited only to urban towns in the present scenario as well as in the foreseeable future. The laboratory situated in Guwahati produces different types of vaccines for animals. It also stores semen used for artificial breeding. The issues pertaining to environmental management in this lab are as follows:

- Most of the chemicals are of routine nature and small quantities of glassware waste do not pose a problem at present. There may be an increase in laboratory activities and the laboratory needs to have a proper[14] handling and management system for handling of these bio-medical wastes.
- Storage of broken bottles and other glassware, in howsoever a small quantity, poses a hazard to staff and population in nearby areas. Syringes and straws are not destroyed and they too are a health hazard.
- Some of the chemicals are of hazardous nature and though necessary precautions are taken in their storage, safe disposal arrangements do not exist.
- Wastewater generated from the laboratory is mostly due to washing of glassware used or by laboratory staff. Chemicals washed from bottles get diluted. Disposal however is through soak pits. Solid wastes produced include damaged glassware, syringes, needles etc.

Artificial Insemination (AI) Centres: The Artificial Insemination Centers are present in district towns as well as in other smaller settlement but usually the visiting vertinary staff carries out the AI activities at the farmer's house. Artificial insemination is therefore a scattered activity however; in some cases the animals are also brought to the AI centers for insemination.

During the process of AI water is used for washing. The wastewater generated from this is minimal. Small quantity of wastewater is disposed off with other wastewaters. Solid wastes from the AI Centres include straws used for insemination, medical gloves, glass syringes and needles glass bottles and cotton wastes. Vaccine distributed from the Vaccine production centres at Guwahati is stored and used here. It was observed that there are proper systems of disposal of waste.

All the waste described above, come under the category of bio – medical wastes. These poses both serious environment and health concerns if not stored, handled, treated and disposed as per the statues. Pathogens from these wastes may lead to contamination of soil, surface and ground water (Refer Box 4-6).

Box 4-6:Handling and Disposal of Wastes from AI Centres at Jagi Road

Solid wastes from the AI Centre at Jagi, 50 km from Guwahati consist of straws used for insemination, medical gloves, glass syringes and needles glass bottles and cotton wastes. These are all come under the category of bio – medical waste. It was observed all these wastes are dumped in a pit just outside the centre along with other solid waste.

[14] An incinerator had been installed several years ago in the laboratory premises, which is not functional at present. The present system of disposal consists of storage of bottles and other glassware in bins in a corner. The reasons appear to be that (a) use of incinerator was considered non-feasible and (b) quantity of wastes generated was small.

b. Poor Hygiene of AI Specialists and the Animal

It has been reported in Cachar District due to non-availability of surgical gloves AI specialists use bare hand for insertion of the semen. This poses health hazard to both the animal and the professional.

c. Handling of Live Vaccines

The medicine voils damaged during packaging is disposed directly in the common dustbin without using disinfectant. Moreover the individuals involved in packaging did not practice basic precautionary and safety measures (Refer Box 4.10).

Box 4-7: Handling and Disposal of Medicine Voils during Packaging

As observed at Institute of Veterinary and Biological Centres, Khanapara, Guwahati personnel packing vaccine in voils were not using protective gloves and masks. Moreover the study team has observed the voils broke during packaging was directly disposed to the common dustbin without disinfecting.

The disposal of the live vaccine in the field may cause the infection in the near by human settlements.

Promotion of Dairy and Poultry Activities

The promotion of dairy was not taken up in ARIASP. As part of AACP, the stress has been on to provide farm inputs such as feed, fodder, medicine, vaccine etc. to the farmers at reasonable price in order to bring down the cost of production of milk. The issues related to the dairy and poultry development are being discussed below.

a. Waste disposal of the dairy & poultry farms

Dairy Farms Small size milk dairies are quite common in Assam, particularly in the rural sector. Some small / medium size dairies also exist in urban fringes. Brief descriptions of these pertaining to wastes generated and disposal methods are given below. In the rural scenario, individuals operate milk dairies. Cows and other milk yielding animals, generally in varying numbers of 5 to 10 are kept. The issues related to management of wastes generated from cattle farms are discussed below.

The wastes from dairy farms generally consist of animal excretions, wasted fodder, rags and plastic or paper containers for cattle feed. Presently farmers do not follow a systematic method of collection of liquid and solid wastes such as excretions from cows and other animals. The dung is collected and heaped in the backyard, which is subsequently used as manure. Remains on floors of sheds are washed away with water. These lies accumulated in depressions or

Figure 4-2: Waste Disposed from Dairy Farm at Barpeta

unlined drains and decompose under anaerobic conditions (Figure 4-2).

Uncontrolled anaerobic digestion of animal excretion in open unlined channels is a source of contamination of surface and underground water as it still has BOD higher than what is prescribed for disposal to inland waters. Further they are the breeding ground for vectors of different diseases.

Duckery and Poultry farms: Duckery and poultry have been propagated as an additional source of income generation for individual households. Solid wastes from duckrey and poultry consist of bird droppings, feathers, leftovers of bird foods, and remains of plastic and jute bags used for packing of bird foods. The observations based on the field visits are as follows:

Little or no wastewater is generated from poultry farms except from periodical washing of pans and floors. Usually there are no well laid out systems for collection and disposal of wastewaters from duckeries and poultries. Wash waters are disposed of in nearby situated depressions where it is allowed to soak in to ground and evaporate. Wash waters are mild and generally do not pose serious problems. However, these will have some BOD and if large quantities are disposed of in small depressions, anaerobic digestion may cause sight and odour nuisances. Percolation into ground is not likely to be a threat to ground water quality. It will also be applicable to surface water because of low organic loads and high dilution. Dumping of solid wastes containing bird droppings, feathers, leftovers of bird foods, and remains of plastic and jute bags used for packing of bird foods on open ground, which have high nutrient content would causes contamination of soil and surface water.

Pig Breeding Farms: Pig breeding in rural areas of Assam is also predominantly in the unorganized sector. Small numbers of animals are kept which cater to local needs. Most of the animals are poor breed and subjected to malnutrition, endemic diseases and parasitic infestation. To improve the breed of pigs a farm has been established in Guwahati.

The wastewater is generated from washing of pigs and dens. Approximately, 50 litres of water is required per pig per day. This includes 20 litres for drinking and the balance for bathing of pigs and for washing of sties. The wash water flows into an open drainage system. Presently, there is no outlet and the wastewater stagnates in a depression near the farm where anaerobic digestion takes place resulting in foul smell and odour in addition to forming a breeding ground for vectors of different diseases. Solid wastes obtained mostly from cleaning of the dens consist of excreta, grit and sand, leftovers of pig feed and packing rags. The collection of solid wastes is done along with other wastes and dumped on adjoining land and poses threat of contamination of land.

In the absence of proper treatment, wastewater lies stagnated in open drains where anaerobic digestion takes place. Contamination of surface and underground water is taking place. Besides these are also sources of fly and mosquito breeding. Dumping of solid wastes in depressions are causing unhygienic conditions and contamination of surface and ground water.

b. On-site management of livestock on the private farms

It was observed that at the private farms no disinfectant is placed at the entrance of the dairy farm. It was further reported at Cachar that the occurrence of Foot and Mouth Disease has increased but the intensity of impact on the milk production is not so severe.

c. Disposal of medicine voils, syringes and needles at Dairy Farms

Through consultations it was learnt that the vertinary doctors visit the dairy farm for treatment of animals. The voils, syringes etc used for medication are usually dumped at the backyard along with other refuse. Further the delivery of the calf is usually carried out at the farm itself and the placenta and afterbirth is buried at the farm. The extent of primary treatment, which needs to be carried out, may not be adequate. Similarly, artificial insemination is carried out at the farm and straws etc generated are disposed along with ordinary refuse at the farm.

Marketing Infrastructure Development

The Marketing Infrastructure Development emphasizes on processing and marketing of the dairy and the poultry products. It also focuses on:

Creation of investment climate for private participation in Dairy industry

Organize the dispersed dairy farmers in to Dairy Co-operative Society (DCS) or Self-Help Groups (SHG);

Increase the milk production in selected areas;

Initiate a process of "Hand Holding" to the marginal farmers; and

Strengthen their capability to produce quality milk and strengthen their livelihood capacities through dairy farming.

The issues related to the marketing infrastructure development are being discussed below.

a. Site selection

The processing plants presently are sited in locations not compatible with the surrounding land uses. They are located mainly in the urban centres surrounded by residential and commercial areas. The wastes generated are highly degradable and leading to foul smell and odour.

Box 4-8: Siting of Dairy processing Plant

The Dairy plants located in Guwahati city are proximous to the residential areas. It was reported during site visits that populations of surrounding areas complain about odour and fowl smell especially during the rainy season. The Slaughterhouse being setup by the Dairy Development Department, government of Assam is located near a natural stream.

b. Waste Disposal in Processing Plants

Milk Processing Centres: Three dairy plants presently operate in Guwahati city and a chilling plant have been set up at the smaller towns to produce packaged milk and milk products. The unit's plans to improve the product line and also enhance their production in the near future. Systematic disposal of liquid and solid wastes generated from these plants is not practiced at present.

Box 4-9: Disposal of Waste water from Central Dairy

The Central dairy, under the Dairy Department, Government of Assam handles about 2500 to 3000 litres of milk per day, uses about 12000 litres of water per day for operation. About 10000 litres of wastewater is to be produced per day. The present wastewater collection system is through open drains, which lead to an open pit. This pit was perhaps dug initially to provide oxidation pond treatment but presently serving as a soakage pit. Because of its depth about 2.5 meters, anaerobic digestion is taking place in the pond.

Though it was reported that the plastic waste are disposed through vendors but during the visit it has been observed that plastics are being used for ignition of boilers.

Constituents of Solid waste generated in Milk processing plant has been presented in Table 4.3. There is no systematic method of collection and disposal of these items. At all the dairy processing plant and chilling plant it was observed that water used for cleaning of Plant and Equipments can be reduced.

In the absence of a properly designed treatment plant, wastewater of strengths much higher than the permissible limits is either percolating in to ground water or finding its way in to natural streams. Contamination of surface and underground water is taking place and open drains and ponds are sources of fly and mosquito breeding.

Slaughterhouses: Presently slaughtering is carried out illegally at individual level. Slaughtering is done with low hygiene standards posing health and environmental hazard due to illegal and unauthorized disposal of wastes generated. Since slaughtering is done in open ground on unlined floors, blood is soaked by the soil. The visceral material is thrown out in open or in depressions and small intestines are washed in the shops polluting surface water and contaminating land.

As part of AACP, slaughterhouses have not been planned but the increase in production of livestock would necessitate establishment of such modern facilities. The Dairy Development Department, Government of Assam is already in the process of installing a slaughterhouse in the Agricultural Complex at Khanapara with a installed capacity of slaughtering 100 pigs and 1500 goats and sheep per day. Constituents of solid wastes generated from slaughterhouse are presented in Table 4.3. Wastewater from slaughter houses is usually strong with BOD of about 4000 ppm, COD 8000 ppm, total solids 4000 to 5000 ppm and pH 6 to 7.

Table 4-3: Constituents of solid wastes from different units

S. No.	Type of unit	Product / Activity	Constituents of wastes
1.	Dairies (Cattle Farms)	Raising of animals	Animal excretions, fodder, plastic bags and rags
2.	Milk Processing Units	Pasteurised Milk, yoghurt, cheese, paneer	Plastic bags, rags, grease, detergents, grit and sand
3.	Pig Breeding Farms	Pigs for slaughtering	Pig excretions, fodder and rags
4.	Slaughter Houses	Varieties of meat	Animal excretions, blood, hair, paunch manure, flesh, grease and offal
5.	Duckeries and Poultries	Raising of birds	Bird droppings, bird food and feathers

S. No.	Type of unit	Product / Activity	Constituents of wastes
6.	Veterinary Hospitals	Deliveries and treatment of sick animals	Glassware, syringes, needles, medical gloves and straws
7.	Veterinary Laboratories	Production of medicines and vaccines for animals	Glassware, syringes, needles, medical gloves and straws
8.	Artificial Insemination Centres	Artificial insemination of animals	Glassware, syringes, needles, medical gloves and straws
9.	Fruits and Vegetable Markets	Purchase and sale of fruits and vegetables	Portions of fresh and rotten fruits and vegetables from dressing paper and plastic bags, wooden or paper packing cases and packing grass
10.	Cold Storages	Preservation of fruits and vegetables	Portions of fresh and rotten fruits and vegetables, paper and plastic bags, wooden or paper packing cases and packing grass
11.	Aromatic Farms	Processing of plants for different uses	Small contents of extracted oils, plant leaves and stems

c. Quality of diary products

The increasing applications of pesticides have the potential to affect the quality of diary products, especially milk –resulting in pesticides entering the food chain. Till date, there has been no documentary evidence towards establishing the possibility or presence of pesticides or contamination in milk, in the project districts. Towards the same, as part of the study, an effort to test the **contamination in milk** has been taken up for **9 samples** from organised as well as unorganised sectors. The parameters tested included:

- **Pesticides** -Aldrin, BHC (Alfa, Beta, Gamma and Delta), DDT (OP and PP) and Parathion methyl
- **Fertilisers** – Urea, and,
- **Metals** – Arsenic, Iron

The results have been presented in Table 4.4. The result does not indicate presence of pesticides and fertilisers. The iron content in the milk may be attributed to mixing of ground water with generally high iron concentrations[15] in the state.

Table 4-4: Results of Milk Sample Tested

PARAMITERS	Production facilities					Distribution channels				Minimum Detectable Level	Method for Testing
	Purbi Dairy	Dairy Fresh	Double Tonned Milk	Double Tonned Milk	Yellow Farmer	Cooler Bottle Farmer 9th GS Road	Primary Dist	Secondary Dist	Cooler Bottle Teritary Paltan bazar		
Aldrin	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	0.01 mg/l	AOAC 17th edition
BHC (ALFA)	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	0.01 mg/l	
BHC (BETA)	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	0.01 mg/l	
BHC (GAMMA)	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	0.01 mg/l	
DDT (OP)	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	0.01 mg/l	
DDT (PP)	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	0.01 mg/l	
Parathion Methyl	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	0.01 mg/l	
Urea	Not Found	Not Found	Not Found	Not Found	Not Found	Not Found	Not Found	Not Found	Not Found	-	GEN.SOP/CALLAB/40
Arsenic (as As)	< 0 05 mg/kg	< 0.05 mg/kg	< 0.05 mg/kg	< 0 05 mg/kg	< 0.05 mg/kg	< 0 05 mg/kg	< 0 05 mg/kg	< 0 05 mg/kg	< 0 05 mg/kg	-	AAS
Iron	6 99 mg/kg	7.88 mg/kg	10 05 mg/kg	25 40 mg/kg	3 28 mg/kg	11 53 mg/kg	7 32 mg/kg	10 44 mg/kg	22 88 mg/kg	-	

Source: Test results of sample collected by LASA, May 2004

[15] As per the Study on "Safe Yield of Ground water and level of Iron, Fluoride, Arsenic and Hydrocarbon in Assam, NERIWALM, Tezpur iron content in ground water in Kamrup district ranges between 5.20 to 6.18 ml/L in monsoon and non monsoon season.

Capacity Enhancement of Farmers

The capacity of the local farmers will be enhanced through the following:

Skill up-gradation of dairy farmers in the rural areas

Increasing their managerial capacity as well as technical know how

Equip them to provide for themselves a safety net, individually as well as through the network of group mobilization where dairy farming would be the instrument.

Impart need base training to the farmers as well as to the Govt. officers of the Dairy Development Department in order to organize the Dairy industry of Assam on modern lines.

a. Mode and Module of Training

The mode of training mainly focuses on the theoretical information dissemination. The training module did not contain the training related to the environmental implication of the unorganized farm practices.

4.3 FISHERY SECTOR

Farmers Ponds and Community Tank Development

The community tanks and farmers ponds are used for the culture fishery but improper management of these water bodies were responsible for the low productivity. In order to increase the productivity to meet the high demand of fish it was decided to increase the area of the farmer's pond and community tanks under scientific pisciculture techniques. As part of the ARIASP 4249 farmer's ponds having water area of 601.83 ha and 730 numbers of Community tank having water area of 825.51 ha was developed. As a result the productivity of farmers pond and community tanks have increased by 192% and 175% respectively.

Under AACP, it is proposed to support semi-intensive fish culture to cover 200 hectare of community tanks ranging from 0.3 hectare to 3.0 hectare to benefit the landless farmers. Similarly 1200 hectare ranging from 0.05 ha to 0.40ha of farmers ponds will be undertaken to benefits of small and marginal farmers.

However certain issues pertaining to the sustainable development of pisciculture need careful consideration. The observations of the site visits and consultations with stakeholders are presented below:

a. Farming (rice and vegetables) on the pond bed

It was observed that pisciculture in certain places are seasonal activities and cannot be undertaken during the summer months i.e. February-April. To supplement the income farmers practice agriculture on the pond beds during the dry season. Rice and vegetables are mainly grown. Fertilisers are not required as the pond bed is already fertilised with fish feed and other organic matter from the fishing activity. Farmers growing vegetables use pesticides, as they are prone to attack by pests. The residual pesticides are washed with water and poses threat to enter the food chain.

At **Barpeta district** it was observed that fishing ponds are used for cultivation. During discussion we were however informed both by the officials and the farmers, at the offices of the

Fish Seeds producers Association, Barpeta Road, that pesticides were not being used in rice. However some of the farmers are using pesticides in vegetables. The fisheries department officials also expressed their helplessness over the situation because these fish farmers do not come to consult them on matters relating to farming practices in the fishponds.

b. Pumping water from Shallow Tube Well into fish pond

Some of the farmers have used shallow tube wells to supplement water in the pond. The ground water contains considerable quantity of iron. It was observed that the water is directly pumped in the pond without being made to flow through any open channel to allow the iron to stabilise[16] with atmospheric oxygen. The iron present would thus use the dissolved oxygen in water to convert ferrous to ferric resulting in deficiency of dissolved oxygen and problems of pisciculture associated herewith.

One of the beneficiaries of ARIASP in Jorhat District had adopted the Horticulture cum Pisciculture scheme and started cultivation of fishes. He had also installed a shallow Tube well for supplying water to the pond as well as irrigating the fields for irrigation. The water is directly pumped form the STW into the pond and then pumped form there for irrigation. As a result the water in the pond was deficient in dissolved oxygen and algal bloom was observed.

c. Water quality

Sometimes local environmental conditions may make a pond unfavorable or completely unsuitable for fish. The common water quality problems encountered often include soft acidic waters, low natural productivity, high clay turbidity, oxygen depletion and acid sulfate soils. Acid-sulfate soils contain iron pyrite (iron sulfide), which is oxidized to sulfuric acid if the soils are exposed to air. Drainage from acid sulfate soils can cause extremely low pH in ponds outside the tolerable range of most fish species. Fishpond waters with pH of 3.6-5.4 have been reported to exert toxic effects on a range of fishes including mortality, reduced growth and poor production. Waters with a pH of less than 6.0 lead to low productivity.

Ponds with substantial populations of phytoplankton or aquatic plants may also experience wide fluctuations in pH. This is caused by fluctuations in CO_2 concentration due to respiration and photosynthetic activity.

Lime, gypsum, alum and potassium permanganate are all chemicals frequently used in aquaculture to regulate water quality. Use of poison should be strictly prohibited for fishing. Pesticides are also frequently used to poison fish. Inorganic and organic chemicals, sewage and heated water may cause eutrophication[17] in pond water.

[16] Iron is present in ferrous state in water in contact with oxygen it is readily converted to ferric state, which is more stable.

[17] Eutrophication is the enrichment of waters with plant nutrients especially phosphorus and nitrogen. This leads to an increase in growth of algae and macrophytes and can result in visible plankton bloom and algal mats - which are not desirable. Decomposition of these plants depletes the Dissolved oxygen (DO_2) and release undesirable substances including toxins and hydrogen sulfide (H_2S).

d. Improper management of tanks after completion

Improper management of community tanks and farmers pond would lead to algal bloom and production of toxins. Such practices in model tank if replicated in other places would have serious consequences.

Development and Management of Beels

As part of the ARIASP, 42 Beels[18] covering water areas of 1955 Ha and 6 Open Water Fisheries covering water area 194 Ha were developed. Presently, the ownership of some of the beels has been transferred to Assam Fisheries Development Corporation and lease out for commercial exploitation. Though the lease period of the beels have been increased from 3 years to 10 years

As part of AACP 3000 hectares of beels would be taken up for development. Of the 3000 ha, 1800 ha with beel size upto 30 ha and medium size beels ranging from 30 –80 ha have been identified in 21 districts.

However certain issues pertaining to the development of beels need careful consideration. Environment monitoring is a must for Fish and livestock integration. Close monitoring of diseases and water quality of the pond water are the prerequisites to save the environment. Ammonia from animal waste and agricultural fertilisers contribute to eutrophication, which kills aquatic and plant life. The observations of the site visits and consultations with stakeholders are presented below:

Leasing of beels: Consultations with the department officials revealed that in the process of open leasing of beels the leasor is neither the community nor any person from the community adjoining the beel. As a result the community loses control over the resources in the beels. In such a situation to sustain their livelihood they either encroach upon the area of the beel or use the beel during the dry months to earn a livelihood.

- **Use of pesticides in cultivation on the fringes of beels:** The beels dry up during summers and the community residing on the periphery of the beel start cultivation within the wetland area. As the cropping cycle is short (approximately three months) vegetables are mostly grown. This cultivation of vegetables triggers the usage of pesticides within beels.
- **Overexploitation of beels: L**easing of beels on a commercial basis results in overexploitation of the beels.

Encroachment of water channels recharging the beels either due to roads or human settlements: Increase in the pressure of livelihood has resulted in encroachment onto the beels. As a result, the drainage channels carrying water into the beels is blocked affecting water inflow into the beels. Additionally, the wastewaters from these settlements are drained into the

[18] 3513 wetlands covering an area of 10123160 Ha, approximately 1.3% of the total geographical area, are mainly lakes/ponds, ox-bow lakes/cut-off meanders, waterlogged (seasonal) and swampy/marshy areas and beels. These inland water bodies especially the beels are huge reservoirs of natural resources. Traditionally these were community properties though the ownership was under the revenue department. The beel was a source of income for the community surrounding the beel. However, as agriculture gained prominence the catchment of the beel deterioted as nutrient and sediment inflow increased.

beels increasing the nutrients present in the water leading to eutrophication. Agricultural activities using fertilisers and pesticides further add to the problem.

Construction of bunds or culverts at the entrance: Consultations with officials in different districts revealed that the bunds have been constructed to demarcate the beels and thereby prevent encroachments. It was also disclosed that the channels connecting the beel to the rivers have also been bunded in some cases and a hume pipe culvert has been placed to allow the water to flow. The hume pipe though would allow the water to flow might hamper the movement of fishes. As a result the natural system of beels are being affected and auto stocking of beels do not take place.

Ghulung Beel in Golaghat District was under ARIASP. It was developed with the help of community. The area is predominated by the Mising tribe. Agriculture was the main activity of the community however they were motivated to form a cooperative "Saru Sumonia Ghulum Meen Palan Samabay Samiti" to under take fishery activity in the beel. A legal literacy campaign was also undertaken to allay fears of the community regarding loosing usufruct right over the beel. The Beel Development Committee was constituted with members of the samiti, Deputy Commissioner, fishery department officials and the nodal NGO.

The beel was covered with peat and the community contributed with the labour towards cleaning of the beel. They were also educated in the benefits that would accrue to the community and the importance of protecting the same, including the inflow of residual pesticides into the beel. The community has been encouraged to grow vegetable crops, which require pesticide only on highland areas, which slopes away from the beel. In low-lying area rice cultivation is practiced. Bunds have also been constructed in Ghulung beels to prevent back flow of water containing nutrients from agricultural field.

Fishing in beels during breeding season: Fishing is still carried out during the breeding season resulting in the depletion of stock and also hampering regeneration.

Use of small mesh size nets for fishing: It was reported that small mesh size nets are used for fishing in beels as a result the spawn and fingerling are netted out resulting in depletion of stocks in the beels.

Lack of Rapport and Group identification: In villages the communities are aligned to the groups for economic, political and ethical reasons. The mobilisation of people to take up development activities the identification of groups and its composition are important for rapport building. The rapport building with the community for taking up beels for eco-friendly development is lacking, leading to the deteoriation of beels and the livelihood of the local or the indigenous people.

Introduction of Exotic species

The wetland are very good breeding ground for several indigenous fish species. They should be preserved for in-situ conservation. In Assam, lack of adequate attention to identify and develop appropriate aquaculture techniques for suitable local species appears to have resulted in the dominance of exotics fish species.

Careful evaluation is required on the introduction and spread of several exotics fish species[19] in the culture system. These species are *Aristichthys nobilis, Hypophthalmichthys molitrix,Ctenopharyngodon idella, Cyprinus carpio ,Oreochromis mossambicus, Puntius javanicus and Clarias gariepinus etc.* It has been lately realized that some farmers release hatchery produced seeds of exotic fish species and hybrid carps in beels and open water for increasing fish production, as they are not aware of the consequences.

Quality Fish Seed Production

To promote pisciculture as a source of income, availability of quality seeds are necessary. To ensure that quality seeds are available to farmer's fish seed production was undertaken as a activity during ARIASP. As fish seed is no longer a complicated activity it has been taken up as a lucrative business by many progressive farmers. The rapid uncontrolled growth in number of privately owned hatcheries would jeopardize the fish seed industry. Already concerns have been expressed at various forums on this uncontrolled nature of activity and its grave economic and environmental consequences.

The unscientific breeding practices have resulted in genetic deteoriation in hatchery population. Lack of quality seeds may be one of the primary reasons for low fish production in the state. Unconscious hybridisation in hatcheries will lead to ecological disaster and many of our native species may start disappearing.

Brood Stock is not maintained: It was observed that the fish breeders do not maintain enough brood stock to produce the quantity of seeds. Selection of brood from a finite population may result in inbreeding depression.

The infrastructure is not scientifically designed: It was observed that the many breeders have only one breeding tank for spawning of fish. And to operate that large size-breeding tank economically, it requires several Kgs of brood fish in one batch. Failing to provide required quantity of single species, often they practice mixed spawning of several species. And as a result, some of the resultant species are hybrid between two species about which no studies have been undertaken.

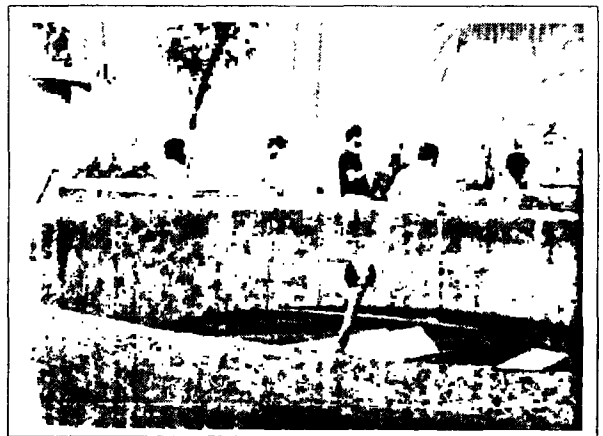


Figure 4-3: Fish Breeding Tank at Mangaldai, Darrang

Small size fishes are used for breeding: Consultations with district officials and at the Assam Agricultural University, Jorhat have revealed that small size immature fishes weighing 200-400 gms are being used for the purpose of breeding. The breeding of under size fishes results in deteoriation of quality of seeds.

Brood stock is not replenished from fresh water : It is required to replenish the brood stock periodically to produce good quality fish seeds and prevent any genetic deformity.

[19] Out of the all these exotics, the best known nuisance species are Aristichthys nobilis (Big head carp) Oreochromis mossambicus (Tilapia) and Clarias gariepinu s(Thai magur). These species should be thoroughly eliminated from the culture system as well as from natural water bodies so as to safe guard our indigenous varieties

Integrated Fish Farming

Fish culture with horticulture and animal husbandry especially fish cum pig farming covering 113.14 hectares and 67.31 hectares was undertaken in ARIASP. It is proposed to support integrated fish culture programme in 250 hectares of pond water area ranging from 0.15 to 0.40 hectares.

Waste disposal of Pig in ponds: Pig-fish integration is slowly gaining importance in many rural areas of the state. Pigs are not maintained hygienically. Concrete floor and other required facilities for the pigs to live and grow in a congenial environment are lacking in most areas. The pig dungs are directly dropped into the fishponds and no careful monitoring system is followed. In some areas, the fishpond water quality has been deteriorated due to excessive amount of pig droppings. The pond water loses it's aesthetic value and some people also reported itching all over the body when they get into the pond for undertaking managerial works and fishing.

Capacity Building of Farmers

As part of AACP, Extension Education through training and demonstration is the most important component of any production system. Awareness camps seminars and workshops will be conducted at different administrative levels to disseminate technologies and sensitise farmers and rural people to issues and thereby motivate them to adopt scientific pisciculture

Improper Replication of Knowledge: It was reported by the Department officials both at Guwahati and at the districts that some of the farmers are replicating the model suggested by the department without proper training or understanding of the implication of the interventions, which can have serious consequences.

4.4 RURAL ROADS

Site visits conducted as part of the study have enabled identification of environmental and social issues. Since the corridors chosen for field visits are in different stages of project, observations at various stages are made. It is observed that most of the lacuna is in construction stage, due to poor / inadequate project preparation. The environmental findings during all stages of the project are:

Scheduling of Construction

Most of the delays in completion of construction with in the stipulated time frame is due to overlooking the likely delays resulting from unsuitable weather conditions. It is observed that set time frame did not consider known risks as set of monsoon, flooding and other factors as harvest season, non-availability of labour in harvest season, non-availability of material in certain seasons etc.

Conservation of top soil

The soil throughout Brahmaputra Valley is very fertile. Top layer of the soil is being used for raising the embankment leading to loss of topsoil. More serious loss of topsoil is evident when the farmer try to level their field by towing in soil into the borrow trenches thereby losing the fertile layer containing residues of the fertilizers used. Usually villagers donate the soil from their agricultural land up to maximum one-meter depth. PWD officials are also not aware of the topsoil conservation

Extraction of Water for construction especially in Hailakandi and North Cachar Hills

Water is a scarce commodity in the region of Hailakandi and North Cachar Hills. The availability of ground water varies across regions and the water table is very deep in these regions. The contractor obtains water for construction from community sources or private wells/tube well owners. In corridors close to major water sources as dams etc., water is procured from the dam reservoir.

Tests as per the project guidelines are conducted for validating the physical parameters such as hardness etc. Most of the water is obtained either from local village sources or transported by tankers. No deterioration of water quality in the water bodies along project corridors is evident.

Cross drainage, road side drainage inadequacy and water logging

The inadequate drainage mechanism results in obstruction of natural drainage pattern. The inadequate drainage mechanism results in obstruction of natural drainage pattern. The problem is further exaggerated in the low-lying region and natural flood plains receiving high intensity rainfall, which can result in instability of embankment, damage to pavement, sinking of foundation, soil erosion, safety hazards and disruption in traffic.

Construction or upgradation of CD structures: The widening or construction of new road leads to the cutting of trees of the surrounding area.

Water Bodies

Upcoming of road adjacent to or passing through water bodies likely to cause following impacts:

- Catchment area of the water body
- Drainage system
- Flood level and water logging
- Flora and fauna dependant on the water body
- Ground water recharging
- Animal husbandry as water bodies are used by animals
- Runoff (increase/decrease)

Road construction activities adjacent to the water bodies too adversely impact the water quality as well as run off due to the movement of vehicles, equipment and machines, waste disposal and removal of vegetation from bank of the pond. Almost in all road visited there exists a lacuna in site preparation

Erosion and Flooding

All the roads visited in flood prone areas of **Brahmaputra valley and Barak Valley**, it is observed that during the selection of roads, no consideration is given on identification of flood and submergence areas. Apart from that no due consideration are given on the contour map, duration of flood, velocity of floodwaters, etc. while finalizing the alignment.

Many of the roads visited in these areas are having high embankment with either no slope protection or are improperly maintained. This results into failure of embankment (eroding of slopes).

The poor site condition and improper stacking of material at the time of construction might cause washing of construction material due to the flood that results into water and soil contamination.

Affect on Agriculture Land

It is observed there is considerable quantity of topsoil loss either due to the upcoming of road, procuring of materials (borrowing of earth, construction of haul roads, etc. near or on the agriculture fields. After the completion of the work these places are left as it is without nay restoration, which further worsens the situation in many of the places, visited.

Tree cutting and absence of aforestation

The widening or construction of new road leads to the felling of trees in many roads visited. It was observed due consideration is not given on minimization of tree felling during alignment finalization. During the project preparation stage no roadside plantation plan was made in any case that leads to haphazard plating of trees. It is observed that there occur lack of awareness among the community for planting and maintaining the planted species. There occur lacunas in implementation framework for tree plantation.

Induced development and change in Landuse

Providing new connectivity to presently unconnected habitations will invariably bring these habitations into mainstream of development. Along the roadside, there would be proliferation of commercial establishment, increase in surrounding land values, increase of other infrastructure facilities, change in landuse from agriculture to non-agriculture uses etc. This facilitates ribbon development.

Affect on Roadside Assets

All the assets such as wells, tube-wells, water-tank, and hand pump; electric poles, etc. are retained as far as possible through geometric modifications. Only concerns observed was that at no places community consultations or community concerns were incorporated wherever these are impacted due to the upcoming of road

Debris Disposal

Construction debris is generated during various activities in pre-construction and construction stages. The construction waste generated is haphazardly dumped around the construction area. This causes clogging of drains and resultant water logging along with unaesthetic appearance at the site. It is observe at many locations, at construction precincts, their lies extraneous material all around creating untidy condition which concerns health and safety of community living or moving near by.

Ambient Air and Noise Level

No major concern of air or noise pollution was observed in all the roads visited. Except at the location of hot-mix and crusher, there exists a lacuna in compliance with legal provisions.

Movement of vehicles and equipment, generator operation, etc. especially near settlement causes some nuisance due to noise.

Occupational health safeguards of workers, traffic safety and public safety during construction

Addressal of safety aspect in any of the project stages is either completely absent or is deficient in few areas. Almost at all roads visited no adequate attention is given on site preparation. As in most of the locations, new connectivity is being undertaken; traffic safety was not a major

concern. However, the risk increases with the formation of embankment or on laying of grade I, when public begin to move causing a traffic as well as public safety issue. These aspects have not been given attention as desirable.

Road with 1 km of sensitive areas[20]

Of all the roads visited in within 1 km of sensitive areas, nowhere roadside inventory of ecological features (such as Area of natural habitat, Type and number of endangered species of flora and fauna, Stream and water bodies, Breeding ground and seasons, Migration season of bird species, Animal crossing, etc.), nature and type of impacts neither were incorporated in Detailed Project Report (DPR) nor any Natural Habitat Plan was prepared. At some places considerations are being given to road geometric restricting the road width and the embankment height to minimize the uptake of land, quantity of material and tree felling in these areas.

It is analyzed that at the time of scheduling the construction activities, no consideration is given on time of migration, time of crossing, breeding habits, etc.

Summary of Environmental Issues

The sections below present a sectorwise account of the impacts of each of the intervention.

4.5 AGRICULTURE & IRRIGATION

The interventions in agriculture aims to provide infrastructure not only for increasing agriculture production but also providing linkages for marketing and value addition. Environmental issues are provided in Table 4-5.

Table 4-5Intervention, Issues & Environment Codes of Practice in Agriculture

INTERVENTION	ISSUES
Horticulture Activity	
Installation of STW/ DTW / RLP	Concentration of STW
	High Concentration of iron & Flouride
Establishment of Agriculture Service Centre	Site Selection
Preservation, promotion of medicinal plants	Cultivation& Collection of Medicinal Plant
	Extraction from Medical Plants
Crop Diversification	Improper & Increased in use of Chemical Fertiliser
	Improper and Increased use of Pesticides
	Loss of Germ Plasm
Development of Marketing & Storage Infrastructure	Site Selection
Mechcanisation of Agriculture	
Land Development	Site Selection

4.6 FISHERY DEVELOPMENT

Fishery development targets sustainable increase in fish productions and improve in the quality and quantity of stock. Issues that resulted from implementation of these interventions are presented in Table 4-6.

Table 4-6: Intervention, Issues & Environment Codes of Practice in Fishery Development

INTERVENTION	ISSUES
Increase in Coverage of Community Tank & Farmer Ponds	Farming on pond bed
	Water Quality
Development of Beels	Use of Pesticides during Cultivation on the fringes of beels
	Over-exploitation of Beels

[20] Sensitive Areas includes National Park, Reserve / Classified Forest, Open Forest, Sanctuaries, Ramsar Sites and Fisheries and Aquatic Habitats

INTERVENTION	ISSUES
	Encroachment of water Channel connecting beels
	Unsustainable use of beels
	Introduction of Exotic Species
Promotion of Private Seed Producers	Brood Stock not Maintained
	Infrastructure not scientifically Designed
	Immature fishes used for breeding
Development of Marketing Framework	Site Selection

4.7 ANIMAL HUSBANDRY AND DAIRY DEVELOPMENT

Interventions are aimed at improving the genetic line of the livestock population and thereby increasing production. Issues identified in the codes of practices are presented in Table 4-7.

Table 4-7: Intervention, Issues & Environment Codes of Practice in Animal Husbandry & Dairy Development

INTERVENTION	ISSUES
Artificial insemination Activity	Waste Disposal from AI Centre
Promotion of Dairy, poultry Activity	Waste Disposal from dairy & poultry activity
Strengthening of Veterinary Dispensary & Hospitals	Waste Generated from Veterinary Infrastructure
Marketing of Dairy, poultry produce	Waste Discharge from Processing Units
	Site Selection

4.8 RURAL ROADS

Improvements to productivity in the sectors of agriculture, horticulture, fishery, animal husbandry, dairy and poultry will generate produce that is highly perishable. This requires not only improvements in marketing facilities but also improvements in accessibility of the production centres to the marketing centres. This raises the demand for improvements to the road network, which involves improvements to the existing network and/or construction of new rural roads. Issues identified are presented in Table 4-8.

Table 4-8: Intervention, Issues & Environment Codes of Practice in Rural Roads

INTERVENTION	ISSUES
Road Construction	Incorporation of environmental concerns in project preparation to avoid impacts in construction and operation stages Avoidance of roads through sensitive areas as reserved forests/sanctuaries/wetlands etc Compliance with legal requirements Devising enhancement measures into project design
	Relocation of utilities, common property resources and cultural properties Avoidance of affect on roadside vegetation
	Avoidance of sensitive areas for location of construction camps Infrastructure arrangements for workers and construction equipment
	Minimising earth requirement
	Avoidance of agriculture lands Redevelopment of borrow areas
	Topsoil removal from areas temporarily/permanently used for construction Storage of topsoil in stockpiles and protection from erosion Reuse of topsoil at areas to be revegetated and in agriculture lands
	Redevelopment of quarries in case new quarries are setup for the project
	Extraction of water in water scarce areas with consent of community
	Slope stability along hill roads Protection of land on hill side from stability loss due to cutting Protection of lands on valley side from debris due to construction Adequacy of drainage for erosion control
	Reuse of cut material in hill roads Safe disposal of wastes
	Avoidance of impacts due to project Protection of precincts from impacts due to construction Relocation in case impacts are unavoidable
	Avoidance of impact on trees Encourage growing of trees on roadside
	Restricting ribbon development at junctions and bus stops Earmarking areas for commercial activities and other amenities

Construction of Bridges, Pipe Culverts, Pre-fabricated box Culverts, vented Causeways	Avoidance from cutting due to alignment Protection of embankment slopes in case of alignment on embankments Rehabilitation of water body
	Conduct of hydrological investigations during project preparation Provision of longitudinal and cross drainage as per requirements Proper location of drainage outfall
Maintenance of Road Construction equipment	Compliance of construction plants and equipment with emission standards of Central Pollution Control Board Maintenance of machinery and equipment to avoid pollution
	Provision of Personal Protective Equipment to workers Provision of basic necessities to workers Public safety while travel along construction sites Public safety during operation of the road

5. Wetland Biodiversity and its Issues

6. Khaoi: Deep drains like structure with in a wetland or a dry land (both natural and man made)(seasonal water logged areas).
7. Beel: these are bigger; Duba, Pitoni, Dalani and Khaoi may be present within the beel. Open water constitutes a major portion of the water surface. It is mainly natural. (Combination of larger tanks, swamps and marshes and reservoirs)

Biodiversity strength differs in each of the wetlands. Moreover, the faunal/floral diversity has a distinct bearing on the geographical location of the wetland system. There some wetlands which are the site of high species diversity on one hand and on the other hand there are wetlands which has got very poor setup for life support systems, hence less biodiversity. Although all wetlands has its own value in terms of socio-economic aspects but in terms of biological diversity they are all not equal All these wetlands cannot get equal weightage for biodiversity conservation priority. Hence, there will have to be some prioritization of the wetlands.

To get a first hand idea about the biodiversity of the wetlands in different zones[26] of Assam, (Brahmaputra valley) six wetland, two from each zone has been selected based on the following criteria from each of the zones:

- One of them with high human interference
- Other with very low human interference.

Wetlands identified for Case Study are presented in table 5.1. Survey of all wetland these six wetland were conducted as part of the study.

Table 5-1: Wetlands surveyed in different regions for AACP

Region	Category	Name of the Wetland
Upper Brahmaputra Valley	Good biodiversity (broadly undisturbed)	Magur beel
	Low biodiversity (disturbed)	Motapung beel
Karbi Anglong Plateau	Good biodiversity (undisturbed.)	Deo-bali-jola
	Low biodiversity (disturbed, with fishery activity)	Mori-kalong
Lower Brahmaputra valley	Good biodiversity (undisturbed)	Sareswar beel
	Low biodiversity (disturbed)	Dhir beel

The biodiversity of these beels have been evaluated with the help of few major indicative taxa I) Birds, ii)fish, iii)angiosperm, which has been recognized as the total biodiversity indicator of the wetlands. The rationale for using these as indicator species are presented in Box 5.2.

[26] To assess impacts of different intervention the state of Assam has been divided into four zones namely i) Lower Brahmaputra valley ii) Upper Brahmaputra Valley iii) Karbi Anglong Plateau iv) Barak Valley

Box 5.2: Rationale for using birds, fishes and angisperms as indicator species.....

BIRDS

- Different bird groups prefer distinctly different micro-habitat and niche separation is clear,
- the food and nutritional requirements of each group are very different.
- they are attracted to a specific site only if welfare factors are abundant and also can leave the site when the specific requirements are wanting.
- They are broadly euro-phagic, and live on diverse food items within the genetical boundary of the species.
- They broadly utilize the surface of the wetlands, and do not come in conflict with any other group.
- Beaks and legs are modified to use the species food resources .

FISHES

- under surface faunal group
- taxonomic diversity- at genus level show diversity in food preference.
- occupy different depth, including benthos fauna
- live on micro-organisms of diverse taxonomic characteristics

ANGISPERMS

- evolutionary higher group.
- occupy more surface area
- diverse nutritional requirements
- diverse pollinator
- can support a large number of micro-fauna and flora

The phytoplankton and zoo-plankton are the baseline food chain components, and primary energy source for a large number of fauna but have not been taken as indicator species. They are diverse in character and also require a variety of nutritional component from water. They are also very sensitive to changes. Seasonal changes both in terms of species diversity as well as on population have been recorded.

Higher groups by and large do not select specific plankton while feeding. The planktons and benthos fauna are diverse. Minor structural differences are part of the key for identification of the species. There are seasonal variations in species diversity as well as population.

Hence, biodiversity study at the microorganism level at species and population requires a lot of time and labour to provide the authentic information. The population status of individual species could offer only the partial primary production status. The species found in these six wetlands is presented as Annexure 5.1.The higher taxa can thus; act as a better indicator of the biodiversity. One the basis of the biodiversity, species richness and information of the physical factors of the wetlands, wetlands have been graded.

5.4 GRADING OF WETLANDS

Comparative Biological Value has been evaluated based on Ranwell's semi-quantitative Index for Comparative Biological Value (CBV). The Comparative Biological Value has been calculated on the basis on the modified methods (Usher, 1986). The gradation of the wetland is done on the basis of the value calculated.

One the basis of the biodiversity and species richness information and with the physical factors of the wetlands, one can use the CBV of the site. The Methodology for calculation is presented in Box 5.3. Normally if the value is high then those wetlands are expected to be considered as the SSSI (**Site Of Special Scientific Interest**).

Box 5.3: Calculation of CBV value of Wetlands

Value on the basis of Ranwell's Semi-quantitative Index for Comparative Biological value(CBV) (modified)

Size (S) , diversity (D), geographical limits(G), Potential for educational research (E), combination value(C), unknown factor (X).are the characteristics taken for evaluation. Here,the Diversity(Dn) expanded as D1, D2 etc for explaining the species diversity. Value between 0-5 in each factor has been taken as range..

Tentative CBV rating : S + D1 + D2 + D3 +Dn +G + E + C + X (5 point each) S: size; D1: bird ; D2: fish ; D3 : angiospem ; Dn : population of all Ds ; G: geographical limits; E: educational research ; C: combination value ; X : unknown factor. (equal valuation of 5 has been allotted, as of now). **Example:** Central Assam; Data: Deo-bali-jhola (complex):Birds: 101 species (including both residential migratory species) 7 RDB species; Angiosperm : 20 species and few key stone species trees (Ficus sp); and Fishes : (appx) 25 species.

As per above formulae CBV Value is 35

The scoring is done based on above parameters and if the score is above 30, then the wetland will be placed in Grade I; 15-30 the wetland in Grade II and Below 15 the Wetland in Grade III. Criteria for Grading wetland into three categories are presented in Table 5.2.

Table 5-2: Categorisation of Wetlands

Category of Wetland	Criteria
Grade I(Site Of Special Scientific Interest)	Wetland must have very high number of species of diversity of different taxa, with appreciable population.
	It harbors RDB (Red data book species) of higher taxa (birds, mammals etc), Or endemic species of birds, mammals, fish or amphibian or aquatic angiosperm, or till date recognized endangered of any taxonomic group.
	Wetland which is large enough to support the species diversity, with presently and in near future do not show any indication of developmental or anthropogenic threat. Or small area wise but support the category (b)
	It may be unique in the district or in the region, with regard to ecosystem functioning
Grade II (Wetland of scientific value). These wetlands are representative of a specific area.	It must be large enough, to support the high biodiversity at species level .
	Have any one of the RDB species of higher taxa, or endemic species whose survival and population buildup could be supported by the wetland.
	It do not show any indication of developmental or anthropogenic threat, as of now or in near future.

Category of Wetland	Criteria
	It must have all good physical and ecosystem dynamics indications, like inflow and outflow, to be a elevated to higher grade.
Grade III (Wetland of less or no scientific value)	This covers wetlands that came under commercial fisheries, or over exploited for a long period of time. These have been systematically degraded by human activities and less chance of recovery. These could also be designated as ecological slum.

CBV values have been calculated for all the six beels surveyed and they have been graded using the above criteria. The CBV and the grades of each of the beels are provided in Table 5.3.

Table 5-3: Grading of Case Study Beels

Beel	CBV	Grade
Deo-bali-jhola	35	Grade I
Morakolong	15	Grade III
Sareswar beel	32	Grade I
Dheer	28	Grade II
Magur	31	Grade I
Motapung	19	Grade II

5.5 ISSUES IN WETLANDS

Issues identified through the case study of beels have been classified under the following:

- Ecological
- Administrative And Legal
- Anthropogenic And Cultural

Issues in Individual Beels are provided in Table 5.4.

Table 5-4: Issues in Case Study Beels

Parameter	Magur	Motapung	Deoball jola	Mori kolong	Swareshwar	Dheer
ECOLOGICAL						
Use of Pesticide	✓	✓				
Eutrophication			✓			
Over Exploitation			✓		✓	✓
Degradation				✓		
Change in species Composition					✓	
ADMINISTRATIVE & LEGAL						
Revenue Land	✓	✓	✓	✓		
Lease			✓		✓	
Mismanagement					✓	
Agriculture in Fringes						✓
Revenue Land	✓	✓	✓	✓		
Lease			✓		✓	

Parameter	Maguri	Motapung	Deoball jola	Mori kolong	Swareshwar	Dheer
Mismanagement					✓	
Agriculture in Fringes						✓
Revenue Land	✓	✓	✓	✓		
ANTHROPOGENIC						
Agriculture	✓	✓			✓	✓
Poisoning of Fishes		✓			✓	
Extensive Use of Pesticides			✓	✓	✓	
Clearance of Vegetation & Collection of reeds			✓		✓	
Encroachment			✓			
Irrigation			✓		✓	
Brick Industry					✓	
Over exploitation of Fish resources						✓

Source: Primary Survey, LASA

5.6 IMPACTS ON WETLANDS

The issues identified are likely to have both ecological and economic impacts. The impacts that are likely are:

- Loss of economically and ecologically viable species
- Loss of endangered and endemic species
- Loss of the productivity of the wetland
- Lesser number of migratory birds
- Lesser number of residential birds, breeding sites
- Change in the community composition of the fish fauna
- Change in the vegetation composition
- Reviving the health of the wetland become increasingly difficult

ANNEXURES

ANNEXURE 1.1: FIRST ROUND STAKEHOLDERS CONSULTATIONS

MINUTES OF MEETING

Date: 25.02.2004 **Venue:** Office of Project Director

Participants

- Dr. Ravi Kota (IAS), Project Director, ARIASP Society
- Dr. Satyendra Singh (IFS), Environment Specialist, ARIASP Society
- Director of Animal Husbandry, Animal Husbandry and Vertinary Department, Govt of Assam
- Nodal Officer (Animal Husbandry), ARIASP
- Director of Dairy Development, Department of Dairy Development, Govt of Assam
- Director of Fisheries, Department of Fisheries, Govt of Assam
- Nodal Officer (Fisheries), ARIASP Society
- Nodal Officer (Agriculture), ARIASP Society.
- Mr. Rahul Singh, LEA Associates South Asia Pvt Ltd.
- Mr. Avijit Ghosh, LEA Associates South Asia Pvt Ltd.

The meeting was preceded over by Dr. Ravi Kota (IAS), Project Director ARIASP Society. Salient points of the discussion are:

1. Selection of districts for site visits:

It was decided that the state would be sub-divided into four regions for the purpose of the study. The study team would visit one district with interventions from all the sectors in each region. The districts selected for the site visits are Barpeta in Lower Assam; Darrang in central Assam; Jorhat and Golaghat[1] in upper Assam; Cachar in Southern Assam.

The schedule of the site visit was finalised and it was decided that the consultants would take up discussions on sector wise interventions in the state with nodal officers of the departments.

2. Discussion with Departments:

a. Department of Fishery

The discussions with nodal officers are as follows:

- It has been reported that carcinogenic substances has been found in fishes in some of the districts of state.

[1] The Golaghat district has been selected to see the interventions in the fishery sector.

- It has been informed that the degradation of beels is due to weeds infestation, silt inflow clogging of water channels. The interventions taken up are Cleaning of beels, stopping of silt infloation, Channel development of the beels.

- The problem of ownership of the beels has also been discussed. The ownership of the beels is with the revenue department and transfer it fishery department for fishery development is lacking.

- Traditional fish feeds are being used. Dry Fishmeals could not be used due to the financial constraints.

- It was also highlighted that problems associated with fishery are over exploitation of resource. And lack of training of the farmers and the official.

b. Department of Agriculture

The discussions with nodal officers are as follows:

- The interventions taken in the ARIASP-1 is the agriculture mechanisation, which involves setting up of shallow tubewells and distribution of tractors and power trillers.
- It was reported that the use of fertiliser and pesticide has increased in past 5-6 years. And it has been attributed to the fact that the use of the fertiliser and pesticide has gone up in area with STW.
- It was also reported that the cultivated area has increased in recent past.
- It has been reported that around 20000 hectare of wetland/Marshy Land/Swamps in 23 district of the state will be taken up for agriculture use. How ever the exact site for this purpose is not yet finalised.

c. Department of Animal Husbandry and Veterinary Sciences

The discussions with nodal officers are as follows:

- The intervention during the first phase has been briefed.
- It has been reported the mode and mechanism of transportation of crayo canes to the AI centres. The crayo canes returned from AI centre does not contain any residual liquid.
- The defunct crayo canes neither contain mercury nor any heavy metal.
- It was reported that the empty bottles of the vaccines are brought back to the Institute of veterinary sciences. The bottles are treated and disposed on the composite municipal site or reused.

- It has been further discussed about the breeding policy of the state. It was reported that till date only 2% of the animal are crossbreed against the government policy of 20%.
- It was reported that hybridisation is maximum 63:37 instead of 75:25 as per the breeding policy to have more resistant variety of hybrid to local climatic conditions.
- As part of the project only backyard poultry with 10-15 local birds are being encouraged.

d. Department of Dairy Development

The discussions with nodal officers are as follows:

- It has been reported that no intervention has been proposed in ARIASP. The integrated dairy development project has been undertaken. The dairy cooperative movement has been initiated in Jorhat, Silchar and Guwahati. In Jorhat and Sichar the movement has failed. In Guwahati the organised dairy cooperative has been functioning.
- The unorganised sector has been the main supplier of milk through out the state.
- The meat processing plant is being established to handle 1500 sheep and goat and 100pigs per day. Though this is not a part of AACP, consultants were asked to visit it.

MINUTES OF MEETING

Date: 26-27 February 2004 **Venue:** Circuit House, Mangaldai

Participants

- Additional District Commissioner, Darrang
- District Veterinary Officer, Darang
- District Dairy Development Officer, Darrang
- District Fishery Development Officer, Darrang
- District Agriculture Officer, Darrang
- Executive Engineer, Irrigation Department, Darrang
- Nodal NGO, ARIASP, Darrang
- Dr. Satyendra Singh (IFS), Environment Specialist, ARIASP
- Dr. S.K. Das, Consultant (Fishery), LEA Associates South Asia Pvt Ltd.
- Mr. Rahul Singh, LEA Associates South Asia Pvt Ltd.
- Mr. Avijit Ghosh, LEA Associates South Asia Pvt Ltd.

The meeting was presided over by Additional District Commissioner, Darrang. Salient points of the discussion are:

1. Discussion with Departments:

a. Department of Fishery

The discussions with district officers are as follows:

- Problem of inbreeding and cross breeding has been reported.
- No new disease has occurred.
- Pollution of water in fishponds is not an issue as semi intensive fish culture is practised.
- Breeders did not maintain the brood stock.
- Rice brain and oil cake has been used as a feed.

b. Department of Agriculture

The discussions with district officers are as follows:

- It has been reported that the concentration of tubewells are in Doalgaon, Shipajhar, Purb Mangaldai, Paschim Mangaldai, and Koilagoan.
- The depth of shallow tubewells is 20-30m and distance between two tubewells is 100m.
- Two to four crops are grown of which two are rice crops and others are pulses, mustard and vegetables.
- Hybrid varieties of rice are replacing the local varieties. Local varieties are also not grown in government farms.

- Pesticides used are Melathion, Fumethion, Diethone, Thiodin and endosulphone.
- Diseases are mainly neck blast and leaf spot.

c. *Department of Animal Husbandry and Veterinary*

The discussions with district officers are as follows:

- Average numbers of cattle per household are 3-4.
- Usually open grazing is practised. However hybrid animals are stall feed.
- Cow dung is used as manure.
- No new disease has been reported.
- Kakhi cambel is reared for duck cum fish culture.

After the meeting with district officials the study team has visited intervention sites. The team has discussion with field staffs, local farmers and members of field management committee. Salient points of the discussion are:

1. **Discussion with beneficiaries:**

a. *Sonali Field management Committee, Bandiya, Mangaldai, Darrang*

The discussions with Member of Committee are as follows:

- Earlier it was a mono crop area; with introduction of STWs the cropping intensity has increased to 3 crops per year.
- Vegetable crops have been introduced with improved irrigation infrastructure.
- Intensive use of pesticide in vegetables has lead to the pest being resistant to the pesticides.
- The fertilisers are not applied in appropriate composition.
- No soil test is carried out for assessing nutrient level in soil.
- Lack of marketing and storage infrastructure.

b. *Futki Hatchery, Bordalguli, Mangaldai, Darrang*

- The farmer was aware of ill effects of cross breeding and inbreeding.
- The farmer was not conversant with good practices of fish breeding.
- It was informed that the farmer has increased the size of fishpond to increase the brood stock.

c. *Shipajhar, Duck farm, Mangaldai, Darrang*

- Droppings are washed and drained into the nearby depressions.
- No bed material was observed.
- Vaccination is carried out every six months. One voil of vaccine is used for 100 ducks.
- No new diseases have been reported.
- Disinfectant was placed at the entrances.

d. Kacharidal Beel Development Committee

- There are 452 beneficiaries of which 305 are from BPL category and 147 belong to APL category
- The beels had degenerated as the channels carrying water into the beel was blocked by the embankment of the village road. The Kacharidal Beel Development Committee had developed four tanks for fish culture.
- Five major carps are reared.
- Natural rainwater is collected into the beel run off is not allowed to enter the beel.
- Rice bran and oil cake is used as fish feed no other formulated feed is used.
- No major out break of disease has taken place. EUS (*Epizotic Ulseritic Syndrome)* is the only disease, which has occurred in the fish stock and is prevalent in the area. Since 1988.Traditional medicines like paste turmeric powder and lime has been used.

e. Pakaridal Lift Irrigation Scheme

The scheme has been developed as part of ARIASP with the involvement of the Nodal NGO. The salient points of discussion are presented below:

- The area is single cropped with development of irrigation facility the multiple cropping would start.
- Command area of the irrigation scheme is 80 ha. 440 m of underground pipe line has been laid for distribution with the involvement of beneficiaries.

f. Intergraded Dairy Development Project, Pureban

The Pureban Co operative Dairy, with was developed as part of the Integrated Development Project, a centrally sponsored scheme. The cooperative dairy has 15 crossbred animals.

- The waste (cow dung) was collected and dumped in the open ground. This was later collected by farmer and used as manure.
- The animals are resistant to disease there has been no major outbreak of disease but FMD has been reported but the intensity of the disease is poor.
- Milk was sold to local vendors at Rs 15/kg.

g. Dolagoan Veterinary Dispensary

- As a practice the veterinary doctor visits the farmers for treatment of animals. The animals are rarely brought here for treatment.
- Only major operations are conducted here. Organised disposal system was not observed but it was reported the body parts are disposed by deep burial.
- Quantification of the volume of waste was not possible but approximately 4-5 kgs. of wastes are generated per month mainly containing used vaccine bottles, syringes etc. These are dumped in an open pit.

- Other wastes generated like straw are disposed on open ground surrounding the Veterinary Center.

h. Deep Tubewell Irrigation System, Bhudan

- With development of irrigation 3 crops have grown, 2 crop of rice and one vegetable crop is grown.
- Inorganic fertilizers are used along with organic manure.
- It has been reported that inadol and indosal are the pesticides, which are mainly used.
- Resistance to pesticides has been observed for the past three years.

MINUTES OF MEETING

Date: 29 February-1 March 2004 **Venue:** Circuit House, Barpeta

Participants

- District Commissioner, Barpeta
- District Veterinary Officer, Barpeta
- District Dairy Development Officer, Barpeta
- District Fishery Development Officer, Barpeta
- District Agriculture Officer, Barpeta
- Executive Engineer, Irrigation Department, Barpeta
- Nodal NGO, ARIASP, Barpeta
- Dr. S.K. Das, Consultant (Fishery), LEA Associates South Asia Pvt Ltd.
- Mr. Rahul Singh, LEA Associates South Asia Pvt Ltd.
- Mr. Avijit Ghosh, LEA Associates South Asia Pvt Ltd.

The meeting was presided over by District Commissioner, Barpeta. Salient points of the discussion are:

1. Discussion with Departments:

a. Department of Fishery

The discussions with district officers are as follows:

- Problem of inbreeding and cross breeding has been reported.
- Growth of Rohu is 800gm per year and Catla is 1.2kgs per year which less than the expected.
- No new disease has occurred.
- Care of brood stock is of concern. Breeders did not maintain the brood stock. The brood stock is collected from fish farmers.

b. Department of Agriculture

The discussions with district officers are as follows:

- Two to four crops are grown of which two are rice crops and others are pulses, mustard and vegetables.
- Hybrid varieties of rice are replacing the local varieties.
- Pesticides used are Ustad, Rogor, Melathion and Di-Methyene.
- Diseases are mainly neck blast and leaf spot.

c. Department of Animal Husbandry and Veterinary

The discussions with district officers are as follows:

- Usually open grazing is practised. However some dairy cooperatives are formed in 5-10km radius of Barpeta town.
- 80-100kg of waste is generated for unit of 3 animals. Cow dung is presently used as manure.
- No new disease has been reported.

After the meeting with district officials the study team has visited intervention sites. The team has discussion with field staffs, local farmers and members of field management committee. Salient points of the discussion are:

1. Discussion with beneficiaries:

a. Fish Seed Producers Association, Barpeta road, Barpeta

The discussions with Member of Committee are as follows:

- Insufficient brood stock leading to the collection of the brood stock from the fish growers.
- Crops are grown on the bed of the pond during winter season to augment income.
- The license has been issued to the fish seed producers.
- Mass awareness about ill effects of farming with pesticides on tank beds has to be created.

b. Nawjagaran dairy farm, Barpeta

- 20 animals out which 15 are cross breeds of different blood lines.
- The waste (cow dung) has been dumped in the open ground at the rear side of the farm.
- The animal are resistant to disease there has been no major outbreak of disease.
- Milk was sold to local vendors at Rs 15/kg.

c. Prabati PPS FMC, Balabheta, Barpeta

- Cropping pattern is paddy-paddy-potato-vegetable.
- Pesticides used are Indofil, Rogor, and Tricell.
- Drinking water is collected from the shallow tubewells. The hand pumps used for collection of water are also installed on the first layer.
- Local variety of rice like Kalamani, Moinaguru has been replaced by high yielding varieties like Ranjit and Bahadur.
- Productivity as wells as the cost of production has increased.

i. Sarbhog Beel, Kumargaon, Barpeta

- This is one of the active beel. It is formed by diversion of Baki River with total water area of the 50 hectares.
- It has been leased to the lesse from Guwahati.
- The encroachment has been observed on the periphery of the beels. The activities are mainly agriculture, residential premises and roads.

j. Artificial Insemination Centre, Barpeta road, Barpeta

- As a practice the veterinary doctor visits the farmers for performing AI activities..
- Organized disposal system was not observed.
- After births are usually disposed by deep burial after disinfections at the farm itself.
- Other wastes generated like straw are disposed on open ground surrounding the AI Center.

k. Chilling Plant, Sarbhog, Barpeta

- No treatment and disposal of wastewater has been observed. The plant has been established in 2004 and mainly focusing on packaging of pasteurized milk.
- Hygienic practice has been maintained during packaging.

MINUTES OF MEETING

Date: 2 March 2004 **Venue:** Circuit House, Nagaon

Participants

- District Fishery Development Officer, Nagaon
- Field Extension Officer, Nagaon
- Member, Fish Seed Producers association, Nagaon
- Nodal NGO, ARIASP, Nagaon
- Dr. S.K. Das, Consultant (Fishery), LEA Associates South Asia Pvt Ltd.
- Mr. Rahul Singh, LEA Associates South Asia Pvt Ltd.
- Mr. Avijit Ghosh, LEA Associates South Asia Pvt Ltd.

The meeting was presided over by District Fishery Development Officer, Nagaon. Salient points of the discussion are:

1. Discussion with Departments:

a. Department of Fishery

The discussions with district officers are as follows:

- Problem of inbreeding and cross breeding has been reported.
- Productivity is low in composite fish culture.
- Semi intensive carp culture is only practiced.
- Rice bran and Oil cake are used as fish feed.
- Narbanga beel has been developed with involvement of the community.
- The beels land has been given on Miyadi Patta for agriculture.
- Nets are placed on the channels which turn hinders the natural conservation.
- Training is only organised on issues related to breeding of fishes and aquaculture.

MINUTES OF MEETING

Date: 3-4 March 2004 **Venue:** Circuit House, Jorhat

Participants

- District Commissioner, Jorhat
- District Veterinary Officer, Jorhat
- District Dairy Development Officer, Jorhat
- District Fishery Development Officer, Jorhat
- District Agriculture Officer, Jorhat
- Executive Engineer, Irrigation Department, Jorhat
- Nodal NGO, ARIASP, Jorhat
- Mr. Rahul Singh, LEA Associates South Asia Pvt Ltd.
- Mr. Avijit Ghosh, LEA Associates South Asia Pvt Ltd.

The meeting was presided over by District Commissioner, Jorhat. Salient points of the discussion are:

1. Discussion with Departments:

a. Department of Fishery

The discussions with district officers are as follows:

- Problem of inbreeding and cross breeding has been reported.
- An aquatic weed has been a problem resulting in fish mortality. Weeds are removed manually.
- Technical guidance is provided to the farmers through training.
- Manuring of fish ponds are done by adding cow dung, urea, suphur phosphate and multiplex.
- Care of brood stock is of concern. Breeders did not maintain the brood stock. The brood stock is collected from fish farmers.

b. Department of Agriculture

The discussions with district officers are as follows:

- Traditional varieties of rice are M.Sali, Jahaia, S.Sali, K. Sali, R. Sali, Joha, Bora and Sapoia. These varieties are being replaced by Bahadur and Ranjit.
- Use of chemical fertiliser has deteoriated soil quality.
- No soil test is done before applying fertilisers.
- Combinations of pesticides are used.
- Water table near urban areas has gone down.
- STWs are installed at 60-80 feet.

c. Department of Animal Husbandry and Veterinary

The discussions with district officers are as follows:

- Animal Husbandry is practised in the proximity of the Jorhat town.
- Training modules for farmers includes rearing, maintenance, treatment and precautionary measures for animals.
- Cross breed animals are 12000 whereas total livestock population is 4 lakhs.
- No new disease has been reported. Moreover the intensity of disease has remained constant.

After the meeting with district officials the study team has visited intervention sites. The team has discussion with field staffs, local farmers and members of field management committee. Salient points of the discussion are:

1. **Discussion with beneficiaries:**

a. Fish Seed Producers Association, Barpeta road, Barpeta

The discussions with Member of Committee are as follows:

- Insufficient brood stock leading to the collection of the brood stock from the fish growers.
- Crops are grown on the bed of the pond during winter season.
- The license has been issued to the fish seed producers.
- Mass awareness about ill effects of farming with pesticides on tank beds has to be created.

b. Dairy farm, Jorhat

- 25 animals out which 18 are cross breeds of different blood lines.
- The waste (cow dung) has been dumped in the open ground at the rear side of the farm.
- The animals were suffering from the FMD. The milk production of the farm has gown down from 250 litres to 125 litres.
- The dairy farms are concentrated near the urban centres.
- The milk distributions are done by the unorganised sector.
- Milk was sold to local vendors at Rs 15/kg.

c. Malokhat PPS FMC, Malokhat , Jorhat

- 34 STWs has been installed in 700 bigha under the FMC. The STWs are concentrated in the low-lying areas of the district along the river.
- Fertiliser consumption has increased.
- Moisture content of soil is high.

MINUTES OF MEETING

Date: 5 March 2004 **Venue:** Circuit House, Golaghat

Participants

- District Commissioner, Golaghat
- District Veterinary Officer, Golaghat
- District Dairy Development Officer, Golaghat
- District Fishery Development Officer, Golaghat
- District Agriculture Officer, Golaghat
- Executive Engineer, Irrigation Department, Golaghat
- Nodal NGO, ARIASP, Golaghat
- Mr. Rahul Singh, LEA Associates South Asia Pvt Ltd.
- Mr. Avijit Ghosh, LEA Associates South Asia Pvt Ltd.

The meeting was presided over by District Commissioner, Jorhat. Salient points of the discussion are:

1. **Discussion with Departments:**

a. Department of Fishery

The discussions with district officers are as follows:

- 273 projects in different category have been implemented.
- Beel development project has been taken up at Deragaon .
- Community pond development at Nargaon.
- Golaghat district has experienced multiplier effect in Fishery development. 400 community tanks and an individual tank have been developed in Merapari area with technical assistance from the department.
- The department maintains regular monitoring of fishery activity with the coordination from other department.
- The regular monitoring of hatcheries are done during the breeding season.
- The licensing of fingerlings is done based on the sustainable capacity of the fish seed producer.

b. Gulung Beel, Deragaon, Golaghat

- This is one of the beels developed with the citizen Government participation. It has total water area of 7 hectare.
- The beel management committee is known as Saru Samunoy Gulung Meen Palan Samvoy Samiti.
- The entire community of Mising tribes has been involved in management and development of beel.
- A legal literacy campaign was undertaken to educate the community about usufruct rights.

- The manual removal of peats and weeds are undertaken by community for restoration of beel.
- The community has been encouraged to grow vegetable crops, which require pesticide only on highland areas, which slopes away from the beel.
- The contribution of the community is in the form of labour.
- The bund has been constructed in selected areas take slopes into consideration to avoid inflow.

MINUTES OF MEETING

Date: 8 March 2004 **Venue:** Circuit House, Silchar

Participants

- District Commissioner, Cachar
- District Veterinary Officer, Cachar
- District Dairy Development Officer, Cachar
- District Fishery Development Officer, Cachar
- District Agriculture Officer, Cachar
- Executive Engineer, Irrigation Department, Cachar
- Dr. H. Pathak, Consultant (Agriculture), LEA Associates South Asia Pvt. Ltd.
- Mr. Rahul Singh, LEA Associates South Asia Pvt Ltd.
- Mr. Avijit Ghosh, LEA Associates South Asia Pvt Ltd.

The meeting was presided over by District Commissioner, Cachar. Salient points of the discussion are:

1. Discussion with Departments:

a. Department of Fishery

The discussions with district officers are as follows:

- Problem of inbreeding and cross breeding has been reported.
- Fish seed industry has been registered and licenses has been issued. But department has no control over fish seed producers.
- Mature fish are not used for breeding.

b. Department of Agriculture

The discussions with district officers are as follows:

- No assured supply of irrigation.
- STWs are also not feasible as water table during lean season is around 50 feet. The draw dawn is around 10-15ft.
- Yield of the tubewells is low ranging between 0.7 to 1.0 cusec.
- Fertiliser consumption has increased and is 57kg per hectare.
- Area under Sali paddy has increased.
- Area under Oilseeds and pulses has remained constant.
- Horticultural crops have been introduced.
- IPM has been started and the response is encouraging.
- Minor irrigation schemes have been implemented.
- Marketing of agriculture produce is a problem.

c. Department of Animal Husbandry and Veterinary

The discussions with district officers are as follows:

- Milk Production has increased with introduction of improved breeds.
- FMD is observed all through out the year instead of seasonal phenomenon. The severity of the disease has decreased.
- Hygienic measures are lacking.

After the meeting with district officials the study team has visited intervention sites. The team has discussion with field staffs, local farmers and members of field management committee. Salient points of the discussion are:

1. **Discussion with beneficiaries:**

a. Salpachar Lift irrigation at Ramnagar, Silchar, Cachar

The discussions with Member of Committee are as follows:

- Command area 35 hectares.
- Community has been involved in the restoration of the water body.
- Distribution system is through pipes and open channel.

b. Eco hatchery,at Kabuganj, Silchar, Cachar

The discussions with Member of Committee are as follows:

- The infrastructure is large enough to support the existing supply of brood stock for quality seed production.

c. Gungnur dairy farm, Silchar, Cachar

- 8 animals out which 6 are cross breeds of different blood lines.
- The waste (cow dung) has been dumped in the depression near the farm.
- The animal are resistant to disease there has been no major outbreak of disease.

Annexure 1.2: CHECKLIST FOR ASSESSING IMPACTS

CHECKLIST FOR FISHERY SECTOR

Culture Fishery

- What is the feed used for fishes?
- Is any high protein feed used?
- Is there any new disease, which has observed in fishes in the recent past?
- Is fishing tanks used for jute retting?
- Is the culture a permanent activity or are other activity taken up for maintaining livelihood?
- Is agriculture practices during the winter season?

Fish Breeding

- Is the number of brood stock sufficient for economical operation of infrastructure?
- When are the fry sold to the dealer/farmers?
- Are the brood stock replenished from the wild population?
- Is there any scheme to supply brood stock to the fish breeders?
- Is there a process of registration of the Fish breeders?

Beel Development

- Is the community involved in the development of the beel?
- Is the beel leased to the community?
- Are any civil works done to protect encroachment of the beels?

CHECKLIST FOR DAIRY PROCESSING

- Location of the processing Plant
- Land use of the surrounding area

Sources of Waste Generation

• Point of Collection of Milk	Y	N
• Storage and Processing of Milk	Y	N
• Cleaning of Plant and Equipments	Y	N

Handling , Management and disposal of waste

Solid waste
Liquid Waste/ Waste Water

Hygiene

Hygienic condition of preparation of product	Y	N
Hygiene of the Workers	Y	N

CHECKLIST FOR DAIRY FARM

Waste Collection and disposal process

Collection of Animal waste

- Is there a organised method of collection?
- How is the waste collected ?

Disposal of Waste

- Is there open dumping of animal dung?
- Is there any plant for composting in the district?
- Is there any bio gas plant working?

Reuse of Waste

- Is the waste reused?
- What is the purpose for which it is used

Medicine and Feed

- How frequently do the vertinary officials visit the site
- How many medicine bottle, syringes and injection voils are generated?
- How these bottles are disposed?
- What is the nature of feed?
- Where are the feeds stored?

Hygiene

- Are disinfectant placed at the entrance of dairy farm
- What are the practices for collection of milk?

CHECKLIST FOR VETERINARY SECTOR

- Location of the Veterinary Hospital
- Has any new disease been reported I animals which were born through AI?
- Have there been any symptoms of deteriorating health conditions of the animals?

Wastes

- Types of waste generated
    - Bio-medical waste
    - Municipal solid Waste
    - Liquid Waste/Waste water
- Constituents of the Waste
- Quantity of waste generated
- How are the Bio-medical wastes stored?
- Is there a process of disinfection of the waste?
- Is there a process to handle emergencies arising out of spillage of vaccines?

Disposal of wastes

- What is the system for disposal of the waste
- If no organised system exist how is it disposed?

CHECKLIST FOR AGRICULTURE SECTOR

1. Cropwise seed required for sowing in kg/hactare
2. Cropwise value of seed – Rs/kg/hectare
3. Land Cost – System for sharing of produce during each cropping season
4. Cost of residue (cropwise)(Rs/quintal/tones)
5. Net amount of pesticide (gram/kg active ingredient/hectare)
6. Yield rate of selected crop (kg/hectare)
7. Value of yield of selected crop (Rs/kg/hectare)
8. Cost of pesticide Rs/kg
9. Farm yard manure required cropwise (tones/hectare)
10. Chemical Fertilizer – Nitrogen (kg/hectare), Phosphate (kg/hectare); Potassium (kg/hectare).
11. Other chemical fertilizer used Zincsulphate (kg/ha); Lime (kg/ha)
12. Method utilized for plouging – Mechanical/Manual – Y/N
13. Tractor used for plouging – hour/hectare usage – Rs/hour
14. If sowing and harvesting is done Machine; then give the rates per hectare
15. Rent of bullock for sowing – Rs/hr
16. Manual labour involved – cropwise

a. Sowing – Male/Female involved

b. Cost of labour involved

c. Plouging – Male/Female

d. Cost of labour involved

e. Harvesting – Male/Female

f. Thrasing/segregation of final produce – Male/Female

h. Cost of labour

17. Price of (Rs/hectare)

Nitrogen, Phosphorus, Potassium, Human labour, Animal labour, Tractor, Farm Yard manure, Zincsulphate, Irrigation.

Annexure 2.1: Sensitive Areas in the State of Assam

Name (District)	Area in sq. Km.	Rare and Endangered Animals and Birds	Major Forest Types	Con. Sta.
National Parks				
1. Dibru-Saikhowa (Tinsukia, Dibrugarh)	340	Elephant, White winged wood duck, aquatic avifauna, feral horse	Tropical wet evergreen and tropical moist deciduous	B
2. Kaziranga (Golaghat, Nagaon, Sonitpur)	849.8*	Rhinoceros, Asiatic water buffalo, swamp deer, elephant tiger, florican, hoolock, and gibbon and capped langur.	Tropical moist deciduous	A
3. Manas (Barpeta, Bangaigaon)	500	Tiger, golden langur, pigmy hog, hispid hare, elephant, gaur, florican	Tropical moist deciduous	C
4. Nameri (Sonitpur)	200	Elephant, gaur, capped langur, golden mahseer	Tropical wet-evergreen and tropical semi-evergreen	A
5. Orang (Darrang, Sonitpur)	78.8	Rhinoceros, spot billed pelican, greater adjutant stork	Tropical moist deciduous	A
Wildlife Sanctuaries				
6. Bherajan-Borajan-Padumani (Tinsukia)	7.22	Primates	Tropical moist deciduous	C
7. Bordoibam-Bilmuks	11.25	Aquatic and migratory bird	Tropical moist deciduous	C
8. (Dhemaji, Lakhimpur)				
9. Barnadi (Darrang)	26.22	Pigmy hog, hispid hare, gaur, elephant, hornbill	Tropical semi-evergreen	B
10. Burhachapori (Sonitpur)	44.06	Tiger, water buffalo, elephant, rhinoceros, florican, resident and migratory aquatic bird	Tropical moist deciduous	B
11. Charasila (Dhubri, Kokrajhar)	45.56	Aquatic birds, golden langur	Tropical moist deciduous	A
12. Deepor beel (Kamrup)	4.14	Aquatic and migratory bird	Tropical moist deciduous	B
13. East Karbi Anglong (Karbi Anglong)	221.81	Elephant and gibbon	Tropical moist deciduous	B
14. Garampani (Karbi Anglong)	6.05	Elephant, gaur, hoolock gibbon, varieties of bird	Tropical moist deciduous	B
15. Holongapar Gibbon (Jorhat)	20.98	Hoolock gibbon, varieties of birds	Tropical semi-evergreen	A
16. Karbi Anglong (Karbi Anglong)	96	Elephant and hill birds	Tropical moist deciduous and tropical semi-evergreen	C
17. Laokhowa (Nagaon)	70.11	Rhinoceros, resident and migratory aquatic bird.	Tropical moist deciduous	C
18. Nambar (Karbi Anglong)	37	Elephant gaur, varieties of birds, hoolock gibbon	Tropical moist deciduous	B
19. Pabitara (Marigaon)	38.83	Rhinoceros resident and migratory aquatic bird	Tropical moist deciduous	A
20. Pani-Dihing (Sibsagar)	33.93	Resident and migratory aquatic and bird	Tropical semi-evergreen	B
21. Sonai-Rupa (Sonitpur)	220	Tiger, elephant hombill	Tropical semi-evergreen	B
22. Marat Longpi (Karbi Anglong)	452	Elephant and hill birds	Tropical moist deciduous	D

Grade I Beels	
Name of Distrcit	***Grade I Beels***
Kokrajhar	Mazbandar
Dhubri	Sareswas
	Dheer
	Dipali
Bongaigaon	Tamranga
	Dalani
Goalpara	Urpod
Barpeta	Kapla
Kamrup	Deepar
	Chandubi
Darrang	Botha
	Beelmukh
	Kotabali
	Jamgonj
	Bardoloni
Tinsukia	Dihing East
	Upper Dihing
	Daimari
Sibsagar	Panidihing
	Phoklai
Jorhat	Bheriki (Majuli)
	Dhakinpat (Majuli)
	Aunihati
	Wetlands
Nawgaon	Haribhanga
Karimganj	Son-beel

Annexure-2.2 National Parks and Sanctuaries

Sl.	Name	District	Size(sq. km.)	Year of establishment
National Parks (NP)				
1.	DIBRU-SAIKHOWA NP	Tinsukia and Dibrugarh	340.00	1986(WS), 1999(NP)
2.	KAZIRANGA NP	Golaghat, Nagaon and Sonitpur	430.00	1950(WS),1974(NP)
3.	MANAS NP	Barpeta and Bongaigaon	500.00 1	950(WS),1990(NP)
4.	NAMERI NP	Sonitpur	200.00	1985(WS), 1998(NP)
5.	ORANG NP	Darrang and Sonitpur	78.81	1985 (WS), 1999(NP
Wildlife Sanctuaries (WS)				
1.	BHERJAN-BORAJAN PODUMONI WS	Tinsukia	7.22	1999
2.	BORDOIbAM - BILMUKH WS	Dhemaji and Lakhimpur	11.25	1996
3.	BARNADI WS	Darrang	26.22	1980
4.	BURHACHAPORI WS	Sonitpur	44.06	1995
5.	CHAKRASHILA WS	Dhubri and Kokrajhar	45.56	1994
6.	DEEPOR BEEL WS	Kamrup	4.14	1989
7.	EAST KARBI ANGLONG WS	Karbi Anglong	221.81	2000
8.	GARAMPANI WS	Karbi Anglong	6.05	1952
9.	GIBBON WS	Jorhat	20.98	1997
10.	KARBI ANGLONG WS	Karbi Anglong	96.00	2000
11.	LAOKHOA WS	Nagaon	70.11	1979
12.	NAMBOR WS	Karbi Anglong	37.00	2000
13.	PABITORA WS	Morigaon	38.83	1998
14.	PANI-DIHING WS	Sibsagar	33.93	1999
15.	SONAI-RUPAI WS	Sonitpur	220.00	1998
16.	MARAT LONGRI WS	Karbi Anglong	452.00	in process

Annexure-2.3: Medicinal and Endangered Plants

Medicinal Plants of Assam			
Sl. No	**Botanical name**	**Family**	**Local name**
1	*Abelmoschus manihot*	Malvaceae	Usipak
2	*Abelmoschus moschatus*	Malvaceae	Gorokhia koroi
3	*Abroma augusta*	Sterculiaceae	Gorokhia koroi
4	*Abrus precatorius*	Papilionaceae	Latumoni
5	*Abutilon indicum*	Malvaceae	Pera petari
6	*Acacia catechu*	Mimosaceae	Khair
7	*Acacia pennata*	Mimosaceae	
8	*Acalypha indica*	Euphorbiaceae	
9	*Achyranthes aspera*	Amaranthaceae	Hatisur
10	*Acarus calamus*	Araceae	Bach
11	*Actinodaphne angustifolia*	Lauraceae	Petarichawa
12	*Adiantum capillus-veneris*	Adiantaceae	
13	*Aegle marmelos*	Rutaceae	Bel
14	*Ageratum conyzoides*	Asteraceae	
15	*Ailanthus altissima*	Simaroubaceae	
16	*Ajuga bracteosa*	Lamiaceae	Nilakantha
17	*Albizia lebbeck*	Mimosaceae	
18	*Albizia odoratissima*	Mimosaceae	
19	*Allamanda cathartica*	Apocynaceae	
20	*Allium sativum*	Liliaceae	Naharu
21	*Alocasia indica*	Araceae	
22	*Alocasia macrorrhiza*	Araceae	Boro mankachu
23	*Aloe barbadensis*	Liliaceae	Sal konwari
24	*Alpinia allughas*	Zingiberaceae	
25	*Alstonia scholaris*	Apocynaceae	Satiana
26	*Alternanthera sessilis*	Amaranthaceae	Mati-kanduri
27	*Altingia excelsa*	Altingiaceae	Jutuli
28	*Amaranthus spinosus*	Amaranthaceae	Khutura
29	*Amomum aromaticum*	Zingiberaceae	
30	*Amorphophallus campanulatus*	Araceae	
31	*Andrographis paniculata*	Acanthaceae	Sirata
32	*Anthocephalus cadamba*	Rubiaceae	Kadom

33	*Antidesma accuminatum*	Euphorbiaceae	Bor-heloch
34	*Antidesma bunius*	Euphorbiaceae	
35	*Antidesma diandrum*	Euphorbiaceae	Abutenga
36	*Antidesma ghaesembilla*	Euphorbiaceae	Heloch
37	*Aquilaria malacensis*	Thymelaeaceae	Agaru, Sasi-goss
38	*Areca catechu*	Arecaceae	Tamul
39	*Argemone maxicana*	Papaveraceae	Kuhum kata
40	*Argyria strigosa*	Convolvulaceae	
41	*Aristolochia tagala*	Aristolochiaceae	Belikol, chohu
42	*Artocarpus heterophyllus*	Moraceae	
43	*Asparagus racemosa*	Liliaceae	Satmul
44	*Atriplex hortensis*	Orache	Pahari palang
45	*Averrhoa carambola*	Oxalidaceae	
46	*Azadirachta indica*	Meliaceae	Mahanim
47	*Azanza lampas*	Malvaceae	Bon kapah
48	*Baccaurea ramiflora*	Euphorbiaceae	Leteku
49	*Bacopa monnieri*	Scrophulariaceae	Brahmi
50	*Baliospurmum montanum*	Euphorbiaceae	
51	*Barringtonia acutangula*	Barringtoniaceae	
52	*Bauhinia purpurea*	Caesalpiniaceae	
53	*Belamcanda chinensis*	Iridaceae	Surjakanti
54	*Bidens pilosa*	Asteraceae	
55	*Biophytum sensitivum*	Oxalidaceae	
56	*Blechnum orientale*	Blechnaceae	Dhekia
57	*Blumea lacera*	Asteraceae	
58	*Boerhavia diffusa*	Nyctaginaceae	Ponownua
59	*Bombax ceiba*	Bombacaceae	Simalu
60	*Borreria hispida*	Rubiaceae	
61	*Brassica juncea*	Brassicaceae	Lai
62	*Bridelia montana*	Euphorbiaceae	
63	*Butea monosperma*	Fabaceae	Palas
64	*Byttneria grandiflora*	Sterculiaceae	Tikani barua
65	*Caesalpinia bonducella*	Caesalpiniaceae	
66	*Callicarpa arborea*	Verbenaceae	
67	*Callicarpa longifolia*	Verbenaceae	
68	*Calotropis gigantea*	Asclepiadaceae Akan	
69	*Calotropis procera*	Asclepiadaceae	Akan

70	*Camellia chinensis*	Theaceae	Sah goss (Tea plant)
71	*Cannabis sativa*	Cannabinaceae	Bhang
72	*Cardiospermum helicacabum*	Sapindaceae	Kapalphuta
73	*Carallia brachiata*	Rhizophoraceae	Kanthekera
74	*Cassia alata*	Caesalpiniaceae	Khor goss
75	*Cassia fistula*	Caesalpiniaceae	Sunaru
76	*Cassia occidentalia*	Caesalpiniaceae	
77	*Cassia sophera*	Caesalpiniaceae	
78	*Cassia tora*	Caesalpiniaceae	
79	*Catharanthus rose us*	Apocynaceae	Nayantara
80	*Cayratia carnosa*	Vitaceae	Ghepeta Iota
81	*Cedrela toona*	Meliaceae	Poma
82	*Celestrus paniculatus*	Celastraceae	
83	*Centella asiatica*	Apiaceae	Manimuni
84	*Chenopodium album*	Chenopodiaceae	Jilmil sak
85	*Chenopodium ambrossoides*	Chenopodiaceae	
86	*Cinnamomum sulphuratum*	Lauraceae	
87	*Cinnamomum tomato*	Lauraceae	Tejpat
88	*Cinnamomum obtusifolium*	Lauraceae	Patihonda, patichanda
89	*Chukrasia tubularis*	Meliaceae	Boga poma
90	*Cissampelos pareira*	Menispermaceae	
91	*Cissus quadrangularis*	Vitaceae	
92	*Cissus rependa*	Vitaceae	Medmedia lota
93	*Cleome viscosa*	Capparidaceae	
94	*Clerodendrum colebrookianum*	Verbinaceae	Nephaphu
95	*Clerodendrum indicum*	Verbinaceae	Dhaptita
96	*Clerodendrum inerme*	Verbinaceae	
97	*Clerodendrum infortunatum*	Verbinaceae	Dhapatita
98	*Clitoria ternatea*	Fabaceae	Aparajita
99	*Coccinia benghalensis*	Cucurbitaceae	
100	*Coriandrum sativum*	Apiaceae	Dhania
101	*Costus speciosus*	Zingiberaceae	Jomlakhuti
102	*Crescentia cujete*	Bignoniaceae	
103	*Crotalaria albida*	Fabaccae	Ban-methi
104	*Croton caudatus*	Euphorbiaceae	Lata-mahudi
105	*Croton joufra*	Euphorbiaceae	Mahudi

106	*Croton tighlium*	Euphorbiaceae	Koni bih
107	*Cryptolepis buccnani*	Asclepiadaceae	
108	*Curculigo orchidioides*	Amaryllidaceae	
109	*Curcuma amada*	Zingiberaceae	Amada
110	*Curcuma aromatica*	Zingiberaceae	Ban-haladhi
111	*Curcuma caesia*	Zingiberaceae	Kola-haladhi
112	*Curcuma domestica*	Zingiberaceae	Haladhi
113	*Curcuma longa*	Zingiberaceae	Haladhi
114	*Curcuma zedoaria*	Zingiberaceae	
115	*Cuscuta reflexa*	Convolvulaceae	Akashi-lota
116	*Cymbopogon flexuosus*	Poaceae	Lemon grass
117	*Cymbopogon khasinanus*	Poaceae	
118	*Cymbopogon pendulus*	Poaceae	
119	*Cynodon dactylon*	Poaceae	
120	*Cyperus rotundus*	Cyperaceae	
121	*Dalbergia pinnata*	Fabaceae	
122	*Datura fastuosa*	Solanaceae	Dhatura
123	*Datura stramonium*	Solanaceae	Kola-dhatura
124	*Deeringia amaranthoides*	Amaranthaceae	Rangoli lota
125	*Derriis cuneifolia*	Fabaceae	
126	*Desmodium gangeticum*	Fabaceae	
127	*Dillenia indica*	Dilleniaceae	Outenga
128	*Dillenia pentagyna*	Dilleniaceae	Akshi
129	*Dillenia scabrella*	Dilleniaceae	Banji-ou
130	*Dioscorea alata*	Dioscoreaceae	Kathalu
131	*Dioscorea bulbifera*	Dioscoreaceae	Kathalu
132	*Dioscorea prazeri*	Dioscoreaceae	
133	*Diospyros peregrina*	Ebenaceae	
134	*Dischidia rafflesiana*	Asclepiadaceae	Honkha ojhar mana
135	*Dracaena angustifolia*	Liliaceae	
136	*Dregea volubilis*	Asclepiadaceae	Khomal Iota
137	*Drymaria cordata*	Caryophyllaceae	
138	*Drynaria quercifolia*	Polypodiaceae	
139	*Eclipta alba*	Asteraceae	Kenharaj
140	*Elaeocarpus sphaericus*	Elaeocarpaceae	Ridra rudrakhya
141	*Elsholtzia blanda*	Lamiaceae	Bon-tulasi
142	*Embelia ribes*	Myrsinaceae	

143	*Emblica officinalis*	Euphorbiaceae	Amlakhi
144	*Engelhardita spicata*	Juglandaceae	Lewa Lal-amiri
145	*Enhydra fluctuans*	Asteraceae	Helochi
146	*Entada phaseoloides*	Mimosaceae	Gila-lewa
147	*Erioglossum rubiginosum*	Sapindaceae	Abigran
148	*Eryngium foetidum*	Apiaceae	Jongoli-memedhu
149	*Erythrina stricta*	Fabaceae	Madar
150	*Eugenia formosa*	Myrtaceae	
151	*Eugenia jambolana*	Myrtaceae	Loha-jam
152	*Eugenia kurzii*	Myrtaceae	Bogijamuk
153	*Eupatorium cannabinum*	Asteraceae	Tong-loti
154	*Eupatorium odoratum*	Asteraceae	Jarmoni ban
155	*Euphorbia hirta*	Euphorbiaceae	
156	*Euphorbia neriifolia*	Euphorbiaceae	Hiju
157	*Eurya japonica*	Theaceae	Saseni, murmura
158	*Euryale ferox*	Nymphaeaceae	Makhana
159	*Ficus bengalensis*	Moraceae	Bor goss
160	*Ficus benjamina*	Moraceae	Chilubor goss
161	*Ficus hispida*	Moraceae	
162	*Ficus religiosa*	Moraceae	
163	*Flemingia strobilifera*	Flagellariaceae	
164	*Garcinia cowa*	Clusiaccae	Kujithekera
165	*Garcinia lanceaefolia*	Clusiaceae	
166	*Garcinia morella*	Clusiaceae	Kujithekera
167	*Garcinia pedunculata*	Clusiaceae	Bor-thekera
168	*Gardenia campanulata*	Rubuaceae	Bitmara, bhi-mona
169	*Garuga pinnata*	Burseraceae	Thotrnola, rohimola Gendheli-poma
170	*Gmelina arborea*	Verbenaceae	Gomari
171	*Gloriosa superba*	Liliaceae	Agnisikha
172	*Glycosmis pentaphylla*	Rutaceae	Hengena poka
173	*Gnetum gnemon*	Gnetaceae	
174	*Gnetum montanum*	Gnetaceae	Mameilet
175	*Grewia hirsuta*	Tiliaceae	Sukta-pata
176	*Gynocardia odorata*	Flacourtiaceae	Lamtem
177	*Hedychium spicatum*	Zingeberaceae	Karpur
178	*Hedyotis scandens*	Rubiaceae	Bhedeli -lota
179	*Heliotropium indicum*	Boraginaceae	-

180	*Helminthostachys zeylanica*	Helminthostachyceae	-
181	*Hibiscus rosa-sinensis*	Malvaceae	Joba
182	*Hiptage benghalensis*	Malpighiaceae	Kerek-Iota
183	*Holarrhena antidysenterica*	Apocynaceae	Dudkhuri, kutuj
184	*Homonoia riparia*	Euphorbiaceae	Hil-kadam
185	*Horsfieldia kingii*	Myrsticaceae	Amol
186	*Houttuynia cordata*	Saururaceae	-
187	*Hovenia dulcis*	Rhamnaceae	Chetia-bola
188	*Hydnocarpus kurzii*	Flacourtiaceae	Chalmugra, lamtem
189	*Hymenodictyon excelsum*	Rubiaceae	Kodam
190	*Hypercium petulum*	Hypericaceae	-
191	*Ichnocarpus frutescens*	Apocynaceae	Lomakandol
192	*Impatiens tripetala*	Balsaminaceae	Koria bijol, dumdeuka
193	*1pomea batats*	Convolvulaceae	Mitha-alu
194	*Ipomea eriocarpa*	Convolvulaceae	Kalmow
195	*1xora coccinea*	Rubiaceae	Rangol
196	*Jatropha curcas*	Euphorbiaceae	Bongali bhotera
197	*Jatropha gossypifolia*	Euphorbiaceae	Bbotera
198	*Juglans regia*	Juglandaceae	Akhrot
199	*Jussiaea suffraticosa*	Onagraceae	-
200	*Justicia gendarussa*	Acanthaceae	Tita-bahek
201	*Kayea assamica*	Clusiaceae	Sia-nahar
202	*Kirganelia reticulata*	Euphorbiaceae	Amloki
203	*Knema angustifolia*	Myrtaceae	Mota-pasuti, tezranga
204	*Lagenaria siceraria*	Cucurbitaceae	Jati-lau, lau
205	*Lagerstroemia speciosa*	Lythraceae	Azar
206	*Lannea coromandelica*	Anacardiaceae	-
207	*Laportea crenulata*	Urticaceae	Sorat goss
208	*Lasia spinosa*	Araceae	-
209	*Lawsonia inermis*	Lythraceae	Jetuka, mehendi
210	*Leea aequata*	Vitaceae	-
211	*Leea crispa*	Vitaceae	-
212	*Leea indica*	Vitaceae	Kukurathengia
213	*Leucas linifolia*	Lamiaceae	Doron bon
214	*Linostoma decandrum*	Thymelaeaceae	Bakalbih, ruteng
215	*Lippia germinata*	Verbenaceae	-
216	*Lithocarpus fenestratus*	Fagaceae	Kuhi

217	*Litsea cubeba Lauraceae*	Mejankari	-
218	*Litsea glutinosa*	Lauraceae	Heluka, bagnala
219	*Litsea monopetala*	Lauraceae	Hoanlu
220	*Litsea salicifolia*	Lauraceae	Dighloti
221	*Lycopodium cernuum*	Lycopodiaceae	-
222	*Lycopodium clavatum*	Lycopodiaceae	-
223	*Macrosolen cochinchinensis*	Loranthaceae	Raghumola
224	*Maesa indica*	Myrsinaceae	Awuapat, maahpora
225	*Mallotus philippensis*	Euphorbiaceae	Jorat, losan
226	*Mangifera sylvatica*	Anacardiaceae	Bon-am
227	*Manihot esculenta*	Euphorbiaceae	Simalu-alu
228	*Melastoma malabathricum*	Melastomataceae	Phutuka
229	*Melia azedarach*	Meliaceae	Ghora-nim
230	*Merremia umbellata*	Convolvulaceae	Goria loti, kolia lata
231	*Mesua ferrea*	Clusiaceae	Nahor
232	*Meyna laxiflora*	Rubiaceae	Kutkura, moin
233	*Mezoneuron cucullatum*	Caesalpiniaceae	Bagh-anchora
234	*Michelia champaca*	Magnoliaceae	Titasopa
235	*Michelia Montana*	Magnoliaceae	Pansopa
236	*Microtoena insuavis*	Lamiaceae	Asomia patchouli
237	*Millettia pachycarpa*	Fabaceae	Bokol bih
238	*Mimosa pudica*	Mimosaceae	Nilajiban
239	*Mimusops elengi*	Sapotaceae	Bokul, gokul
240	*Mirabilis jalapa*	Nyctaginaceae	Gadhuli -gopal
241	*Mitragyna rotundifolia*	Rubiaceae	Timi
242	*Momordica dioica*	Cucurbitaceae	Bhatkarela
243	*Moringa oleifera*	Moringaceae	Sajina
244	*Morus alba*	Moraceae	Nuni goss
245	*Mucuna prurita*	Fabaceae	Bandar kekua
246	*Murraya koenigii*	Rutaceae	Narasingha
247	*Murraya paniculata*	Rutaceae	-
248	*Mussaenda glabra*	Rubiaceae	Sonarupa
249	*Myrica esculenta*	Myricaceae	Nagatenga
250	*Nasturtium indicum*	Brassicaceae	-
251	*Nelumbo nucifera*	Nymphaeaceae	Podum
252	*Nerium indicum*	Apocynaceae	Karabi
253	*Nyctanthus arbor-tristis*	Oleaceae	Sewali phul

254	*Nymphaea alba*	Nymphaeaceae	Bhet , kumud
255	*Nymphaea stellata*	Nymphaeaceae	Neel-padma
256	*0cimum basilicum*	Lamiaceae	Tulasi
257	*0cimum gratissimum*	Lamiaceae	Ram-tulasi
258	*0cimum sanctum*	Lamiaceae	Kola-tulasi
259	*0lax acuminata*	Olacaceae	-
260	*0ldenlandia corymbosa*	Olacaceae	-
261	*Oroxylum indicum*	Bignoniaceae	Bhatghila
262	*0sbekia nepalensis*	Melastomataceae	Boga-phutuka
263	*0xalis corniculata*	Oxalidaceae	Tengeshi-tenga
264	*Paederia foetida*	Rubiaceae	Bhedeli-lota
265	*Peperomia pellucida*	Piperaceae	-
266	*Phlogocanthus thyrsiflorus*	Acanthaceae	Tita-phul
267	*Phylanthus fraternus*	Euphorbiaceae	Bhui-amlakhi (1)
268	*Phyllanthuis urinaria*	Euphorbiaceae	Bhui-amlakhi (2)
269	*Phytolacca acinosa*	Phytolaccaceae	Jaiong
270	*Picrasma javanica*	Simaroubaceae	Bon-posala, nimita
271	*Piper betle*	Piperaceae	Pan
272	*Piper longum*	Piperaceae	Pipoli
273	*Piper nigram*	Piperaceae	Jaluk
274	*Pithecellobium*	clypearia	Mimosaceae Bhasahu
275	*Pithecellobium monadelphum*	Mimosaceae	Moj, Bhasahu
276	*Plumbago indica*	Plumbaginaceae	Ronga-agechi
277	*Plumbago zeylenica*	Plumbaginaceae	Boga-agechi
278	*Plumeria acuminata*	Apocynaceae	Gulanchi,gulancha
279	*Pogostemon parviflora*	Lamiaceae	-
280	*Polygonum chinensis*	Polygonaceae	-
281	*Polygonum micrpcephallum*	Polygonaceae	-
282	*Pongamia pinnata*	Fabaceae	Karchaw
283	*Pothos cathcartii*	Araceae	Hathi dhekiya
284	*Pueraria tuberosa*	Fabaceae	-
285	*Randia dumetorum*	Rubiaceae	-
286	*Rauvilfia serpentina*	Apocyanaceae	Aràchontita
287	*Rauvolfia tetraphylla*	Apocyanaceae	-
288	*Ricinus communis*	Euphorbiaceae	-
289	*Rubia cordifolia*	Rubiaceae	Majathi
290	*Rubus moluccanus*	Rosaceae	-

291	*Rumex nepalensis*	Polygonaceae	-
292	*Salmalia malabarica*	Bombacaceae	-
293	*Saraca indica*	Caesalpinaceae Asoka	-
294	*Schima wallichii*	Theaceae	Makriasal, nogabhe
295	*Scoparia dulcis*	Scrophulariaceae	-
296	*Sesbania graniflora*	Fabaceae	-
297	*Setaria italica*	Poaceae	Kaon
298	*Sida acuta*	Malvaceae	Boriala
299	*Sida cordifolia*	Malvaceae	Sun-borial
300	*Sida rhombifolia*	Malvaceae	Borialatr>
301	*Smilex macrophylla*	Liliaceae	-
302	*Solanum indicum*	Solanaceae	Tid bhakuri
303	*Solanum khasianum*	Solanaceae	-
304	*Solanum nigrum*	Solanaceae	Pichkati
305	*Solanum torvum*	Solanaceae	Bhit-tita, hathibhekuri
306	*Solanum zanthocarpum*	Solanaceae	-
307	*Sonchus arvensis*	Asteraceae	-
308	*Spilanthus acmella*	Asteraccae	Pirazha
309	*Spondias pinnata*	Anacardiaceae	Amora
310	*Stachytarpheta indica*	Verbanaceae	-
311	*Stephania hernandifolia*	Menispermaceae	Tubuki-lot, goldua
312	*Streblus asper Moraceae*	Khorua	-
313	*Strychnos nux-vomica*	Loganiaceae	-
314	*Symplocos racemosa*	Symplocaceae	Kavirang, bhomroti
315	*Syzygium cumini*	Myrtaceae	Kalajam
316	*Tamarindus indica*	Caesalpinaceae	Tetuli
317	*Tectona grandis*	Verbanaceae	Ching-jagu
318	*Tephrosia candida*	Fabaccae	Boga medaloa
319	*Tephrosia purpurea*	Fabaceae	-
320	*Tephrosia vagenilis*	Fabaceae	-
321	*Terminalia arjuna*	Combretaceae	Arjun
322	*Terminalia bellirica*	Combretaceae	-
323	*Terminalia chebu;a*	Combretaceae	Hilikha
324	*Terminalia myriocarpa*	Combretaceae	Hollock
325	*Thevetia peruviana*	Apocyanaceae	-
326	*Thevetia nerifolia*	Apocyanaceae	-
327	*Tinospora cordifolia*	Menispermaceae	-

328	*Trichossanthes palmata*	Cucurbitaceae	-
329	*Tylophora indica*	Asclepiadaceae	-
330	*Typhonium trilobatum*	Araceae	Samakosu
331	*Verbena officinalis*	Verbenaceae	-
332	*Vesica adhatoda*	Acanthaceae	Bahek
333	*Vetivera zizanoides*	Poaceae	-
334	*Viburnum colebrookianum*	Caprifoliaceae	Mezenga
335	*Vinca rosea*	Apocyanaceae	-
336	*Vitex negundo*	Verbenaceae	Posotia
337	*Vitis latifoliavina rosea*	Vitaceae	-
338	*Wedelia calandulacea*	Asteraceae	Maha -bhringraj
339	*Wrightia tomentosa*	Apocynaceae	Atkuri
340	*Xanthium strumarium*	Asteraceae	Agara
341	*Xanthozylum alatum*	Rutaceae	-
342	*Xanthozylum budrunga*	Rutaceae	Bajramani, bajranali
343	*Xanthozylum nitidum*	Rutaceae	Tejmuri, tejmui
344	*Zinziber officinale*	Zingeberaceae	Ada
345	*Zingiber rubens*	Zingeberaceae	-
346	*Zingiber zerumbet*	Zingeberaceae	Barahu
347	*Ziziphus mauritiana*	Rhamnaceae	Bogori

R : Rare; VL : Vulnerable; CR : Critically rare; E : Endemic; EN : Endangered

Source : State Biodiversity Strategy & Action Plan, Assam 2002

Rare and Endangered Plants, Assam

Some of Rare and Endangered Plants, Assam				
Sl.	**Name of species**	**Family**	**Status**	**Distribution**
1	*Acanthephipium silhetense*	Orchidaceae	R	Garampani, Golaghat
2	*Acalypha australis*	Euphorbiaceae	R	Kachugaon R. F.
3	*Acranthera tomentosa*	Rubiaceae	V, En	Assam
4	*Adinendra griffithii*	Theaceae	E, R	Assam
5	*Albertisia mesistophylla*	Menispermaceae	Ex	Assam
6	*Anoectochilus sikkimensis*	Orchidaceae	R	Garampani, Golaghat
7	*Apostasia nuda*	Orchidaceae	R	Garampani, Golaghat
8	*Brassiopsis polycantha*	Araliaceae	R	Upper Assam
9	*Begonia tessaricarpa*	Begoniaceae	Ex	Assam
10	*Beilschmiema pseudomicropora*	Lauraceae	En	Digboi
11	*Bulbophllum mishmeense*	Orchidaceae	R, En	Assam
12	*B. virens*	Orchidaceae	R	Assam
13	*Calanthe herbacea*	Orchidaceae	R	Assam
14	*C. odora*	Orchidaceae	R	Assam
15	*assia wallichiana*	Leguminosae	R	Manas
16	*Ceropegia lucida*	Asclepiadaceae	E, Ex	Cachar
17	*Chysoslossum assamicum*	Orchidaceae	R	Assam
18	*Clematis fulvicoma*	Ranunculaceae	R	Assam
19	*Coelogyne rossiana*	Orchidaceae	V	Assam
20	*Dendrobium aruanticum*	Orchidaceae	E	Assam
21	*Dioscorea deltoidea*	Dioscoreaceae	V	Assam
22	*Dysoxylum reticulatum*	Meliaceae	R	Assam
23	*Eulophia manii*	Orchidaceae	R, En	Assam

24	*Fissistigma santapaui*	Annonaceae	En	Assam
25	*Flacourtia helferi*	Flacourtiaceae	R	Assam
26	*Galiola altissima*	Orchidaceae	R, Ex.	Assam
27	*Goniothalamus simsonii*	Annonaceae	R	Assam
28	*Goodyera prainii*	Orchidaceae	R.	Assam
29	*Habenaria trifurcata*	Orchidaceae	R.	Assam
30	*Hedyotis brunonsis*	Rubiaceae	R	Assam
31	*H. scabra*	Rubiaceae	R	Assam
32	*Illigera appendiculata*	Hernandiaceae	R	Cachar
33	*Indofevillea khasiana*	Cucurbitaceae	R	Assam
34	*Lagerstroemia minuticarpa*	Lythraceae	Ex.	Assam
35	*Liparis delicatula*	Orchidaceae	R, En	Assam
36	*L. prainii*	Orchidaceae	En	Assam
37	*L. vestita*	Orchidaceae	En	Assam
38	*Loropetalum chinense*	Hamamelidaceae	R	Assam
39	*Livistona jenkinsiana*	Arecaceae	E	Assam
40	*Maba cacharensis*	Ebenaceae	R	Cachar
41	*Magnolia caveana*	Magnoliaceae	R	Assam
42	*Miliusa dolicantha*	Annonaceae	R	Assam
43	*M. gustavi*	Magnoliaceae	En	Upper Assam
44	*M. insignis*	Magnoliaccae	R	Assam
45	*M. rabaniana*	Magnoliaceae	R	Assam
46	*Michelia baillonii*	Magnoliaceae	R	Assam
47	*Michelia mannii*	Magnoliaceae	R, En	Upper Assam
48	*Ophiorrhiza hispida*	Rubiaceae	E	Assam
49	*O. tingens*	Rubiaceae	V	Assam
50	*Orophea polycarpa*	Annonaceae	R	Cachar
51	*Paphiopedilum spicerianum*	Orchidaceae	R	Cachar
52	*Phlogocanthus asperula*	Acanthaceae	R	Upper Assam
53	*Polysolenia wallichii*	Rubiaceae	R	Cachar
54	*Smithia grandis*	Leguminogae	R	Kamrup

55	*Sterculia khasiana*	Sterculiaceae	R	Assam
56	*Stylidium kunthii*	Stylidiaceae	R	Kamrup
57	*Symplocos glauca*	Symplocaceae	R	Assam
58	*Syzygium assamicum*	Myrtaceae	R	Assam
59	*Vanilla pillifera*	Orchidaceae	R	Assam

R - Rare, E - Endangered, En - Endemic, V - Vulnerable, Ex - Extinct

Source : State Biodiversity Strategy and Action Plan, Assam, 2002

Development of Composite Network

By its very definition, the Cross Border Road Transport Efficiency Study aims at optimizing transport efficiencies by rationalizing inter – state procedures carried out at the borders of various states on the Indian Highways. The highways that would be affected by such procedures would necessarily be those that cross state boundaries. The study has identified this set of highways as the "Composite Network", since it comprises all categories of roads, including both National and State Highways.

The criteria developed and procedures adopted for identification of this Composite Network are outlined below:

- Consider ALL National Highways of the country;
- Eliminate those National Highways that DO NOT cross any state boundary at all;
- Superimpose the State Highway Network on this set;
- Eliminate those State Highways that DO NOT cross any state boundary at all;
- Cross – check if any Major District Roads (MDRs) or even lower category of roads cross any state border (s). If so, include these also in the set; and
- Superimpose major cities (with population above One Million) and major ports of the country to re –affirm the economic significance of the identified composite network. This exercise would also locate the major activity hubs that would be directly affected by an improvement in cross border transport efficiencies, with a view to better appreciate the scale and spread of econoimic impact of this study.

The above-mentioned exercise has been carried out as part of this phase of the study. The identified Composite Network is depicted in Volume II of this report.

The Primary Network

The primary network as defined in the Terms of Reference is the Golden Quadrilateral.

COMPOSITE HIGHWAY NETWORK:

The process of developing the composite highway network has involved consideration of five key parameters viz:

- All the National Highways that cross Inter State boundaries
- All the State Highways that cross inter state boundaries
- All the metropolitan cities as per the 2001 census with population of 1000000 and above.
- All the 13 Major Ports of the country.

All the above four parameters were plotted in a map of India with the state boundaries marked. The million plus cities signify the centers of economic and industrial activity and administrative functions carried out by such cities. Their transport connectivity is through a network of National Highways and state highways.

The thirteen major ports are the centers of export and import trade. The ports play an important role by enabling movement of raw material and finished products to and from the hinterland. The ports are also inter- connected through a network of state highways and national highways.

The goods vehicles (lorries/trucks) traveling from one or more centers of economic activity to another and/ or connecting to a port city is required to cross several state borders.

At the border crossings the respective state governments' agencies subject the goods vehicles to a series of checks primarily on the commodity being carried for collection of any pending liability in the form of applicable sales tax and verification of the legality of the goods. The goods vehicles registration papers and their permit to operate on inter state routes are also checked at the border crossings.

These checks, which the goods vehicles have to under go at the border crossings, is presumed to contribute towards delays increase in cost.

As the fundamental principle of any transportation system is to reach the goods and people from its point of origin to point of destination in the least possible time and through the shortest route.

The development of the composite network shall enable the appreciation and understanding of the goods vehicle movement along the national highways and state highways.

COMPOSITE PRIMARY NETWORK

The primary network has been developed from the composite highway network connecting the four Mega cities of Delhi, Mumbai, Chennai and Kolkata. Along the Golden Quadrilateral (GQ) the towns from Class I (above 100000) to class V (Above 5000 - 9999) has been marked.

URBAN CENTRES ALONG GOLDEN QUADRILATERAL

The Golden Quadrilateral connects four metropolitan city of country namely Delhi (National capital); Mumbai (Economic Capital); Kolkata (Cultural Capital) and Chennai (-). It traverses through 15 metropolitan settlements, which includes 9 state capitals.

It is clear from Table 2-2 that around 50-60% of Urban Centres on Golden Quadrilateral is above 1 lakh population. Moreover no settlements on GQ are less than 10000 populations. The higher order settlements with concentration of economic activities are located on the GQ. The corridor wise detail of socio-economic status of urban settlements has been presented in annexure 2-1.

Table XX: Class wise[1] Urban Centres on Golden Quadrilateral

Name of Corridor	Number of Corridor	Class I	Class II	Class III	Class IV	Class V	Class VI	Total
Delhi to Kolkata	NH-2	19	5	3	2	1	0	30
Kolkata to Chennai	NH-6, 60 & 5	11	6	3	1	0	0	21
Chennai to Mumbai	NH-4, 7 & 46	12	9	2	0	0	0	23
Mumbai to Delhi	NH-8, 76 & 79	13	3	2	0	0	0	18
Golden Quadrilateral		**55**	**23**	**10**	**3**	**1**	**0**	**92**

Source: Town Directory Census of India, 1991

About 40% of the total urban populations of country reside in urban settlements on the Golden Quadrilateral (Refer

Table XX). 73.6 million Population is in urban settlements along GQ. About 97% population is concentrated in the class I cities located along GQ. The high concentration of population in class I cities are due to concentration of economic activities in the class I cities. This further strengthen the fact of intense inter urban migration leading to degradation of civic life in the higher order settlements and regional imbalances.

Table XX: Class wise Population Distribution in Urban Centres

Name of Corridor	Number of Corridor	Population in Million						
		Class I	Class II	Class III	Class IV	Class V	Class VI	Total
Delhi to Kolkata	NH-2	22.9	0.4	0.1	0.03	0.01	0	23.4

[1] Class I- Above 100000; Class II-50000-99999; Class III-20000-49999; Class IV-10000-19999; Class V-5000-9999; Class VI-Below 5000

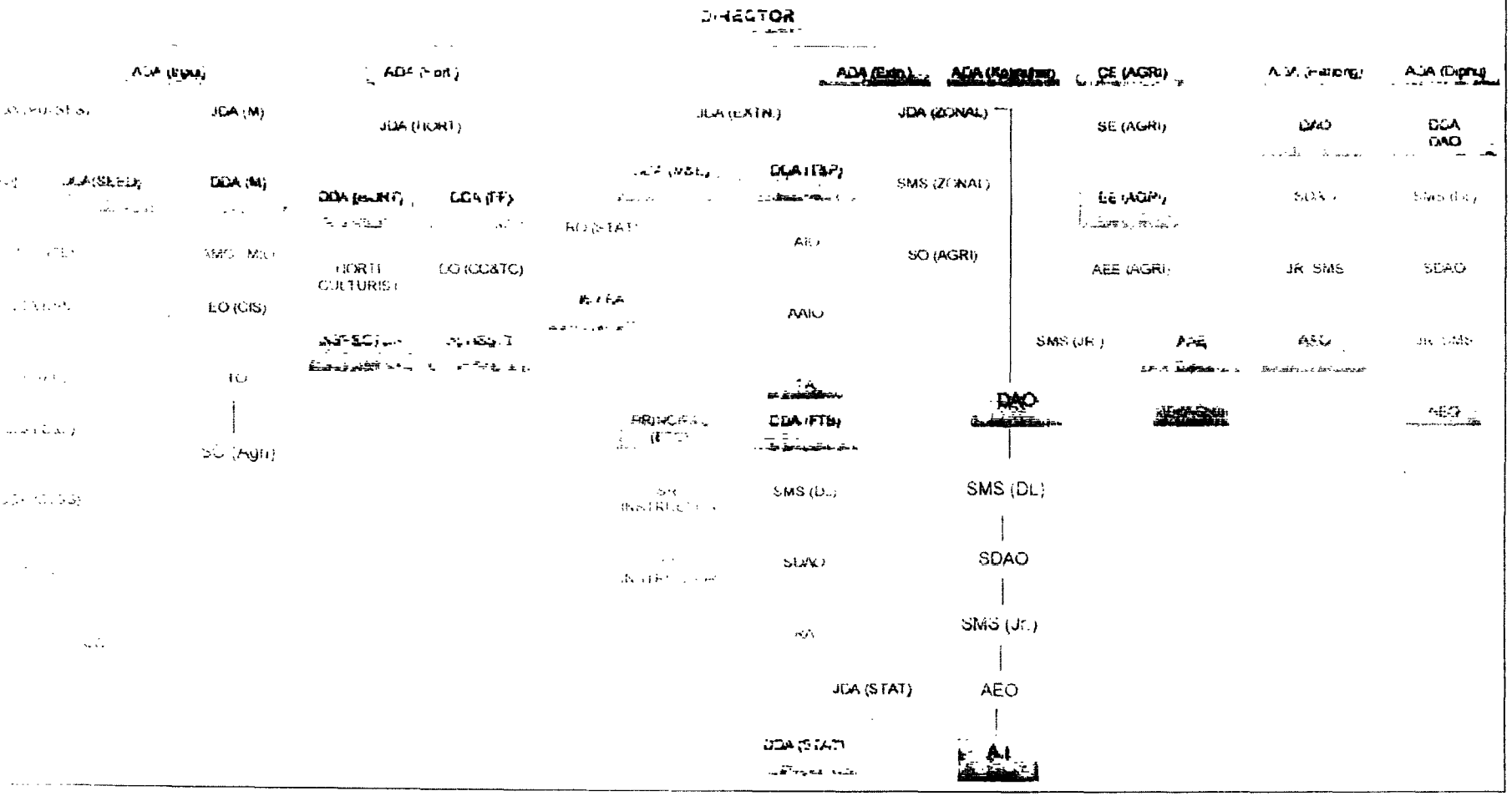
Kolkata to Chennai	NH-6, 60 & 5	7.8	0.5	0.1	0.01	0	0	8.41
Chennai to Mumbai	NH-4, 7 & 46	15.1	0.6	0.09	0	0	0	15.79
Mumbai to Delhi	NH-8, 76 & 79	25.7	0.25	0.05	0	0	0	26.0
Golden Quadrilateral		**71.50**	**1.75**	**0.34**	**0.04**	**0.01**	**0.00**	**73.6**

Source: Town Directory Census of India, 2001

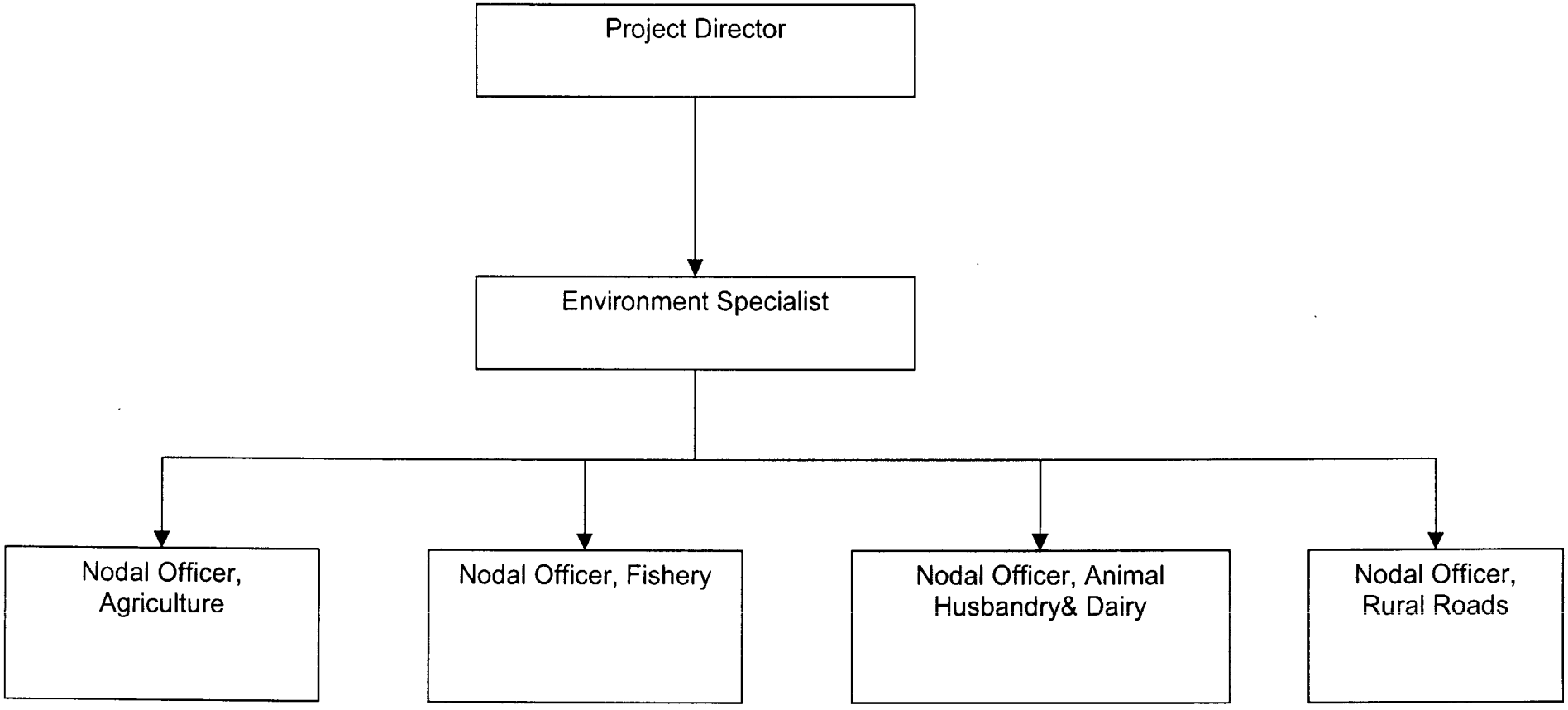
This shall enable the major cities in the hinterland and the ports to discharge their functions optimally and contribute to the economic growth and development of the country.

ANNEXURE-3-1: ORGANIZATIONS STRUCTURE OF DEPARTMENTS UNDER AACP

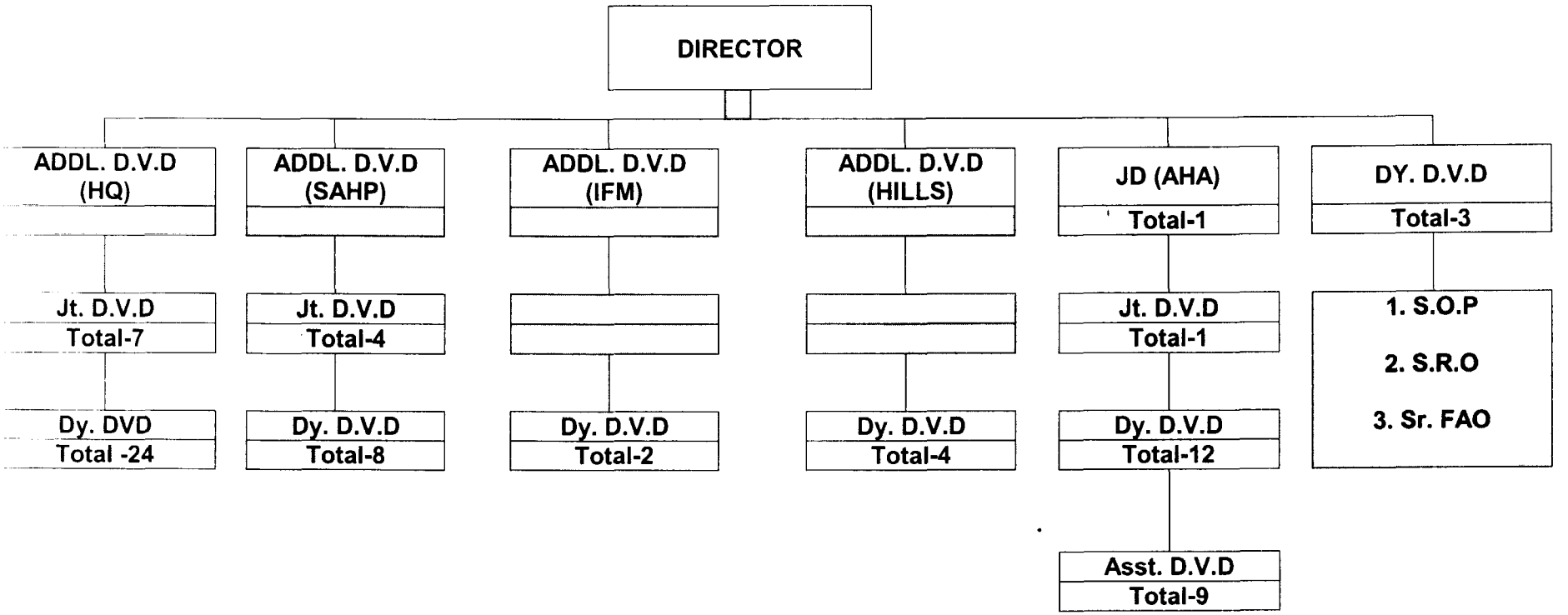
(DIRECTORATE, ZONAL and DISTRICT LEVEL)



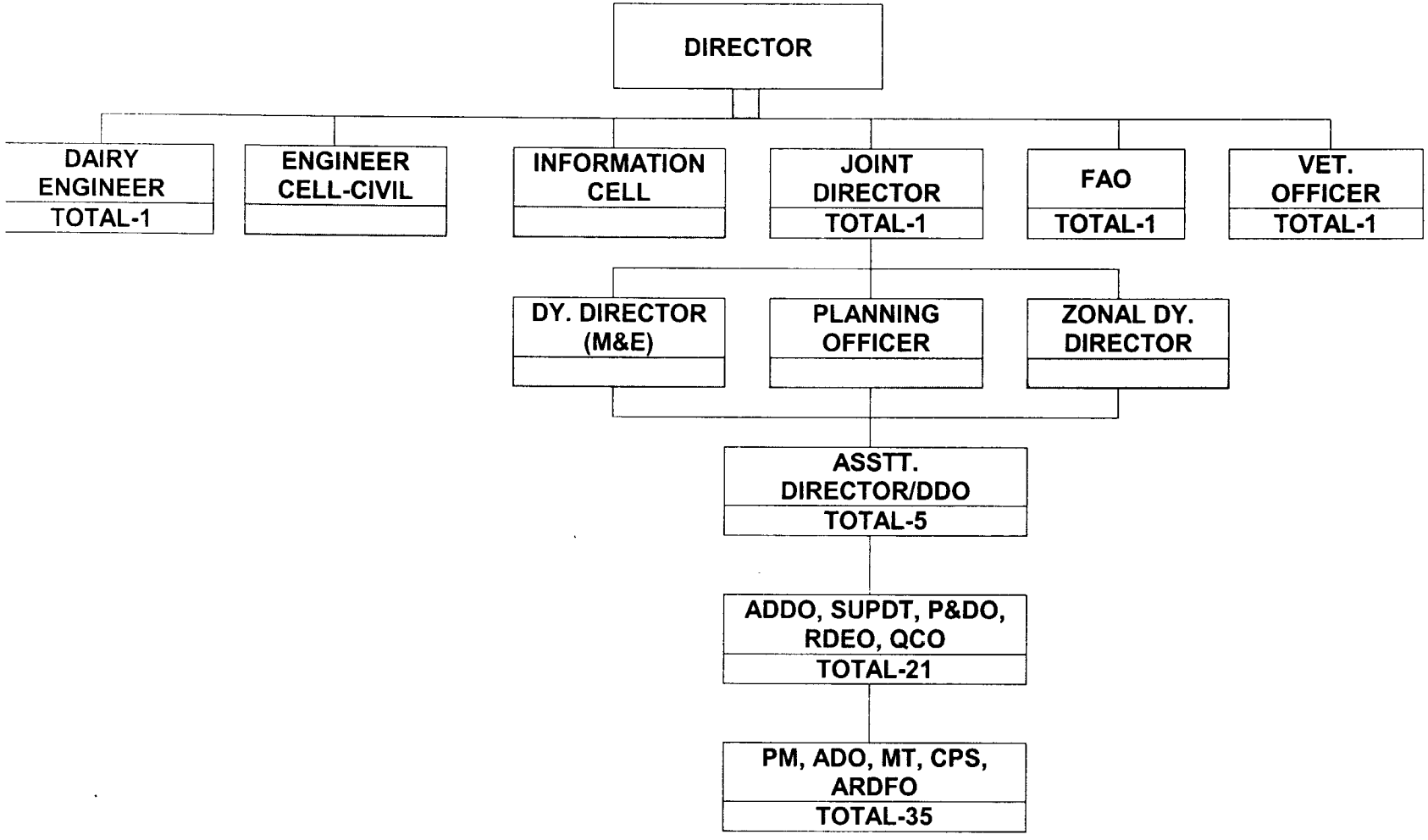
ORGANIZATION STRUCTURE OF ARIASP SOCIETY



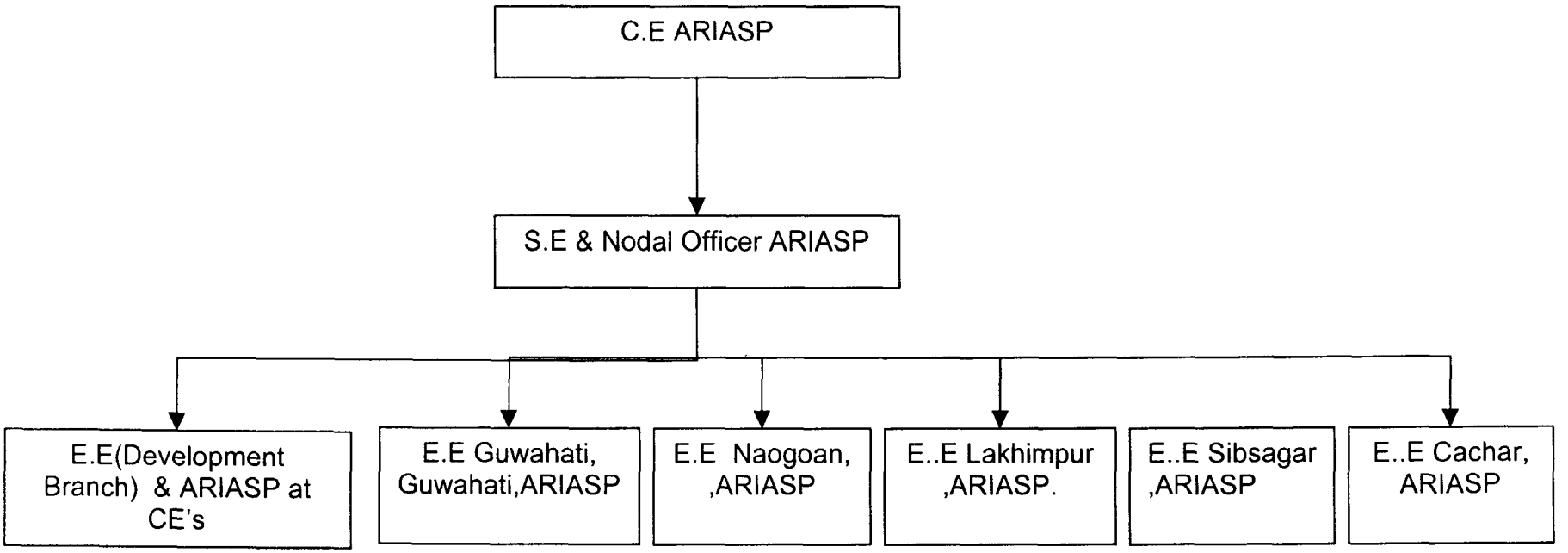
ORGANIZATION STRUCTURE OF ANIMAL HUSBANDRY AND VETERINARY



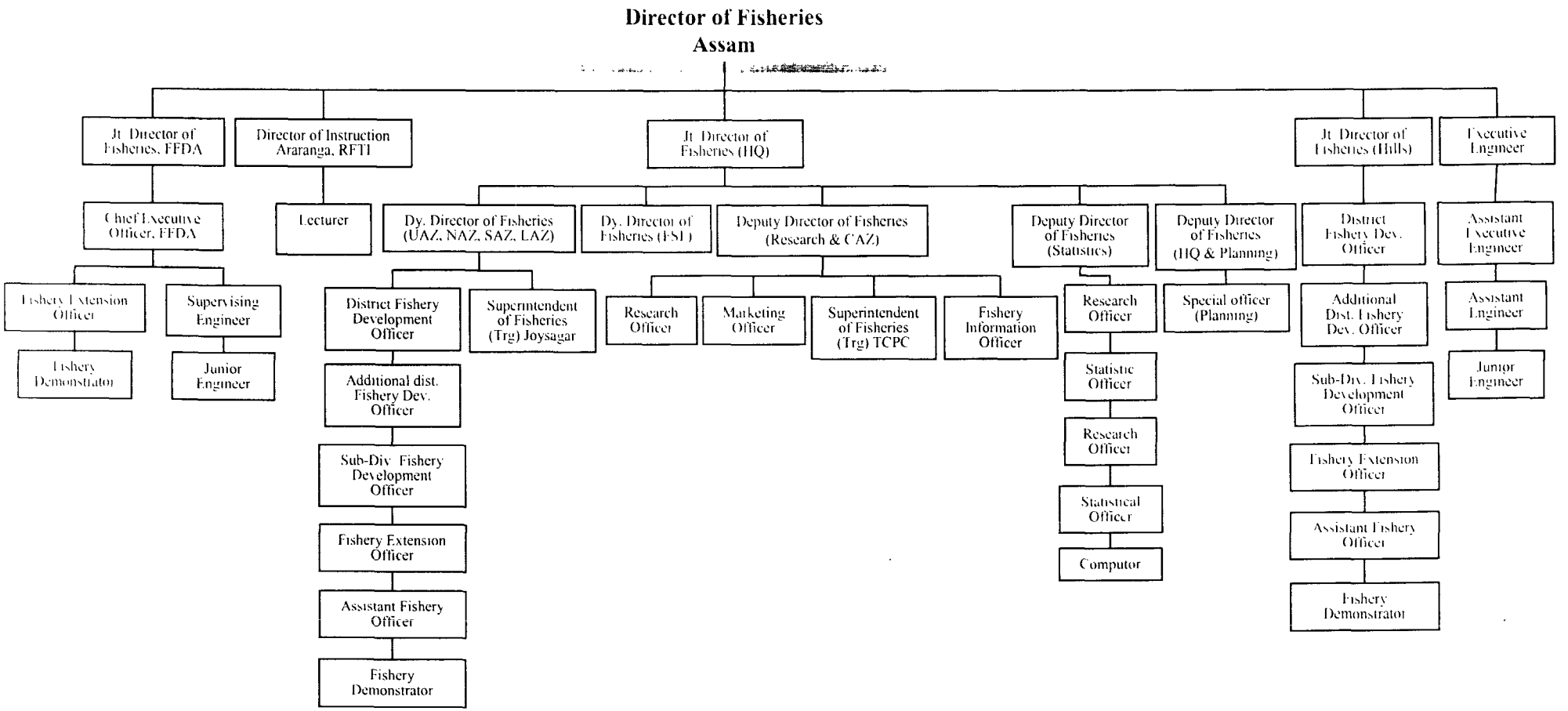
ORGANIZATION STRUCTURE OF DAIRY DEVELOPMENT DEPARTMENT



ORGANIZATION STRUCTURE OF PUBLIC WORKS DEPARTMENT



ORGANIZATION STRUCTURE OF FISHERY DEPARTMENT



Annexure 5.1: Indicators Species in each beels

Sareswar beel: Area 1700 hc

Fishes	Angiosperm	Birds
Rohu (*Labio rohita*)	Nymphaea rubra	Little Grebe
Katla(*Catla catla*)	Nymphaeya lotus	Great Crested Grebe
Mrigal(*Cirrhinus mringala*)	Eichornia	Indian Cormorant
Kali Baus(*Labio calbasu*)	Hydrilla spp.	Little Cormorant
Kursa	Pistia	Indian Shag
Grass Carp (ex)(*Ctnophryngodon idilla*)	Enhydra flactuans	Great Cormorant
Common Carp (ex)(*Cyprinus carpio*)	Utricularia stellus	Indian Darter
Silver Carp (ex)(Hypohthalmicthys *molitrix)*	Trifolium	Cattle Egret
Brghead Carp (ex)(*Arichthys noblis*)	Jussiaea spp.	Large Egret
Koi (*Anabus testudineus*)	Polygonum hydropiper	Smaller Egret
Magur (*Clarius batracus*)	Ipomea aquitica	Little Egret
Singhi(*Heteropnustis fossilis*)	Trapa spp.	Purple Heron
Thai Magur (ex) (*Clarius garaepinus*)	Scirpus articulates	Night Heron
Japani Koi /Telapia (ex)(*Talapia mozambika*)	Cynadon (Grass	Indian Pond Heron
Soul(*Channa striatus*)	Cyperus (Grass)	Chinese Pond Heron
Gajar	Duck weed	Little Green Heron
Sal(*Channa morulius*)	Vallisneria	Tiger Bittern
Garka Cheng (rare) (*Channa amphibious*)	Nelumbo nucifera	Chestnut Bittern
Cheng (*Channa gachua*)	Monochoria spp.	Black Bittern
Gorio(*Channa punctatus*)		Asian Open-Bill Stork
Boal (barali)(*Wallago attu*)		Lesser Adjutant Stork
Aari (white)(*Arichthys singala*)		Fulvous Whistling Duck
Guji (aari, *darker in colour)(Aricthys* sp)		Indian Whistling Duck
Chital(*Notopterus chitala*)		Greylag Goose
Fali (*Notopterus notopterus*)		Bar-Headed Goose
Boro bami (*Mastoceunbalus armutus*)		Common Shelduck
Gotta bami(*Mastoceunbalus* sp)		Comb Duck
Choto bami(*Mastoceunbalus* sp)		Cotton Teal
Nadal / nandar bami (rare)(*Anguilla bengalensis*)		Common Teal
Kuchia(*Monopterus cuchia*)		Garganey
Tengra(*Mystus tengra*)		Mallard
Gulsa Tengra(*Mystus* sp)		SpotBill Duck
Baijja Tengra(*Mystus* sp)		Northern Pintail
Tinkatali		Gadwall
Puthi(*Puntius* sp)		Northern Shoveler
		Marbled Teal
		Red Crested Pochard
		Common Pochard
		Ferruginous Duck
		Baer,s Pochard
		Tufted Duck
		Smew
		White Brested Water Hen
		Moorehen
		Purple Moorehen
		Black Coot
		Bronze-Winged Jacana

Fishes	Angiosperm	Birds
		Pheasant-tailed Jacana
		Painted Snipe
		Fantail Snipe
		Northern Lapwing
		Spurwinged Lapwing
		Red-wattled Lapwing
		Grey -headed Lapwing
		Pacific Golden Plover
		Ringed Plover
		Little Ringed Plover
		Kentish Plover
		Lesser Sand Plover
		Common Redshank
		Greenshakn
		Marsh Sandpiper
		Green Sandpiper
		Common Sandpiper
		Pintail Snipe
		Common Snipe
		Little Stint
		Temminick's Stint
		Black Headed Gull
		Indian River Tern
		White Winged Black Tern
		Yellow Wagtail
		White Wagtail
		Grey wagtail
		Pied Kingfisher
		White Breasted Kingfisher
		Small Blue Kingfisher
		Grey Headed Fishing Eagle
		Barn Swallow
		Nepal House Martin

Dheer Beel beel: 532 hc(monsoon)and 460 hc in winter

FISHES	ANGIOSPERM	BIRDS
Rohu	Nymphaea rubra	Little Grebe
Katla	Nymphaeya lotus	Indian Cormorant
Mrigal	*Eichornia sp.*	Little Cormorant
Kali Baus	*Hydrilla* spp.	Great Cormorant
Kursa	Pistia sp	Indian Darter
Grass Carp (ex)	Enhydra flactuans	Cattle Egret
Common Carp (ex)	Utricularia stellus	Large Egret
Silver Carp (ex)	Trifolium sp	Smaller Egret
Bricade Carp (ex)	*Jussiaea* spp.	Little Egret
Koi	Polygonum hydropiper	Night Heron
Magur	Ipomea aquitica	Indian Pond Heron
Singhi	*Trapa* spp.	Chinese Pond Heron
Thai Magur (ex)	Scirpus atriculates	Little Green Heron
Japani Koi /Telapia (ex)	*Cynadon* (Grass	Tiger Bittern
Soul	*Cyperus* (Grass)	Chestnut Bittern
Sal	Duck weed	Black Bittern
Cheng	*Vallisneria* sp.	Asian Open-Bill Stork
Gorio	Nelumbo nucifera	Lesser Adjutant Stork
Boal (barali)	*Monochoria* spp.	Greylag Goose
Aari (white)		Bar-Headed Goose
Chital		Cotton Teal
Fali		Common Teal
Boro bami		Garganey
Nadal / nandar bami (rare)		Mallard

FISHES	ANGIOSPERM	BIRDS
Kuchia		SpotBill Duck
Tengra		Northern Pintail
Baijja Tengra		Gadwall
Puthi		Northern Shoveler
		Marbled Teal
		Red Crested Pochard
		Ferruginous Duck
		White Breasted Water Hen
		Moorhen
		Purple Moorhen
		Black Coot
		Bronze-Winged Jacana
		Pheasant-tailed Jacana
		Painted Snipe
		Northern Lapwing
		Red-wattled Lapwing
		Pacific Golden Plover
		Ringed Plover
		Little Ringed Plover
		Kentish Plover
		Lesser Sand Plover
		Common Redshank
		Green shank
		Green Sandpiper
		Common Sandpiper
		Common Snipe
		Black Headed Gull
		Indian River Tern
		White Winged Black Tern
		Yellow Wagtail
		White Wagtail
		Grey wagtail
		Pied Kingfisher
		White Breasted Kingfisher
		Small Blue Kingfisher
		Grey Headed Fishing Eagle
		Nepal House Martin

Deo-bali-jhola beel: 20 sq km(Appx)

Fish	Angisperm	Birds
Labeo rohita	Eichhornia crosspipes	Little grebe
Catla catla	Pistia stratiotes	Cormorant
Cirrhinus wringala	Lemna minor	Little Cormorant
Noforpferus chitala	Ipomania aquatica	Purple heron
Noforpterus noforpertus	Pollinia cilata.	Pond heron
Wallago attu	Arundo donax.	Cattle Egret
Aoricthyts aor	Erianthus ravannae	Little Egret
Channa morulius	Cynodon doctylon	Night heron
Channa morulius	Cyperus iria.	Chestnut bittern
Channa striatus	Chrysopogon acciculatus.	Black bittern
C. Puncpatus	Eleusine indica.	Openbill stork
C. Quphitius	Arundo donax	Adjutant
C. garhua	Salix terasperma	Lesser Adjutant
Puntus sp		Lesser whistling teal
Colisa sofa		Large whistling teal
Anabus testudineus		Pintail
Clarius batrarhus		Gargarney
Hefero preutes fossilis		White eyed poachard
Meptus tenga		Pariah kite
Mastoceunbalus armatus		Shikra
M. arcufeatus		Pied harrier
Colisa fariatis		Marsh harrier
Rasbora daniconius		Red necked falcon

Fish	Angisperm	Birds
Labeobata		Kestrel
Pinaeusmonador		Blackwinged kite
Chanda ranga		Swamp pertridge
Xenetodon carila		Common bustard quail
Oxygestor bacaila		White breasted water hen
Lepidocephatus gunita		Water cock
Puntis sarana		Moorhen
Botia darid		Purple Moorhen
		Coot
		Pheasant tailed jacana
		Bronze winged jacana
		Red wattled lapwing
		Wood sandpiper
		Common sandpiper
		Yellow legged green
		pigeon
		Spotted dove
		Roseringed parakeet
		Rufus bellied plaintive
		cuckoo
		Koel
		Spotted owlet
		Lesser Pied kingfisher
		Storkbilled kingfisher
		White breasted king fisher
		Small blue kingfisher
		Green bee-eater
		Indian roller
		Hoopoe
		Bluethroated barbet
		Bushlark
		Eastern skylark
		Whiskered tern
		Blackbellied tern
		Brown shrike
		Blackheaded oriole
		Black drongo
		Pied myna
		Jungle myna
		Common Myna
		Orangebilled jungle myna
		Indian tree pie
		Common iora
		Redvented bulbul
		Lesser coucal
		House Crow
		Jungle crow
		Grey tit
		Striated babbler
		Ruby throat
		Blue throat
		Magpie robin
		Collard bush chat
		Jerdon's bush chat
		Whitetailed stone chat
		Streaked wren warbler
		Yellowbellied wren Warbler
		Streaked fantail warbler
		Striated marsh warbler

Fish	Angisperm	Birds
		Bristled grass warbler
		Indian great reed warbler
		Indian plain wren warbler
		White bellied yuhina
		Tailor bird
		Brown shrike
		Rufuousbacked shrike
		Paddy field pipit
		Water pipit
		Yellow wagtail
		Pied wagtail
		Yellow headed wagtail
		Red munia
		Black headed munia
		Spotted Munia
		White backed munia
		Java sparrow
		House sparrow
		Black throated weaver bird
		Streaked weaver bird
		Baya

Morakolang : Length 2.3 km(appx) width 112 m (av); depth 1.8 m (winter) 5m(monsoon)

Fish	Angisperm	birds
Labeo rohita	Eichhornia crosspipes	Little grebe
Cirrhinus wringala	Salix terasperma	Little cormorant
Noforpferus chitala	Nymphaea escelenta	Pond heron
Nefropterus netropterus	Lemna minor	Cattle egret
Wallago attu	Ipomoea aquatica	Little egret
Channa morulius		Chestnut bittern
Channa striatus		Openbill stork
C. puncpatus		Lesser adjutant
C. quaphitius		Lesser whistling teal
C. garhua		White eyed poachard
Puntus sp		Moorhen
Anabus testudineus		Purple moorhen
Clarius batrarhus		Pheasant tailed jacana
Hefero preutes fossilis		Bronze winged jacana
Meptus tengra		Red wattled lapwing
Mastoceunbalus armatus		Common sandpiper
M. arcufeatus		Lesser pied kingfisher
Colisa fariatis		White breasted kingfisher
Rasbora daniconius		Small blue kingfisher
Pinaeusmonador		
Chanda ranga		
Xenetodon carila		
Oxygestor bacaila		
Punitus sarana		
Botia darid		

Magori beel : water spread : 8sq km summer; 5 sq km winter

Fish	Angisperm	birds
Cheni puti (punctius sarana)	Dal (Andropogon spp.)	Great created grebe
Tita Puti	Tora (Alpinia alloghus)	Little grebe
Jati puti	Helonchi	Large cormorant
Bati puti	Rarpuni (Pistia stra fiotes)	Little cormorant
Darikana (Rasbora daniconius)	Saru-puni(Lema panei costata)	Darter
Naga chhenga (Channa barka)	Bhet (Nymphia spp.)	Grey heron
Changali (C. gachua)	Kalmou(Impomea reptans)	Little green heron
Fal-changali(C.stewarti)	Meteka (Wichhornia spp)	Pond heron
Matlu		Cattle egret
Sal (C.marulius)		Large egret
Shol(C.striatus)		Little egret
Goroi(C.punctatus)		Night heron
Barali (Wallogo attu)		Open billed stork
Pavo(Ompok bimaculatus)		Black stork
Pabo (O. pubda)		Gray lagged goose
Pabo goda (O.pabo)		Lesser whistling teal
Patimotra (Glossogobius Giuria)		Bar headed goose
Boriola-1(Barilios barna)		Ruddy shel duck
Boriola-2(Bola bola)		Pintail
Kharalia		Spot billed duck
Bhangan(Labeo bata)		Cotton teal
Gohoan		mallard
Kori (Labeo gonius)		Common teal
Mali(Labeo calbasu)		Gadwall
Lasim (Cirihinos reba)		Red crested pochard
Aleng (Pasbora clenya)		Common pochard
Rahu (Labio rohita)		White eyed pochard
Mirika (Crihina mrigala)		Pheasant tailed jacana
Bahu(Catla catla)		Bronzed winged jacana
Pithia (Tor tor)		Red wattled lapwing
Hil-ghoria (Barbus tor)		Northern lapwing
Rani-		Little ringed plover

Fish	Angisperm	birds
Zebra(Noemacheilos botia)		
Haro- rani(Cobitis thermalis)		Spotted red shank
Fut futia rani		Common green shank
Botia (Noemacheelus pavonaceus)		Common snipe
Singhi(H.fosilis)		Black headed gull
Mahur (Clarius batracus)		Pallases Gull
Bacha(Eutropii chttys vacha		River tern
Coch (Slionia salnia)		Coot
Naria (Clupisoma garna)		Indian moor hen
Bheu (Mystus sp)		Purple moor hen
Hingra(Mystus tangra)		White breasted water hen
Hingra golcha(		Chinese pond heron
Hingra kola		Little bittern
Hingra sonali		Black bittern
Ari (Mystus seenghala)		Cinnamon bittern
Gorua(		
Kurkori-II/kath bhengra		
Kurkora-I		
Koi(Anabus testodineus)		
Vhashali (Colisa sota)		
Khalihana(Calisa fasciatus)		
Gedgedi(Nadus marmortta)		
Randhani (Badis badis)		
Chanda-I(Lcignathus cquulos)		
Chanda-II		
Chanda-III		
Kakilla(Xenentodon cancila)		
Cuchia(Amphipnous cuchia)		
Tora		
Haru bami		
Kola bami		

Fish	Angisperm	birds
Ganga tup		
Boga photuki bami-I		
Boga photuki bami-II		
Boga photuki bami-III		
Chital (Notopterus chitala)		
Kanduli(N.notopterus)		
Mua		
Nepora		
Halani		
Karati		
Ilish (Hilsa illisha)		
Naru (Lebeo panguisia)		
Kajali (		
Chelkona/ chepkhouri		
Retha		

Motapung beel

Fish	Angisperm	birds
Cheni puti (punctius sarana)	Dal (Andropogon spp.)	Large cormorant
Tita Puti	Tora (Alpinia alloghus)	Little cormorant
Darikana (Rasbora daniconius)	Helonchi	Darter
Naga chhenga (Channa barka)		Pond heron
Changali (C. gachua)	Saru-puni(Lema panei costata)	Cattle egret
Sal (C.marulius)		Large egret
Shol(C.striatus)	Kalmou(Impomea reptans)	Little egret
Goroi(C.punctatus)	Meteka (Wichhornia spp)	Night heron
Patimotra (Glossogobius Giuria)		Open billed stork
Boriola-1(Barilios barna)		Lesser whistling teal
Boriola-2(Bola bola)		Spot billed duck
Bhangan(Labeo bata)		Cotton teal
Kori (Labeo gonius)		mallard
Lasim (Cirihinos reba)		Gadwall
Rahu (Labio rohita)		Red crested pochard
Mirika (Crihina mrigala)		Pheasant tailed jacana

Fish	Angisperm	birds
Rani-Zebra(Noemacheilos botia)		Bronzed winged jacana
Haro- rani(Cobitis thermalis)		Red wattled lapwing
Fut futia rani		Northern lapwing
Singhi(H.fosilis)		Little ringed plover
Mahur (Clarius batracus)		Spotted red shank
Bacha(Eutropii chttys vacha		Common green shank
Coch (Slionia salnia)		Common snipe
Naria (Clupisoma garna)		River tern
Gorua(		Coot
Kurkori-/kath bhengra		Indian moor hen
Koi(Anabus testodineus)		Purple moor hen
Khalihana(Calisa fasciatus)		White breasted water hen
Gedgedi(Nadus marmortta)		Chinese pond heron
Randhani (Badis badis)		Little bittern
Chanda-(Lcignathus cquulos)		Cinnamon bittern
Kakilla(Xenentodon cancila)		
Cuchia(Amphipnous cuchia)		
Haru bami		
Kola bami		
Ganga tup		
Boga photuki bami-I		
Chital (Notopterus chitala)		
Kanduli(N.notopterus)		
Nepora		
Karati		
Naru (Lebeo panguisia)		
Chelkona/ chepkhouri		
Retha		
Fish	Angisperm	birds
Cheni puti (punctius	Dal (Andropogon spp.)	Large cormorant

Fish	Angisperm	birds
sarana)		
Tita Puti	Tora (Alpinia alloghus)	Little cormorant
Darikana (Rasbora daniconius)	Helonchi	Darter
Naga chhenga (Channa barka)		Pond heron