

Environmental Assessment Report

Initial Environmental Examination for the Goshinga Subproject
Project Number: 39432
February 2009

BAN: Preparing the Participatory Small-Scale Water Resources Sector Project

Prepared by Local Government Engineering Department for the Asian Development Bank (ADB).

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INITIAL ENVIRONMENTAL EXAMINATION FOR THE GOSHINGA SUBPROJECT

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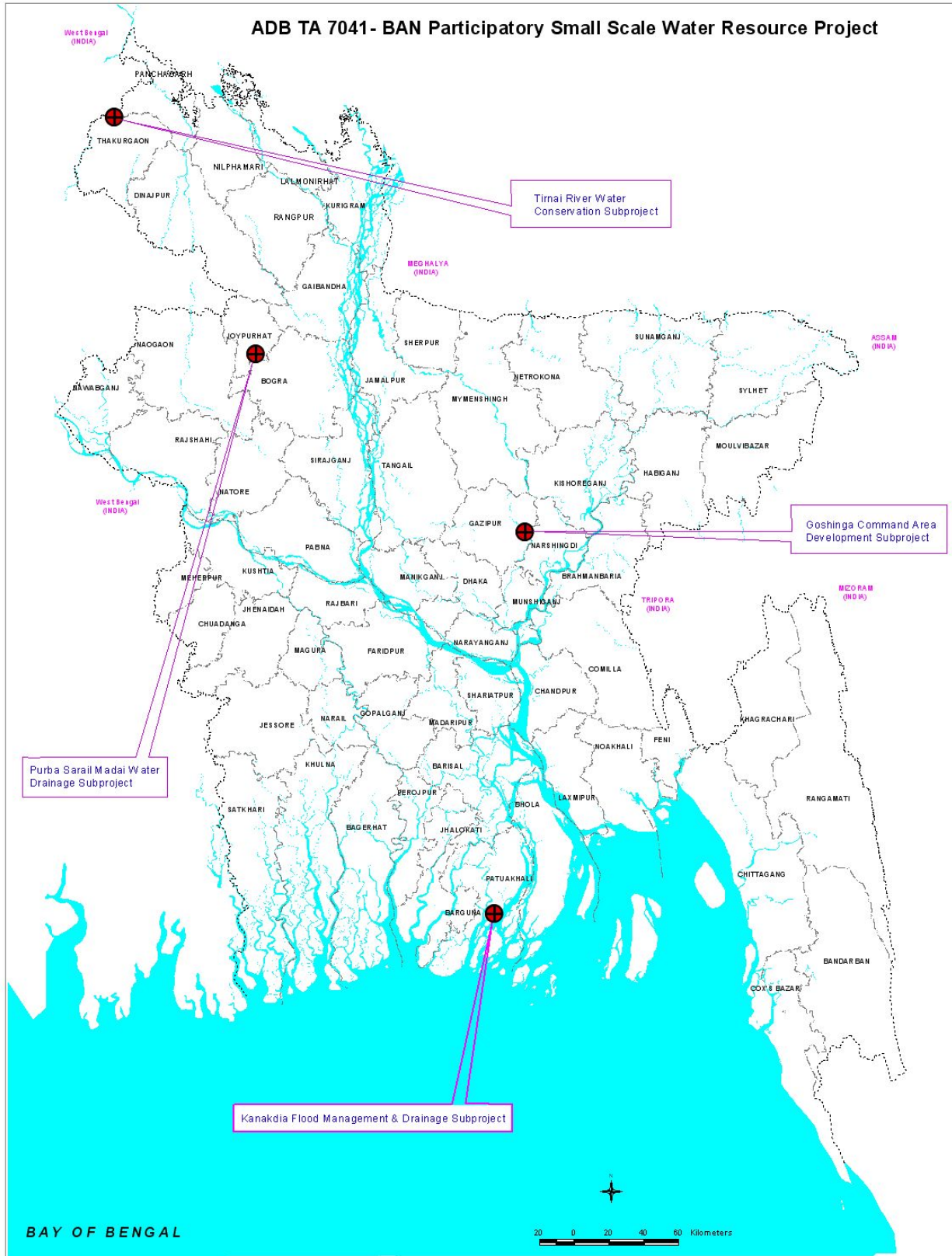
Glossary

Aman	wet season rice
aus	early wet season rice
beel	natural depression that may or may not retain water throughout the year
baor	dead arm of a river – billabong or ox-bow
boro	irrigated dry season rice
haor	large natural depression
jaimohal	state owned water body leased out for fishing
khal	natural or man made canal
khas	state owned land or water body
mouza	a small administrative area usually composed of a number of villages
para	administrative division – subdivision of a Union
Union	administrative division – subdivision of an upazila
upazila	administrative division – subdivision of a district

Abbreviations

ADB	Asian Development Bank
ADTA	Advisory Technical Assistance
AP	affected person
CAD	Command Area Development
DAE	Department of Agricultural Extension
DOE	Department of Environment
EMMP	Environmental Management and Monitoring Plan
ES	Environmental Section of IWRMU
HYV	high yielding variety
IEE	Initial environmental examination
IGA	income generating activities
ICM	integrated crop management
IPM	integrated pest management
IWRMU	Integrated Water Resource Management Unit of LGED
LGED	Local Government Engineering Department
MOU	memorandum of understanding
NGO	non-government organization
O&M	operation and maintenance
REA	rapid environmental assessment
SPFR	subproject feasibility reports
SGADS	Social and Gender and Development Section of IWRMU
WMCA	Water Management Cooperative Association
UP	Union Parishad

Map 1: Location of Sample Subprojects



INITIAL ENVIRONMENTAL EXAMINATION FOR THE GOSHINGA SUBPROJECT

A. Introduction

1. Purpose and Scope

1. This report is the Initial Environmental Examination (IEE) of the proposed subproject identified as the Goshinga Command Area Development (CAD) subproject, which is located in Goshinga Union of Sreepur Upazila of Gazipur District. The subproject is one of the subprojects identified for inclusion in the Participatory Small-Scale Water Resources Project (the Project) during project preparation undertaken between March and August, 2008.¹ The Project, a sector loan project will be implemented from 2009 until 2017 at a cost of \$130 million. The Project will build upon the successes and be guided by the lessons of the Small-Scale Water Resources Development Project Phase 2 (SSW-2)² and its predecessor project the Small-Scale Water Resources Development Project Phase 1 (SSW-1).³

2. The Project will improve sectoral development through participatory rehabilitation and management of SSWR⁴ infrastructure. The Project will assist beneficiaries to establish Water Management Cooperative Associations (WMCAs) and to develop and/or upgrade infrastructure for: (i) flood management; (ii) drainage improvement; (iii) water conservation; (iv) command area development; and (v) combinations of these four basic categories. Four sample subprojects have been identified and subproject feasibility reports (SPFRs) for each of these have been prepared. It is expected the Project will support the implementation of up to 300 subprojects. The Project will operate in 61 of the 64 districts nationwide.

3. The Project proponent is the Local Government Engineering Department (LGED) which will implement the subproject. LGED is a department of the Government within Local Government Division of the Ministry of Local Government, Rural Development and Cooperatives with headquarters located in Dhaka, Bangladesh, and with the following contact information:

Contact person:	The Additional Chief Engineer (Planning)
Address:	Local Government Engineering Department Dhaka, Bangladesh
Telephone No.:	(880) 815-8626
Fax No.:	(880) 911-5720
Website:	http://www.lged.org

4. Sample subprojects have been identified to support the Government strategy to improve agricultural production and reduce poverty. These and future candidate subprojects will form one component of the Project and are consistent with the ADB 2005 Country Strategy and Program. Initially feasibility studies of four sample subprojects were undertaken, including consultation and the participation of stakeholders at various stages of project preparation. Of the four, one the Tirnai River subproject did not meet the social selection criteria for which more than 40% of subproject benefitted area should be *operated* by functionally landless sharecroppers, and marginal or small farmers (up to 1 ha). The subproject (and associated safeguard outputs) was subsequently omitted from the project design.

¹ ADB TA 7041-BAN: Project Preparatory TA for Participatory Small-Scale Water Resource Project.

² ADB Loan 1831-BAN for \$34m approved 12 July 2001 and implemented from 2002 with a scheduled completion on 30 June 2009 is expected to develop 275 subprojects in 61 of the 64 districts countrywide.

³ ADB Loan 1381-BAN for \$32m approved 26 September 1995 and implemented from 1996 to 2002 developed 280 subprojects in the western half of the country.

⁴ "Small-scale" in the context of the Project is less than 1,000 ha of net beneficiary area.

5. The IEE of this sample subproject is closely linked to the requirements and procedures of the Government's Environmental Conservation Act (1995) and Environmental Conservation Rules (1997). Government responsibility for environmental issues is vested with the Department of Environment within the Ministry of Environment and Forests. The IEE was conducted by consultants engaged during the preparation of the Project and in consultation with staff of DOE and LGED. Consultants were in the field during April and May, 2008. During this time field observations were made and consultation with local officials, groups and potential beneficiaries and affected people took place. Support and assistance in the field was provided by the LGED District Office. The conduct of an IEE, and its subsequent approval by ADB is a prerequisite for ADB support to the subproject. For the three sample subproject IEEs, these were reviewed by LGED and DOE during loan fact finding mission during which the document format was agreed. Subsequently, LGED submitted approval⁵ of IEEs and environmental assessment and review procedures (EARP) and requested for disclosure on ADB website.

6. The objectives of the IEE are to: (i) determine the state of the environment in the subproject area; (ii) identify key environmental issues associated with the subproject; (iii) recommend appropriate mitigation measures; and (iv) develop an environmental management and monitoring plan (EMMP).

2. Methodology

7. This IEE is prepared in accordance with the Environmental Conservation Act and in accordance with the ADB Environmental Policy (2002) and the "Environmental Assessment Guidelines of the Asian Development Bank" (2003).

8. Data gathering and assessment of key environmental issues were undertaken using the ADB Rapid Environmental Assessment methodology which comprises:

- (i) review of documents;
- (ii) meetings with Project stakeholders and stakeholder representatives;
- (iii) identifying environmental issues which need to be addressed by the Project; and
- (iv) gathering of primary environmental data from field reconnaissance.

B. Description of the Project and Subproject

1. The Project

9. The expected impact of the Participatory Small-Scale Water Resource Project (the Project), a sector project, is the enhanced effectiveness and sustainability in agricultural and fishery production by the introduction of improved water management and flood control, along with poverty reduction through small scale water resource (SSWR) development. The Project objective is to develop sustainable stakeholder driven, SSWR management systems with special attention to the poorer sections of the community. In order for the Project to meet these objectives the Project will operate in three components:

- (i) Component A – the Institutional Strengthening Component;
- (ii) Component B – the Participatory Development Component; and
- (iii) Component C – the Small-Scale Water Resources (SSWR) Infrastructure Component.

10. **Component A – the Institutional Strengthening Component** will continue to focus on strengthening the capacity and capability of agencies directly engaged in SSWR development. In particular this will include IWRMU but it will also include line agencies of Department of Agricultural Extension (DAE), Department of Fisheries (DOF), the Department of Cooperatives

⁵ Memo No. LGED/SE(IWRM)/T-14/08/4015 dated 29 October 2008.

(DOC) and, as appropriate, the Department of Livestock (DOL). Activities of the component will also strengthen linkages between these agencies, as well as the Department of Woman Affairs (DWA) in regard to SSWR development particularly at district and *upazila* levels. Sectoral and institutional reviews will be undertaken during Project preparation.

11. The Project will continue the capacity and capability enhancement of IWRMU in planning, design, environmental, social, O&M, and monitoring and evaluation functions in order to internalize and institutionalize the SSWR development process. Of particular concern will be the reflection of IWRMU activities and responsibilities within the LGED district and *upazila* offices.

12. **Component B – the Participatory Development Component** will improve beneficiary participation in SSWR development by the strengthening of WMCAs. This will be done through continued refinement of critical aspects of the participatory project process and value addition to performing WMCAs through structural and non-structural interventions. Project support to WMCAs will consist of management training for the elected management committees, as well as for the general membership. Detailed training will be based on lessons from SSW-2 activities, particularly where WMCAs have operated successfully, or where problems have been perceived. Training inputs will build on the extensive training activities of SSW-2. The Project will assist the district and *upazila* line offices of DAE, DOF and DOC to interface with WMCAs and support their success where necessary.

13. **Component C – SSWR Infrastructure Component** is by far the largest component of the Project in terms of expenditure, activity and focus. Yet the desired outputs of this component will not be optimized without the support of successfully managed Components A and B. The SSWR Infrastructure Component will develop SSWR management systems by implementing subprojects with appropriate agricultural extension and fisheries development activities, as well as environmental and appropriate levels of social safeguard regulation and monitoring. The significant aspect of the subproject selection procedures is the beneficiary identification and initial request for Project intervention which is elevated to LGED at district level through regular Government processes.

14. Based on SSW-1 and SSW-2 experience, it is expected that Project activities will result in: (i) the protection of 100,000ha of land from flooding; (ii) drainage of 57,000ha of land; (iii) an increase of irrigated areas at subproject sites from 72,000ha to 90,000ha; (iv) a general increase in cropping intensity at subproject sites from 170% to 185%; (v) an increase in cropped areas at subproject sites from 360,000ha to 386,000ha; (vi) an increase in cereal production at subproject sites from 880,000 tons to 1.2m tons; and (vii) an increase in non-cereal production at subproject sites from 445,000 tons to 655,000 tons. Further, it is estimated that the Project will increase fisheries production by around 250 tons per year for floodplain fisheries⁶ and by 2,500 tons per year for fisheries in permanent water bodies.

2. The Subproject

15. The Goshinga subproject was proposed by the local people through Goshinga Union Parishad and following established subproject section procedures, the request was elevated through regular channels prior to being recommended for feasibility study. The subproject is aimed at providing permanent irrigation facilities for boro crop in the dry season as well as extending the existing network through construction of buried pipe water distribution system.

⁶ Flood plain fisheries refer to fisheries in land inundated during the wet season to the extent that fish raising is possible – this includes the raising of fish in rice paddy. Fishing in permanent water bodies is carried out where water is retained throughout the year.

16. The subproject is located in Goshinga Union of Sreepur Upazila, Gazipur District. The geographical position of the subproject is found between latitude 24° 9' 35" to 24° 11' 59" and longitude 90° 30' 57" to 90° 33' 17". The subproject covers 3 mouzas⁷: (i) Goshinga, (ii) Khozekhani, and (iii) Karnapur and 5 villages (i) Goshinga, (ii) Khozekhani, (iii) Karnapur, (iv) Khilpara, and (v) Matiagara. It is bounded on the north by high land along the bank of Janerakhal and south by Kacha Road from Hayat kharchale to Goshinga and Narayanpur khal. There is a road from Hayat khar chala to Sreepur Road crossing on the west side and towards the east there are high ridges between the sealed road from Bamni to Kapasia and Banar/Sitalakhya River which also touches the eastern boundary. The Banar river originates from the Old Brahmaputra river in Mymensingh district and flows south-eastward through the border of Gazipur and Narshingdi Districts and joins the Buriganga River and ultimately discharges to Meghna river near Munshiganj. The location of the subproject is shown on the Map 1 at the front of the document and the subproject layout is shown on Map 2.

17. The Goshinga subproject is a command area development project⁸ in the agriculture sector. The subproject area suffers from water availability in the dry season in some 600ha land suitable for boro and other cultivated crops. The Goshinga subproject will construct some 13 km of buried pipe irrigation line and pump house with required facilities. DOE project classification does not exactly match with this type of intervention, however, in comparing it with other similar described work it would appear to be categorized as orange-B group for DOE classification. The proposed subproject is expected to have both beneficial and adverse type of impacts. Both types of impacts will be site specific and the impact zone will remain within the immediate area of the subproject site. Moreover, all adverse impacts will be reversible and can be adjusted by the design of appropriate mitigation measures.

Table 1: Estimated Subproject Cost

Item	Cost (in Tk.)
Earthwork for pipe network system	1,219,680.00
Construction of 900mm dia. x 65m RCC pipe	252,785.00
Construction of 800mm dia. x 63m RCC pipe	176,400.00
Construction of 700mm dia. x 788m RCC pipe	2,218,220.00
Construction of 600mm dia. x 300m RCC pipe	550,800.00
Construction of 500mm dia. x 800m RCC pipe	1,208,000.00
Construction of 400mm dia. x 2,053m RCC pipe	2,703,801.00
Construction of 350mm dia. x 2,789m RCC pipe	3,502,984.00
Construction of 300mm dia. x 6,228m RCC pipe	7,573,248.00
300mm x 65 units Alfa-Alfa Valve including Air vent	594,000.00
pipe 250mm x 65 units	
Header Tank (6.0mx2.0m)	200,000.00
Community crop processing & storing facilities	450,000.00
	Sub-Total
	20,648,918.00
Supporting Works (@3% of subtotal)	619,497.54
Land Acquisition	150,000.00
	Base Cost
	21,419,415.54
Physical Contingencies (7% of Base Cost)	1,499,359.09
Price Contingencies (5% of Base Cost)	1,070,970.78
Design and Engineering (5% of Base Cost)	1,070,970.78
TOTAL INVESTMENT COST	25,060,716.18

⁷ A "mouza" is a small administrative area for land revenue purposes and is normally composed of several villages.

⁸ The Project will support four basic types of subprojects. These types are: (i) Command Area Development; (ii) Drainage; (iii) Water Conservation; and (iv) Flood Management. Some subprojects will involve combinations of these four basic types.

C. Description of the Environment

1. Physical Resources

18. The subproject experiences a maximum mean temperature of 35°C in May and a minimum mean temperature of 17°C in January. It has an average annual rainfall of 2,376 mm. Rainfall usually starts in April and continues until September. Almost 95% of the annual rainfall occurs in the monsoon season. The maximum humidity measured from July to September is around 90% and minimum is about 70% from January to April. The ambient air quality data for the proposed subproject area is not available. However, it is situated in a purely rural environment and there is no apparent urban/industrial air pollution.

19. The Banar/Sitalakhya River is the only surface water source for the subproject. This river passes by the east boundary of the subproject with an average width of 50m. The Banar/Sitalakhya River is stable and has perennial flow with about 6.5m water depth during dry season. The ground water resource is partially used for irrigating boro and aman crops through 15-20 shallow tube wells and one deep tube well. Higher fuel cost for operating these tube wells and draw down of the water table during dry season⁹ have limited the use of this resource in agriculture. No information is available on the subproject area regarding quality of surface water or ground water. This is information gap will be addressed during subproject implementation through water quality monitoring.

20. The landscape of the subproject comprises level upland and closely dissected terraces associated with either shallow or deep valleys. The major soil types are deep red brown terrace soils, shallow red brown terrace soils, and acid basin clays. Soils in the valleys are dark grey heavy clays. This type of soil has low moisture and organic matter content, and strong acidic character. Fertility levels are also comparatively low due to lower levels of potassium, phosphorus, sulphur, and calcium. Seismological studies¹⁰ show that the subproject area has very little risk of earthquake.

21. The Goshinga subproject area is considered upland. The uplands are above normal flood levels or are subject to seasonal shallow flooding. Valleys within the area behave like floodplains and are subject to shallow to deep flooding through the rainy season. Drainage to the river is fairly rapid resulting in water scarcity for agriculture. Land inundation classifications¹¹ in the Goshinga subproject area are:

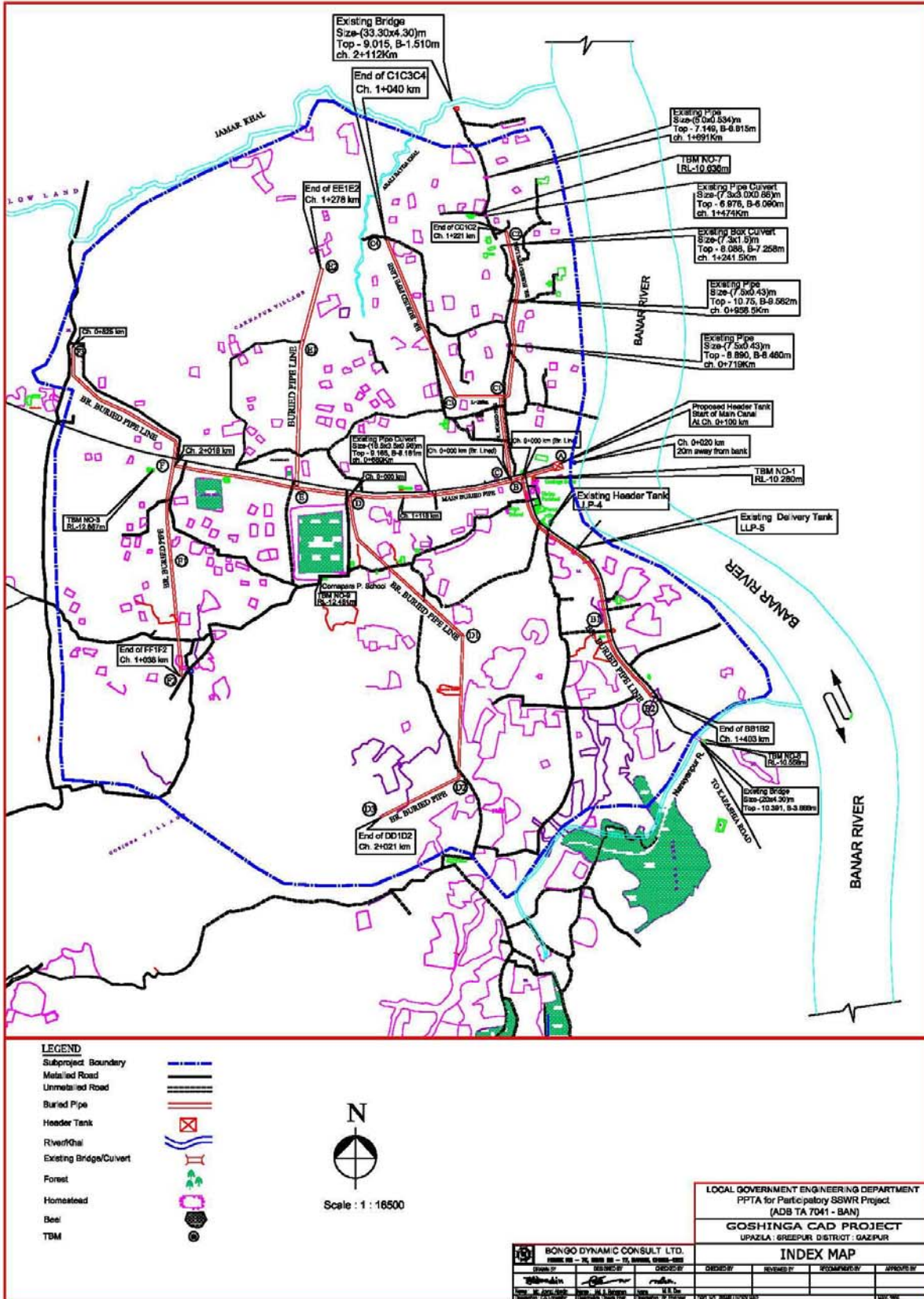
Non-cultivated high land including forest area (F ₀)	–	42 %	(425 ha)
Agricultural lands with < 0.3 m flood depth (F ₁)	–	28 %	(289 ha)
Agricultural lands with 0.3 m - 0.9 m flood depth (F ₂)	–	25 %	(255 ha)
Agricultural lands with 0.9 m - 1.8 m flood depth (F ₃)	–	5 %	(56 ha)
		Total	= 1,025 ha

⁹ There is no formal monitoring of seasonal standing water levels and comments are based in farmer observations.

¹⁰ MH Ali and JR Choudhury, Assessment of seismic hazard in Bangladesh – Disaster Research Training and Management Centre, Dhaka University, Dhaka, 2001.

¹¹ In Bangladesh, land is classified for flood inundation at follows: F₀ = highland not normally flooded; F₁ = medium land seasonally flooded up to 900mm; F₂ = medium land seasonally flooded between 900mm and 1,800mm; F₃ = lowland seasonally flooded over 1,800mm for less than 9 months a year; and F₄ = very lowland seasonally flooded over 1,800mm for more than 9 months a year.

Map 2: Layout of Subproject Area



2. Ecological Resources

22. The Goshinga subproject falls under agro-ecological zone (AEZ)#28: Madhupur Tract. This zone is subdivided into (i) level, deeply weathered, terrace areas; (ii) closely dissected, deeply weathered, terrace areas; (iii) closely dissected, shallowly weathered, terrace areas; (iv) level, shallowly weathered, terrace areas; (v) broad, deep valleys; and (vi) mixed Madhupur Tract and floodplain land. The general soil types under this AEZ are deep red-brown terrace soils and in some cases shallow grey terrace soils with clayey texture.

23. The available lands of the subproject lie between clearly defined patches of elevated land with Teak and Gorjan forests. The lands to benefit from the subproject are now entirely used for agricultural purposes and occupy about 58% of the gross area. The elevated forest land accounts for about 30% of the gross area. The net subproject area will be only around 600ha, which is all outside the elevated parts of the reserve forest. The forest land and the elevated land are clearly defined and separated as can be seen in Photograph 1 in Attachment A.

24. Birds appear to be abundant in the reserve forests and along the riparian corridor as well as in the homestead gardens. Other wildlife including monkeys, foxes, snakes, bats, rats, squirrels, jackals, etc., also live in the forests. Known fauna are listed in Attachment B. There is no identified natural fish breeding ground¹² within the proposed subproject area.

25. The presence of arsenic in groundwater, first detected in 1993, is now being monitored in 60 of the 64 districts, nationwide. The Department of Public Health Engineering estimates that 20 million people are exposed to arsenic poisoning. Arsenic in groundwater in Bangladesh is sourced from the host sediment primarily from the oxidation of arsenic rich pyrites¹³. While some subprojects supported by the Project access groundwater for crop irrigation, main interventions will be aimed at improving access to surface water and reducing reliance on groundwater for irrigation.

26. The use of organochlorine insecticides (except heptachlor) for all agricultural and public health purposes was banned in Bangladesh by late 1993, although stocks could be used after that time and emergency use of limited quantities of DDT for plague control was permitted in 1994. Water samples from the different regions of Bangladesh were studied for organochlorine insecticide residues (OCs) during 1992–1995, both before and after the banning of the use of OCs. Packed column gas chromatographic (Electron Capture Detector mode) techniques were used and recovery was checked by monitoring the extraction of radio-labelled compounds with a Liquid Scintillation Counter. The results indicate slight contamination of some of the water samples of both surface and underground sources with residues of DDT, heptachlor, lindane and dieldrin. The majority of the samples, were found to be free from residues¹⁴. Although use of heptachlor is allowed for specific purposes, its presence in surface water and ground water at levels well above WHO-recommended limits remains a matter of concern.

3. Economic Development

27. The subproject area is predominantly rural however, the proposed subproject has good communication facilities. A concrete road passing east-west almost bisecting the subproject

¹² Natural fish breeding grounds are those water bodies which link to running waterways such as rivers and canals, and where fish are able to migrate for breeding during the monsoon season and return to the streams during the dry season.

¹³ McArthur JM, P. Ravenscroft, S. Safilia, MF Thirwell: Arsenic in Groundwater: Testing pollution mechanisms for sedimentary aquifers in Bangladesh. Water Resources Research, Dhaka, 2001.

¹⁴ M. A. Matin, M. A. Malek, M. R. Amin, S. Rahman, J. Khatoon, M. Rahman, M. Aminuddin and A. J. Mian ; Institute of Food and Radiation Biology, Atomic Energy Research Establishment, Dhaka, 1997.

area connecting Dhaka-Mymensingh highway with the Sreepur Upazila headquarters. There is another road from north to south along the eastern boundary connecting Bamna on the north to Kapasia on the south. Moreover, there are some earthen roads making a network of local communication. The electricity grid extends to the subproject area, however, power supply and transmission facilities are inadequate. There are no known mineral resources in the subproject area.

28. The Banar/Sitalakhya River has no embankments. The maximum water level in this river during monsoon varies from 8.15 m PWD¹⁵ to 9.00 m PWD. The existing net cultivable area of the subproject is estimated at 600 ha. The current land use for crop production is diversified. Major crops grown in the area are t. aman and high yielding variety (HYV) boro rice crops, vegetables, pulses, and oil seeds. The present cropping intensity is about 143%. However, the HYV boro rice crop suffers damage in the dry season with only limited infrastructure available to pump and distribute irrigation water from the river. The local farmers reportedly use chemical fertilizers such as: urea, TSP and MP, and pesticides like, Basudin, Furadan, Nogos, Diazinon, Dimecron, and Malathion at the following rates:

Type of crop	Fertilizer, kg/ha	Pesticides, kg/ha	Pesticide, ml/ha
HYV Boro rice	Urea – 40.5	Basudin – 1.2	Nogos – 101
	TSP – 24.0	Furadan – 1.2	Dimecron – 100
	MP – 8.0		Malathion – 81
HYV Aman and others	Urea – 36.5	Basudin – 0.8	Nogos –
	TSP – 16.0	Furadan – 0.8	Dimecron – 81
	MP – 6.0		Malathion – 81

29. There are no seasonal flood lands or any other type of water bodies for natural fishery. However, there are about 40 reasonable size fish culture ponds covering about 12ha of water area under agricultural land category. These ponds and some seasonal water bodies occupying about 2ha are used for culture fishery. Annual fish culture in the subproject area is estimated at about 20 tons. Fish culture is becoming popular. There are about 6 species of very common, another 6 species of common, 11 species of rare, and another 11 species of very rare fish available in the locality.¹⁶ There are also about 35 small-scale poultry farms.

4. Social and Cultural Resources

30. Goshinga subproject has a total population of 12,580 living in 2,496 households (HHs). The beneficiary population is expected to be 8,760 belonging to 1,796 households. The occupation of subproject beneficiary people by household size is:

Farmers holding/operating > 0.21 ha of land	–	1,074 HHs	(60 %)
Day labourers	–	295 HHs	(16 %)
Fishers and navigators	–	36 HHs	(2 %)
Trade, transport, etc., services	–	334 HHs	(19 %)
Other	–	58 HHs	(3 %)
Total	=	1,796 HHs	100 %

¹⁵ Public Works Department (PWD) datum is universally used throughout Bangladesh.

¹⁶ “Very common”, “common”, “rare” and “very rare” are terms used in Bangladesh and are not consistent with international terminology. “Very common” are species found in all areas in abundance; “common” are found in all areas but not in abundance; “rare” are found in selected areas only; and very rare is the terminology used for vulnerable species as defined by IUCN, Bangladesh.

31. There are about 20 genuine fisher and 45 subsistence fisher families¹⁷ living within the proposed subproject area. They live on fishing in the nearby Banar/Sitalakhya River outside the proposed subproject boundary. There are also about 100 genuine and subsistence fish farmer families engaged in fish culture as well as catch fisheries in culture ponds within the subproject. The daily average wage rate for agriculture labor in peak season is Tk140 while for lean season it is about Tk100. While the Government has no established minimum wage for agricultural labor, these figures are the amounts expected by workers.

32. The subproject has seven schools, one *madrassa*, one club, one cooperative society, and 11 mosques. There are several local NGOs extending support for socio-economic development work through micro-credit programs. Besides these local NGOs, national NGOs such as Grameen Bank and BRAC are also working within the subproject area. There is no historical site, recreation or tourist spot within the proposed subproject area and the Department of Archaeology within the Ministry of Cultural Affairs has no designated archaeological site within the subproject area. There are no known indigenous people living in the subproject area and no social conflict has been reported on socio-cultural or religious differences.

D. Screening of Potential Environmental Impacts and Mitigation Measures

33. Using the sectoral environmental checklist of the Department of Environment¹⁸ and the ADB Rapid Environmental Assessment Checklist, all environmental aspects of the subproject have been screened out. Those subproject aspects that will result in significant adverse impacts were identified, assessed and corresponding mitigation measures recommended. These impacts include:

- (i) leaching out of soil nutrient if excessive application of irrigation water is not controlled; and
- (ii) contribution by subproject operations to soil and water pollution arising from an increased use of chemical fertilizers and pesticides.

34. The Goshinga subproject is located near the reserve forests in Sreepur Upazila in Gazipur district. The results of DOE screening, as presented in Attachment C, indicate that, this subproject does not directly encroach upon the nearby reserve forest. It has a gross area of 1,025ha with about 30% reserve forest area. The subproject net area, where the engineering works are proposed, is only 600ha, which is away from the reserve forest zone. The actual subproject development works will remain confined within these 600 ha land. The screening exercise for the ADB rapid environmental assessment (REA) checklist set out in Attachment D shows some concerns regarding protected area subproject siting and possible impacts on soil nutrient loss, soil pollution, water pollution, etc. However, the subproject location does not encroach on any restricted area and any adverse environmental impacts are able to be satisfactorily mitigated as shown in later sections of this IEE. In order to comply with environmental mitigation requirements, special attention must be given during designing of irrigation network to avoid any intrusion on to reserve forests, and formulating protective measures against soil and water pollution.

35. As a matter of Project policy, subproject design will minimize resettlement including land and asset acquisition. The Resettlement Framework has been drafted and is appended to the Subproject Feasibility Report to which this IEE is also annexed. Pending finalization of the Resettlement Plan, following detailed subproject design, initial findings are that there will be no

¹⁷ Genuine fishers, also known as ethnic fishers, are those whose livelihood is, and historically was, predominantly derived from fishing activities. Subsistence fishes are those who supplement their food supply or income from fishing predominantly on public land.

¹⁸ LGED introduced Environmental Assessment Guidelines in 2006, however the DOE Guidelines are considered to more appropriately address the requirements of the 1995 Environment Conservation Rule.

involuntary resettlement and asset acquisition will be limited to temporary disruption to cropping activities during subproject construction. Irrigation water distribution is through a buried pipe system and following construction of the distribution system land will be once again made available for its former use. Compensation for disruption and subsequent use of land for buried infrastructure has been calculated and is set out in the Draft Resettlement Plan. Photograph No 2, in Attachment A shows how resettlement issues will be avoided through the installation of a buried pipe distribution system.

36. Potential environmental impacts of the Goshinga subproject have been assessed by considering the cause-effect relationship between the proposed engineering interventions and the existing environmental conditions. The assessed results in terms of subproject stage, impact issue, impact type, and mitigation measures against anticipated issues are summarized in Table 1. These are discussed below.

- (i) Temporary warehouse and labor shed construction
- (ii) Drinking water and sanitation arrangements for workers.
- (iii) Environmental pollution from construction site waste (solid waste and surface runoff)
- (iv) Tree removal and terrestrial biodiversity loss.
- (v) Noise, vibration and dust
- (vi) Water and soil pollution from increased use of chemical fertilizer and pesticides
- (vii) Soil nutrient loss
- (viii) Proximity to forest reserve

37. The nature and scope of these environmental impacts include:

- (i) **Temporary warehouse and labor shed construction** – there will be a need for temporary construction of warehouse for storing construction materials, and labor sheds for accommodation of working laborers. These will be removed/decommissioned upon completion of construction phase.
- (ii) **Drinking water and sanitation arrangements** – to supply the drinking water requirements of the workers tube wells will be installed at the construction. Water sealed latrines and septic tanks will be constructed to handle the sewage generated in the construction site.
- (iii) **Solid wastes from construction site** – solid wastes composed of municipal waste from the construction workers, construction debris from the decommissioning of temporary construction RCC structures, and excavated soil from the construction of 13 kilometers buried RCC pipeline will be generated.
- (i) **Runoff from construction site** – during monsoon, surface runoff from the construction site will carry silt and deteriorate water quality of the receiving water. This impact is considered minimal and co-terminus with the construction phase. Simple bunding work will be undertaken to ensure pollutants do not drain into waterways.
- (iv) **Tree removal and terrestrial biodiversity loss** – the proposed buried pipe line will mainly follow existing road alignments where there exist a number of trees and hedges. Placement of the irrigation pipes will require removal of approximately 43 trees (as estimated in the resettlement plan [RP]). The exact numbers of trees to be removed can only be determined following the completion of the detailed design.
- (v) **Noise, vibration and dust** – emissions from heavy equipment and transport of workers and materials over unpaved roads will be substantial. However, since the subproject is located in a rural environment and construction sites are far from the residences, minimal impacts during the construction phase are anticipated.

- (vi) **Water and soil pollution from increased use of chemical fertilizer and pesticides** – there is a present practice of chemical fertilizer and pesticides application at rates of 72.5 kg/ha and 2.4 kg/ha, respectively, in HYV boro rice cultivation. More area coverage and better irrigation facility will potentially increase the present rate of agrochemical use in line with increased cropped area. Agricultural runoff may deteriorate the receiving water quality while the enhancement of irrigation facilities will indirectly increase use of these agrochemicals leading to soil pollution problems in crop lands.
- (vii) **Soil nutrient loss** – the agricultural lands within the existing subproject area and proposed extended area are moderately fertile. Easy availability of irrigation water is likely to enhance land use, and such an event may result in leaching of nutrient materials from moderately fertile agricultural soils.
- (viii) **Proximity to forestry reserve** – although the subproject area is close to a forestry reserve, the boundaries are clearly defined, and land levels in the forestry reserve are significantly higher than in the subproject area.

38. Steps to be taken to mitigate the identified potential adverse environmental impacts will include:

- (i) **Temporary warehouse and labor shed construction** – contractor will ensure no residual adverse impacts following dismantling.
- (ii) **Drinking water and sanitation arrangements** – regular groundwater quality monitoring of tubewells will be undertaken to ensure that suitability of drinking purposes (e.g. arsenic levels are below the standards). Septic tanks will be desludged and wastes properly disposed of after meeting applicable requirements.
- (ii) **Solid wastes from construction site** – all solid waste, including construction debris, will be hauled and disposed in a government approved site. Excess excavated materials (mainly fine river silts) will be utilized (as is currently practiced) by farmers on their adjacent agricultural lands
- (iii) **Runoff from Construction Site** - simple bunding work will be undertaken by the contractor to ensure pollutants do not drain into waterways
- (iv) **Tree removal and terrestrial biodiversity loss** – tree removal will be minimized and removed trees replaced ten fold.¹⁹
- (v) **Noise, vibration and dust** – workers will be supplied with, and required to wear, ear muffs when working close to machinery, water will be sprayed to suppress dust on an as required basis.
- (vi) **Water and soil pollution from increased use of chemical fertilizer and pesticides** – extensive training and farmer training programs on preparation and use of green manure, compost, bio- fertilizer materials, and the application of integrated pest management (IPM) techniques in crop pest control. Steps will also be taken to minimize water runoff from cropped areas to waterways.
- (vii) **Soil nutrient loss** – this kind of soil nutrient loss can be protected by providing guidelines to the farmers and motivating them on use of optimum volumes of irrigation water.
- (viii) **Proximity to Forest Reserve** – land levels in the forest reserve are significantly higher than in the subproject area and there will be no flow of residual water from the subproject area to the forest. During construction workers and contractors will be required to avoid infringement of forest areas.

¹⁹ Government requirements are that removed trees be replaced by two trees. The Project has adopted a ten for one tree replacement policy.

Table 2: Summary of Potential Impacts and Proposed Mitigation Measures for Goshinga Subproject²⁰

Subproject Stage	Potential Impact	Type of impact			Impact mitigation measure or Remarks
		Positive	Negative	Minor/Nil	
Pre-construction	Proximity to forest reserve		✓		Although the subproject area is close to a forestry reserve, the boundaries are clearly defined, and land levels in the forestry reserve are significantly higher than in the subproject area preventing water from subproject from discharging to the forest reserve. During construction workers and contractors will be required to avoid infringement of forest areas
	Design of subproject			✓	Not required
	Road accessibility and condition			✓	Not required
Construction	Temporary warehouse & labor shed construction			✓	Insignificant impact all temporary structures will be removed. Contractor will ensure no residual adverse impacts.
	Drinking water and sanitation arrangement		✓		Regular groundwater quality monitoring of tubewells Septic tanks will be desludged and wastes properly disposed of after meeting applicable requirements..
	Solid wastes from construction site		✓		All solid waste, particularly construction debris, will be hauled and disposed in a government- approved site. Excess excavated materials (mainly fine river silts) will be utilized (as is currently practiced) by farmers on their adjacent agricultural lands
	Runoff from Construction Site			✓	Simple bunding work by the contractor along works alignment to ensure pollutants do not drain into waterways
	Tree cutting/Terrestrial biodiversity loss		✓		Re-plantation of ten times of cut trees
	Noise , vibration and dust			✓	Worker ear protection provided Water will be sprayed to suppress dust on an as required basis
Operation and Maintenance Phase	Extended area under irrigation coverage	✓			Not applicable
	Increased use of chemical fertilizer & pesticides, and deterioration of soil and water quality		✓		Extensive training and motivation program for farmers on preparation and use of green manure, compost, bio, etc., fertilizer materials, and apply integrated pest management (IPM) technique in crop pest control. Extension support will be provided by Department of Agriculture Extension field staff either as integral to their seasonal/annual plan or as part of the Project's capacity building activities (funded under Component B of the Project). In addition, Project Implementation Consultants (PIC) will provide technical support and advice which will be integral to Project costs.

²⁰ This format was developed for the preparation of IEEs during SSW-1 and SSW-2. The format is considered to be a useful lead into the formulation of the EMMP.

Subproject Stage	Potential Impact	Type of impact			Impact mitigation measure or Remarks
		Positive	Negative	Minor/Nil	
					Drainage water from crop land run-off to be prevented from entering water bodies by bunding and land storage. Recycling of drainage water will be practiced where practical.
	Soil erosion			✓	Not required
	Reduced water level in nearby river			✓	Not required
	Replacement of ground water irrigation by surface water	✓			Not applicable
	Eutrophication and algal bloom			✓	Not required
	Natural fishery loss			✓	Not required
	Chemical pollution in receiving water bodies		✓		Proper arrangements for protecting water bodies from directly receiving farm house run-off/leachates by constructing bunds and provision of arrangements for the recycling of run-off water.
	Soil pollution		✓		Training and motivation of farmers on preparation and use of green manure, compost, bio, etc., fertilizer materials, and apply integrated pest management (IPM) technique in crop pest control
	Changes in cropping pattern with new variety			✓	Not required
	Crop diversity increase			✓	Not required
	Increase in cropping intensity and crop production	✓			Not applicable
	Irrigation and draught protection	✓			Not applicable
	Culture fishery development	✓			Not applicable
	Soil nutrient loss		✓		Insignificant impact requiring guidelines and motivation of farmers on optimum use of irrigation water
	Institutional development on water use	✓			Not applicable

E. Environmental Management and Monitoring Plan

39. LGED has signed Memoranda of Understanding (MOU) with the Department of Agricultural Extension (DAE) and other Ministries/Departments. As per the MOU, DAE will conduct training for the beneficiary farmers of the Project. Responsibilities for all agencies with respect to the mitigation of environmental impacts are set out in the Environmental Management and Monitoring Plan (EMMP). The EMMP can be found in Attachment E and the subproject implementation schedule is set out in Attachment F.

F. Public Consultation and Information Disclosure

40. Stakeholders at Goshinga subproject were identified under four main groups: (i) beneficiaries and affected persons (APs) in the subproject area; (ii) community leaders; (iii) Government officials at the central, district and upazila levels; and (iv) NGOs working at the local and regional levels. Stakeholder participation was completed in two steps: (i) firstly to collect and disseminate information through briefing and discussion meetings; and (ii) secondly to receive feed back for formulating appropriate mitigation measures against the adverse impacts. In order to ensure appropriate feed back a range of information sharing techniques was used. Techniques used for different stakeholder groups included (i) the completion of checklists and questionnaires; (ii) discussion with villagers; (iii) semi-structured interviews; (iv) small group meetings; and (v) site visits. Special efforts were made to include the elderly,

women, and vulnerable groups and to allow them to express their views regarding the proposed subproject. Stakeholder consultation has been undertaken within the Goshinga subproject area between 1 April and 15 May, 2008. Four separate events of public consultation and meetings were held involving some 90 stakeholders from village, *upazila* and district levels.

41. With regard to issues or concerns of the proposed subproject, only one concern was raised by stakeholders and this was for the quick implementation of the proposed works. The local people are eagerly waiting the subproject since it was first mooted 2 years ago. According to beneficiaries and APs consulted, the subproject will have no adverse impact and as a result no mitigation measures were suggested.

42. Once the subproject has been formally approved, details of the subproject will be published in a widely circulated local newspaper in Bangla language. Notifications will advise that this IEE is available for public scrutiny at offices of (i) the UP; (ii) the Upazila Engineer; (iii) the LGED District Office; and (iv) IWRMU. Notifications will invite submissions from members of the public, or organizations within the community, within a period of two weeks following public notification. Notification will advise that further information on the subproject may be obtained at the office of the LGED Upazila Engineer who will coordinate the stakeholder consultation process.

43. Details of public consultations are listed in Attachment G. Photograph 3 in Attachment A shows the consultation process in progress.

G. Findings and Recommendations

1. Findings

44. The screening process carried out in the IEE, adopting the Government and the ADB environmental assessment checklists, has not identified any significant negative environmental impact that will not be adequately mitigated by the subproject. It is concluded from the environmental assessment that:

- (i) the subproject will not result in any unwarranted loss of national resources and any adverse impact on the Goshinga Forest Reserve;
- (ii) the subproject will not cause any additional hazards to endangered species;
- (iii) no involuntary resettlement will occur and land and asset acquisition will be minimized and duly compensated;
- (iv) the subproject will provide employment opportunities to the local people and will provide more reliable irrigation water, resulting in an increase in cropping intensity and crop yields; and
- (v) the subproject will help improve the economy in the region.

2. Recommendations

45. Adverse environmental impacts resulting from subproject activities are listed above together with measures to mitigate these impacts to a satisfactory level. Subproject activities will be monitored during implementation to ensure that these measures are adopted and that impacts are reduced to a satisfactory level. In addition, random monitoring will continue for a period of three years following subproject completion with focus on these specific issues:

- (i) the proper removal of temporary structures and facilities required during subproject construction;
- (ii) the status of planted trees compensating tree removal during construction;
- (iii) ambient concentration of pesticides at specific locations specially up and downstream the subproject area; and
- (iv) any perceived impact on the adjoining forestry reserve.

46. In the event of another subproject proceeding within ten kilometers of this subproject, cumulative impact assessment will be undertaken to take into account the impacts of the co-located sub-projects.

47. The screening process conducted is considered adequate and no significant adverse environmental impacts exist that are considered to warrant further detailed study or an Environmental Impact Assessment.

H. Conclusions

48. In consideration of implementing the recommended impact mitigation measures, it is concluded that the anticipated adverse impacts of the Goshinga subproject will remain within acceptable limits. The direct and indirect beneficial impacts from extended irrigation coverage are expected to outweigh the adverse impacts. The increased agricultural production from some 303 hectares of extended irrigation coverage with the future cropping intensity of 193% will create significant employment opportunity and boost economic activity in the area. Therefore the subproject is assessed as environmentally feasible and sustainable and is accepted for implementation from an environmental viewpoint. No further studies are considered necessary.

Attachment A: Photographs Supporting the Subproject

Photo 1 – This shows the clear delineation between paddy – the subproject net area to be benefited and the forest reserve which is located on the adjacent upland area.



Photo 2 – Buildings constructed over existing open irrigation channels will not be disturbed when piped irrigation is installed. The pipes will pass under the existing buildings with no negative impacts.



Photo 3 - IEE questionnaires fill-up interviewing the local people in the Goshinga U.P. office



Photo 4 - Discussion meeting and feed back session with a group of people in Goshinga village

Attachment B: List of Biological Species in the Subproject Area

This list of biological species in the subproject area has been prepared with the assistance of information sourced from the IUCN Bangladesh Country Office.

Bird species

<u>Local name</u>	<u>Scientific name</u>
Kokil	<i>Coracina novaehollandiae</i>
Lal sharow	<i>Acridotheues tristis</i>
Goo bogi	<i>Bubulcus ibis</i>
Kokila	<i>Cuculus micropterus</i>
Doikol	<i>Copsychus saularis</i>
Kanabogi	<i>Ardeola grayii</i>
Fatikjol	<i>Aegithina tiphia</i>
Mach ranga	<i>Alcedo atthis</i>
Latora	<i>Artemus fuscus</i>
Dhar kauwah	<i>Corvus macrorhynchus</i>
Pati kauwah	<i>Corvus splendens</i>
Paraya	<i>Plocius philippinua</i>

Fish species

<u>Local name</u>	<u>Scientific name</u>
Lal khalisha	<i>Colisa lalius</i>
Koi	<i>Anabas testudineus</i>
Ranga chanda	<i>Chanda ranga</i>
Kharshulla	<i>Mugil corsuls</i>
Chapila	<i>Gudusia chapra</i>
Rui	<i>Labeo rohita</i>
Golda icha	<i>Macrobrachium rosenbergii</i>
Gura icha	<i>Macrobrachium lamrrei</i>
Karfu	<i>Cyprinus carpio</i>
Bashpata	<i>Danio devario</i>
Taki	<i>Channa punctatus</i>
Shol	<i>Channa striata</i>
Mrigel	<i>Cirrhinus mrigala</i>
Magur	<i>Clarius batrachus</i>
Tin Chokha	<i>Aplocheilus panchax</i>
Mola	<i>Amblypharyngodon mola</i>
Kathalia icha	<i>Macrobrachium villosimanus</i>
Guchi baim	<i>Mastacembelus pancalus</i>
Katla	<i>Catla catla</i>
Gol chanda	<i>Chanda baculis</i>
Batasi	<i>Clupisoma atherrinoides</i>
Khalisa	<i>Colisa fasciatus</i>
Tengra	<i>Batasio batasio</i>
Kaikla	<i>Xenentodon cancila</i>
Boal	<i>Wallago attu</i>
Jat puti	<i>Puntius sophore</i>
Teri puti	<i>Puntius terio</i>
Tit puti	<i>Puntius ticto</i>
Bajri tengra	<i>Mystus tengara</i>

Tengra	Mustus vittatus
Foli	Notopterus notopterus
Chela	Oxygaster pholo
Dankina	Rasbora daniconius
Ful chela	Salmostoma phulo

Plant species

<u>Local name</u>	<u>Scientific name</u>
Lebu	Citrus limmon
Chalta	Dillenia indica
Mahagoni	Swietenia macrophyla
Chatim	Alstonia scholaris
Bash	Bambosa sp.
Supari	Areca catechu
Koroi	Albizia lucida
Amm	Magnifera indica
Rentree	Samanea saman
Peara	Psidium guava

Mammal/Reptile/Amphibian species

<u>Local name</u>	<u>Scientific name</u>
Khek Shial	Canes aureas
Dhora sap	Amphiesma stolata
Badur	Pteropus giganteus
Idur	Mus musculus
Bon Biral	Felis chaus
Shial	Vulpes bengalensis

Attachment C: Department of Environment Checklist

Screening questions	Yes	No	Remark
(i) Is the proposed subproject located within any conserved natural and/or planted forests on elevated lands (Barind)/Garh areas in greater Dinajpur/ Dhaka/Mymensingh district?		✓	The Goshinga subproject is located near Garh areas of greater Dhaka district. There are some conserved forests within 1,025 ha of subproject gross area. But these will not be disturbed as the forests are located outside the proposed 600ha intervention area.
(ii) Does the proposed subproject encroach on any conserved natural and/or planted forests on mountain valleys surrounding the Indian border of greater Sylhet district?		✓	
(iii) Is the proposed subproject situated within any conserved natural and/or planted forests of hill ranges in greater Chittagong district?		✓	
(iv) Will the proposed subproject development intervene with any conserved natural and/or planted forests of Sundarban area and south coast of the Bay of Bengal?		✓	
(v) Is the subproject within 10 km peripheral distance of the 7,620,034 ha Sundarban reserve forest area in Bagerhat, Khulna & Satkhira districts?		✓	
(vi) Is the proposed subproject situated within 10,465 ha conserved area containing sand rim, estuary, forest, wetland, etc. on either side of the Cox's Bazar-Tekhnaf sea beach in Cox's Bazar district?		✓	
(vii) Is the subproject proposal from Narikel Jinjira and/or Sonadia Ghoti Bhangra mouja/s of 590 ha Saint Martin Deep and 4,916 ha Sonadia Deep in Cox's Bazar district?		✓	
(viii) Is the subproject located within the 18,383 ha inundation zone of Hakaluki Haor in Moulvi Bazar/Sylhet districts and 9,727 ha Tanguar Haor in Sunamganj district?		✓	
(ix) Is the subproject situated within the 200 ha floodplain of Marjat Baor in Jhenaidah district?		✓	
(x) Is the subproject located within any very sensitive aquatic ecosystem of Ganges floodplain and Meghna estuaries?		✓	

Attachment D: Rapid Environmental Assessment Checklist (Irrigation)

SCREENING QUESTIONS	Yes	No	Remarks
A. Project Siting - Is the subproject area adjacent to or within any of the following environmentally sensitive areas?			
▪ Protected Area		✓	
▪ Wetland		✓	
▪ Mangrove		✓	
▪ Estuarin		✓	
▪ Buffer Zone Of Protected Area	✓		The Goshinga subproject is close to the conserve forests of Bhawal Garh in greater Dhaka district. But the proposed works will not encroach as all work will be done within the net area of 600 ha, which is remote from these forests.
▪ Special Area for Protecting Biodiversity		✓	
B. Potential Environmental Impacts Will The project cause:			
▪ loss of precious ecological values (e.g. result of encroachment into forests/swamplands or historical/cultural buildings/areas, disruption of hydrology of natural waterways, regional flooding, and drainage hazards)?		✓	
▪ conflicts in water supply rights and related social conflicts?		✓	
▪ impediments to movements of people and animals?		✓	
▪ potential ecological problems due to increased soil erosion and siltation, leading to decreased stream capacity?		✓	
▪ insufficient drainage leading to salinity intrusion?		✓	
▪ over pumping of groundwater, leading to salinization or ground subsidence?		✓	
▪ impairment of downstream water quality and therefore, impairment of downstream beneficial uses of water?		✓	
▪ dislocation or involuntary resettlement of people?		✓	
▪ potential social conflicts arising from land tenure and land use issues?		✓	
▪ soil erosion before compaction and lining of canals?		✓	The subproject will have earthwork for buried pipe line construction. But, there will be no major soil erosion due to high clayey soil texture and turving type protective works.
▪ noise from construction equipment?		✓	Mitigated with the use of noise supressors.
▪ dust		✓	Mitigated with the use of water sprays as appropriate.
▪ labor-related social problems especially if workers from different areas are hired?		✓	
▪ waterlogging and soil salinization due to inadequate drainage and farm management?		✓	

<ul style="list-style-type: none"> ▪ leaching of soil nutrients and changes in soil characteristics due to excessive application of irrigation water? 	✓		Increased irrigation water supply may lead to leaching out of soil nutrient if excessive application of irrigation water is not controlled. Guidelines for optimum use of irrigation water and user training will mitigate the problem.
<ul style="list-style-type: none"> ▪ reduction of downstream water supply during peak seasons? 		✓	
<ul style="list-style-type: none"> ▪ soil pollution, polluted farm runoff and groundwater, and public health risks due to excessive application of fertilizers and pesticides? 	✓		The subproject is likely to contribute to soil and water pollution arising from increased use of chemical fertilizer and pesticides. Use of compost fertilizer, applying IPM techniques and protecting water bodies from receiving farm runoff will mitigate these pollution risks.
<ul style="list-style-type: none"> ▪ soil erosion (furrow, surface)? 		✓	
<ul style="list-style-type: none"> ▪ scouring of canals? 		✓	
<ul style="list-style-type: none"> ▪ clogging of canals by sediments? 		✓	
<ul style="list-style-type: none"> ▪ clogging of canals by weeds? 		✓	
<ul style="list-style-type: none"> ▪ seawater intrusion into downstream freshwater systems? 		✓	
<ul style="list-style-type: none"> ▪ introduction of increase in incidence of waterborne or water related diseases? 		✓	

Attachment E: Environmental Mitigation Plan

Project Stage	Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities	Cost Estimates
Pre-Construction	Proximity to forestry reserve	Proximity to forest reserve	Land levels in the forest reserve are significantly higher than <u>in the subproject area and there will be no flow of residual water from the subproject area to the forest. During construction workers and contractors will be required to avoid infringement of forest areas.</u>	Project Implementation Consultants, Contractor, LGED Upazila Engineer	Included in the sub-project costs.
Construction	Drinking water and sanitation arrangement	Risk of using contaminated groundwater from tubewells Generation of sewage and sludge from septic tanks	Monitoring of groundwater quality to establish suitability for drinking Septic tanks will be de-sludged and wastes properly disposed after meeting applicable standards	Contractor, LGED District, and Upazilla Engineer	Included in the sub-project costs
	Construction	Solid wastes generation	All municipal and construction debris will be hauled and disposed in a government approved site Excess excavated materials will be utilized either as backfill material around settlement areas or to raise embankments	Contractor, LGED District, and Upazilla Engineer	Included in the sub-project costs
	Labor Shed Construction	Minor impacts on surrounding area during dismantling	Ensure no residual adverse impacts following dismantling.	Contractor, LGED District, and Upazilla Engineer	Included in the sub-project costs
	Runoff from construction site	Pollutants entering waterway	Simple bunding work by the contractor along works alignment to ensure pollutants do not drain into waterways	Contractor, LGED District, and Upazilla Engineer	Included in the sub-project costs
	Tree cutting	Terrestrial biodiversity loss	Tree removal will be minimized and removed trees replaced ten fold	Project Implementation Consultants,, LGED District, and Upazilla Engineer	Included in the sub-project costs

Project Stage	Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities	Cost Estimates
	Construction related activities such as earthworks or concreting	Noise, vibration and dust	Worker ear protection provided Water will be sprayed to suppress dust on an as required basis	Contractor, LGED District, and Upazilla Engineer	Included in subproject costs
Operation	Irrigation water supply	Increased use of chemical fertilizer and pesticide causing deterioration of soil and water quality	Extensive training and farmer training programs on preparation and use of green manure, compost, bio- fertilizer materials, and the application of integrated pest management (IPM) techniques in crop pest control. Minimize water runoff from cropped areas to waterways	DAE Field Operatives	Included in the sub-project costs (under Component B for capacity building of WMCAs, to be implemented by DAE under their existing seasonal or annual work plans)
	Irrigation water supply	Soil nutrient loss	training and motivation of farmers will be undertaken on preparation and use of green manure, compost, bio, etc., fertilizer materials, and application of integrated pest management (IPM) technique in crop pest control	DAE Field operatives	Included in project costs (under Component B for capacity building of WMCAs, to be implemented by DAE under their existing seasonal or annual work plans)

Attachment F: Environmental Monitoring Plan

	Mitigation Measure	Parameters to be Monitored	Location	Measurements	Frequency	Responsibilities	Cost
Pre-Construction Phase	<p>Land levels in the forest reserve are significantly higher than in the subproject area and there will be no flow of residual water from the subproject area to the forest.</p> <p><u>During construction workers, and contractors will be required to avoid infringement of forest areas.</u></p>	<p>Not applicable</p> <p>Boundaries and areas covered with Teak and Gorjan forests.</p>	Teak and Gorjan Forests	Visual and geodetic survey	Annual	District LGED, LGED's Integrated Water Resources Management Unit (IWRMU)- Environment and Social Safeguards Section (ESS), Project Implementation Consultants (PIC)	Included in project cost
Construction	<p>Monitoring of groundwater quality to establish suitability for drinking</p> <p>Septic tanks will be de-sludged and wastes properly disposed after meeting applicable standards</p>	<p>Arsenic and pesticides</p> <p>Septic tanks de-sludged</p> <p>Location of disposal sites</p>	<p>All tubewells to be used by the workers</p> <p>Construction site</p> <p>To be determined</p>	<p>Water sampling and analysis</p> <p>Once-after completion of construction</p>	Annual	LGED (District) and IWRMU ESS	Included in project cost
	All municipal and construction debris will be hauled and disposed in a	Location of disposal sites	To be determined	Visual	<p>Monthly during construction phase</p> <p>Monthly during</p>	<p>Contractor and LGED</p> <p>Contractor and LGED</p>	Included in project cost

	Mitigation Measure	Parameters to be Monitored	Location	Measurements	Frequency	Responsibilities	Cost
	government approved site Excess excavated materials (mainly fine river silts) will be utilized (as is currently practiced) by farmers on their adjacent agricultural lands	Chemical composition	To be determined	Silt sampling and analysis	construction		Included in construction cost
	Extensive training and farmer training programs on preparation and use of green manure, compost, bio-fertilizer materials, and the application of integrated pest management (IPM) techniques in crop pest control. Minimize water runoff from cropped areas to waterways	Crop yields Pesticides and nutrients content of receiving water	Cropped area Jamar Khal and Narayanpur River	Annual report on yield and water quality monitoring (pesticides and nutrients)	Annual	WMCA and Department of Agriculture Extension (DAE)	Included in construction cost
Operation and Maintenance	Comprehensive training and capacity building of WMCAs and LGED personnel in system operation. Joint development of	Preparation of approved system operation manual System	WMCA Subproject	None None	One time To be agreed with WMCA	WMCA, Upazila Engineer WMCA, Upzila Engineer/System Operator	Included in project costs To be financed by WMCA

	Mitigation Measure	Parameters to be Monitored	Location	Measurements	Frequency	Responsibilities	Cost
	system operation plan.	operator appointed Gate opening, water levels and rate of siltation recorded in operator's log book	Regulator and control sections along channel	Gate opening, gauge reading and depth of siltation in control section	Daily for gate opening and gauge reading and weekly for siltation	System operator	None

Attachment G: Subproject Implementation Schedule
Participatory Small-Scale Water Resources Project
Goshinga Subproject
Implementation Schedule of Sample Subproject

	Year 1	Year 2	Year 3	Year 4	Year 5
Stage 1. Identification and Feasibility					
Proposal Approved by DLIAPEC Meeting	▲				
Stage 2. Design and Institutional Establishment					
Organizing Committee	■				
Recruit and Train Community Assistant	■				
Information Campaign	■				
First Management Committee	■				
Prepare Engineering Design IEE and EMMP	■				
Present Design, IEE and EMMP to Stakeholders	■				
Finalize RP, incl. Land Acquisition Plan	■				
Seek ADB and DOE approval to IEE and EMMP	■				
Sign Implementation Agreement		▲			
Stage 3. Construction and First-Year Joint O&M					
Tendering and Issue Work Order		■			
Construction of Structures		■	■		
Form and Train Labor Contracting Societies			■		
Construction of earthworks by LCS Groups			■		
LGED construction supervision		■	■		
WMCA monitoring during construction		■	■		
WMCA Institutional Establishment and Training		■	■		
Agriculture and Fisheries Support			■	■	
Poverty Reduction Plan		■			
First-Year Joint O&M				■	
Establish O&M Committee and Plan O&M				■	
Implement RP and EMMP		■	■	■	
Signature of Lease Agreement (Handover)					▲
WMCA operates and maintain subproject					■
IWRMU support					■

Attachment H: Public Consultation

Stakeholder Group	Type of Information to be Disclosed	Methods for Disclosure of Information	Agenda for Consultation	Methods for Consultation	Stakeholder Comments	Mitigation to be taken if necessary
Householders in and around subproject area	Inconvenience during sub-project construction including noise, dust and loss of access.	Consultation with householders in and around subproject area	During May, 2008	Household survey	Of 94 respondents 83 said that they were unconcerned with temporary inconvenience of the nature described. Eleven respondents said they would be concerned about temporary inconvenience.	Mitigation measures will be implemented as described in the EMMP.
Householders in and around subproject area	Possible changes to river and canal flow, groundwater and flood patterns	Consultation with householders in and around subproject area	During May, 2008	Household survey	Of 94 respondents, 92 said they would be unaffected by changing water conditions around the subproject area including groundwater regimes. Two respondents said they would be concerned by changes to flow, groundwater and flood patterns.	FSPR indicate no change except to possible change to the groundwater regime, which could possibly result in a higher water table. As salinity is not a concern this would be a benefit.
Householders in and around subproject area	Possible decline in fisheries	Consultation with householders in and around subproject area	During May, 2008	Household survey	Of 94 respondents, one was concerned for a possible decline in fisheries production.	Annex F3.2 of the Subproject Feasibility Report indicates a potential and substantial increase to fish production following subproject implementation.
Householders in and around subproject area	Possibility of increased flooding outside subproject area	Consultation with householders in and around subproject area	During May, 2008	Household survey	Of 94 respondents, one was concerned for a possible increase in flooding outside the subproject area.	The Subproject Feasibility Report indicates there will be no change in flood conditions outside the

						subproject area as a result of subproject implementation.
Government Officials (9)	Full description of proposed subproject.	Focus Group Discussion	24 April 2008 at Sreepur Upazila Engineers Office	Focus Group Discussion	Stakeholders requested implementation of subproject as soon as possible.	
Beneficiaries and Affected People. (33)	Full description of proposed subproject	Focus Group Discussion	24 April 2008 in front of Al-haq Abdul Morol's house	Focus Group Discussion	Stakeholders requested implementation of subproject as soon as possible.	
Beneficiaries and Affected People and NGOs (37)	Full description of proposed subproject	Focus Group Discussion	24 April 2008 at Goshinga Union Parishad Office	Focus Group Discussion	Stakeholders requested implementation of subproject as soon as possible.	
Beneficiaries and Affected People (11)	Full description of proposed subproject	Focus Group Discussion	Khezekhani Mosque	Focus Group Discussion	Stakeholders requested implementation of subproject as soon as possible.	