তফসিল-১

[বিধি ৪(১) দ্রঃ]

পণ্য, কার্য, সেবা, ইত্যাদি ক্রয়ের আদর্শ দলিলসমূহের তালিকা

পণ্য ও সংশ্লিষ্ট সেবা

পিজি ১	অভ্যন্তরীণ/ আন্তর্জাতিক ক্রয়	কোটেশনের মাধ্যমে পণ্য সংগ্রহের ক্ষেত্রে অনুরোধ জ্ঞাপনের জন্য দলিল (SRFQ) (টাকা ০.৫০ মিলিয়ন পর্যন্ত মূল্যমানের ক্রয়ের জন্য)
পিজি ২	অভ্যন্তরীণ ক্রয়	সীমিত অথবা উন্মুক্ত দরপত্রের মাধ্যমে পণ্য সংগ্রহের ক্ষেত্রে দরপত্র দলিল (STD) (টাকা ২.৫ মিলিয়ন পর্যন্ত)
পিজি ৩	অভ্যন্তরীণ ক্রয়	উন্মুক্ত দরপত্রের মাধ্যমে পণ্য সংগ্রহের ক্ষেত্রে দরপত্র দলিল (STD) (টাকা ২.৫ মিলিয়ন এর উর্দ্ধে)
পিজি ৪	আন্তর্জাতিক ক্রয়	উন্মুক্ত দরপত্রের মাধ্যমে পণ্য সংগ্রহের ক্ষেত্রে দরপত্র দলিল (STD) (যে কোন মূল্যমানের)
পিজি ৫	অভ্যন্তরীণ/ আন্তর্জাতিক ক্রয়	প্লান্ট ও যন্ত্রপাতি সরবরাহ এবং সংস্থাপনের জন্য দরপত্র দলিল (STD) ["টার্নকি চুক্তির আওতায়"- এক পর্যায় ও দুই পর্যায় বিশিষ্ট পদ্ধতির জন্য প্রযোজ্য হইবে (যে কোন মূল্যমানের)]
পিজি ৬	আন্তর্জাতিক ক্রয়	কোটেশনের প্রদানের মাধ্যমে বিভাজ্য (divisible) পণ্য সামগ্রী অধিক পরিমাণে (in bulk) সংগ্রহের ক্ষেত্রে অনুরোধ জ্ঞাপনের জন্য দলিল (SRFQ) (যে কোন মূল্যমানের)
পিকিউজি	অভ্যন্তরীণ/ আন্তর্জাতিক ক্রয়	প্লান্ট ও যন্ত্রপাতি সরবরাহ এবং সংস্থাপনের ক্ষেত্রে প্রাক-যোগ্যতা নির্ধারণে দলিল (PQS) (টাকা ১৫০.০০ মিলিয়ন মূল্যমানের উর্ধ্বে)

কার্য ও ভৌত সেবা

পিডব্লিউ ১	অভ্যন্তরীণ/ আন্তর্জাতিক ক্রয়	কোটেশনের মাধ্যমে কার্য সম্পাদনের ক্ষেত্রে অনুরোধ জ্ঞাপনের জন্য দলিল (SRFQ) (টাকা ০.৫০ মিলিয়ন মূল্যমানের ক্রয়ের জন্য)

পিডব্লিউ ২	অভ্যন্তরীণ ক্রয়	সীমিত অথবা উন্মুক্ত দরপত্রের মাধ্যমে কার্য সম্পাদনের ক্ষেত্রে দরপত্র দলিল (STD) (টাকা ১০.০০ মিলিয়ন পর্যন্ত)
পিডব্লিউ ৩	অভ্যন্তরীণ ক্রয়	উন্মুক্ত দরপত্রের মাধ্যমে কার্য সম্পাদনের ক্ষেত্রে দরপত্র দলিল (STD) ঃ প্রাক-যোগ্যতা নির্ধারণ ব্যতীত। (টাকা ৩৫০.০০ মিলিয়ন পর্যন্ত)
পিডব্লিউ ৪	অভ্যন্তরীণ ক্রয়	উন্মুক্ত দরপত্রের মাধ্যমে নির্মাণ কার্য অথবা সংস্থাপনার নকশা তৈরী ও সম্পাদনের ক্ষেত্রে দরপত্র দলিল (STD) ঃ (টাকা ৩৫০.০০ মিলিয়ন মূল্যমানের উর্ধ্বে)
পিকিউডব্লিউ ৪	অভ্যন্তরীণ ক্রয়	কার্য সম্পাদনের ক্ষেত্রে প্রাক-যোগ্যতা নির্ধারণের জন্য দলিল (SPD) (টাকা ৩৫০.০০ মিলিয়ন এর উর্ধ্বে)
পিডব্লিউ ৫	আন্তর্জাতিক ক্রয়	বৃহৎ এবং জটিল কার্য সম্পাদনের ক্ষেত্রে দরপত্র দলিল (STD) (টাকা ৩৫০.০০ মিলিয়ন এর উর্ধ্বে)
পিকিউডব্লিউ ৫	আন্তর্জাতিক ক্রয়	কার্য সম্পাদনের ক্ষেত্রে প্রাক-যোগ্যতা নির্ধারণের জন্য দলিল (SPD) (টাকা ৩৫০.০০ মিলিয়ন এর উর্ধ্বে)

বুদ্ধিবৃত্তিক এবং পেশাগত সেবা

পিএস ১	অভ্যন্তরীণ	সামাজিক সেবামূলক (Community Services) সংগঠন নির্বাচনের ক্ষেত্রে প্রস্তাব দাখিলের অনুরোধ সম্বলিত দলিল (RFP)
পিএস ২	অভ্যন্তরীণ	এন জি ও নির্বাচনের ক্ষেত্রে প্রস্তাব দাখিলের অনুরোধ সম্বলিত দলিল (RFP)
পিএস ৩ ও ৪	অভ্যন্তরীণ	থোক চুক্তি (lump-sum) অথবা সময় ভিত্তিক (time-based) ব্যক্তি পরামর্শক নির্বাচনের ক্ষেত্রে প্রস্তাব দাখিলের অনুরোধ সম্বলিত দলিল (RFA)
পিএস ৫	অভ্যন্তরীণ	পরামর্শক প্রতিষ্ঠান নির্বাচনের ক্ষেত্রে প্রস্তাব দাখিলের অনুরোধ সম্বলিত দলিল (SRFP) (simple থোক চুক্তি - টাকা ১০.০০ মিলিয়ন পর্যন্ত)
পিএস ৬	অভ্যন্তরীণ	পরামর্শক প্রতিষ্ঠান নির্বাচনের ক্ষেত্রে প্রস্তাব দাখিলের অনুরোধ সম্বলিত দলিল (SRFP) (simple সময় ভিত্তিক - টাকা ১০.০০ মিলিয়ন পর্যন্ত)

পিএস ৭	অভ্যন্তরীণ	পরামর্শক প্রতিষ্ঠান নির্বাচনের ক্ষেত্রে প্রস্তাব দাখিলের অনুরোধ সম্বলিত দলিল (SRFP) (জটিল ও থোক চুক্তি- টাকা ১০.০০ মিলিয়ন এর উর্ধ্বে)
পিএস ৮	অভ্যন্তরীণ	পরামর্শক প্রতিষ্ঠান নির্বাচনের ক্ষেত্রে প্রস্তাব দাখিলের অনুরোধ সম্বলিত দলিল (SRFP) (জটিল ও সময়ভিত্তিক চুক্তি- টাকা ১০.০০ মিলিয়ন এর উর্ধ্বে)
পিএস ৯ ও পিএস ১০	আন্তর্জাতিক	থোক চুক্তি (lump-sum) অথবা সময় ভিত্তিক (time-based) ব্যক্তি পরামর্শক নির্বাচনের ক্ষেত্রে প্রস্তাব দাখিলের অনুরোধ সম্বলিত দলিল (RFA)
পিএস ১১	আন্তর্জাতিক	পরামর্শক প্রতিষ্ঠান নির্বাচনের ক্ষেত্রে প্রস্তাব দাখিলের অনুরোধ সম্বলিত দলিল (SRFP) (থোক চুক্তি- যে কোন মূল্যমানের)
পিএস ১২	আন্তর্জাতিক	পরামর্শক প্রতিষ্ঠান নির্বাচনের ক্ষেত্রে প্রস্তাব দাখিলের অনুরোধ সম্বলিত দলিল (SRFP) (সময় ভিত্তিক চুক্তি- যে কোন মূল্যমানের)
পিএস এন	অভ্যন্তরীণ	পরামর্শ বিহীন সেবা গ্রহণের ক্ষেত্রে প্রস্তাব দাখিলের অনুরোধ সম্বলিত দলিল (RFP) (যে কোন মূল্যমানের)

মূল্যায়ন

ইভিডবিস্তজি		পণ্য ক্রয় ও কার্য সম্পাদনের ক্ষেত্রে দরপত্র উন্মুক্তকরণ ও মূল্যায়ন প্রতিবেদন প্রস্তুত সংক্রান্ত ছক ও নির্দেশাবলী।
ই ভি এস		পরামর্শক সেবা গ্রহণের ক্ষেত্রে প্রস্তাব উন্মুক্তকরণ ও মূল্যায়ন প্রতিবেদন প্রস্তুত সংক্রান্ত ছক ও নির্দেশাবলী।
পিএপি		অনুমোদনকারী কর্তৃপক্ষের জন্য মূল্যায়ন কমিটি কর্তৃক "ক্রয় প্রস্তাব" শিরোনামে সার-সংক্ষেপ প্রস্তুত করিবার ছক ও নির্দেশাবলী।
আরপিপি		ক্রয় প্রক্রিয়া উত্তর পুনরীক্ষণ (Procurement Post Review) পদ্ধতি।

তফসিল- ২

বিধি	সময়, মূল্য, ইত্যাদি
	দরপত্র ও প্রস্তাব উন্মুক্তকরণ কমিটি ঃ
৭	দরপত্র বা প্রস্তাব মূল্যায়ন কমিটি হইতে ১(এক) জন এবং সংশিষ্ট ক্রয়কারী এবং অন্যান্য সংস্থার ২ জন সদস্যসহ কমিটি নিম্নরূপভাবে গঠন করা হইবে ঃ (ক) চেয়ারপারসন; (খ) সদস্য; (গ) সদস্য-সচিব।
	দরপত্র ও প্রস্তাব মূল্যায়ন কমিটি ঃ
৮(১) ৮(৮)	▶ কমপক্ষে ৫ (পাঁচ) জন এবং সাধারণত অনধিক ৭ (সাত) জন সদস্য, যাহাদের মধ্যে ক্রয়কারীর নিয়ন্ত্রণকারী মন্ত্রণালয় বা বিভাগ বা এজেন্সীর বহির্ভূত কমপক্ষে ২ (দুই) জন সদস্য অন্তর্ভুক্ত থাকিবে; ▶ মূল্যায়নে ২ (দুই) জন বহিঃসদস্যসহ কমপক্ষে ৫ (পাঁচ) জন সদস্যের উপস্থিতি এবং মূল্যায়ন প্রতিবেদনে স্বাক্ষর আবশ্যক হইবে।
৮(২)	**স্বল্প-মূল্যের ক্রয়ের জন্য দরপত্র ও প্রস্তাব মূল্যায়ন কমিটি ঃ**
৮(৮)	▶ কমপক্ষে ৩ (তিন) জন সদস্য, যাহাদের মধ্যে ১ (এক) জন অন্য সংস্থা বা ক্রয়কারী হইতে নির্বাচন করিতে হইবে; ▶ মূল্যায়নে কমপক্ষে ৩ (তিন) জন সদস্যের উপস্থিতি আবশ্যক হইবে।
৮(২)	**যে প্রাক্কলিত মূল্যের ক্রয়ের ক্ষেত্রে মূল্যায়ন কমিটির সদস্য সংখ্যা হ্রাস করা যাইবে ঃ**
	▶ ১৫ (পনের) লক্ষ টাকা বা উহার নিম্ন মূল্যের পণ্য ও সংশিষ্ট সেবা ক্রয়ের ক্ষেত্রে; ▶ ৩০ (ত্রিশ) লক্ষ টাকা বা উহার নিম্ন মূল্যের কার্য ও ভৌত সেবা ক্রয়ের ক্ষেত্রে; ▶ ৫ (পাঁচ) লক্ষ টাকা বা উহার নিম্ন মূল্যের বুদ্ধিবৃত্তিক ও পেশাগত সেবা ক্রয়ের ক্ষেত্রে।
৮(১৪)	**কারিগরী সাব-কমিটির সদস্য সংখ্যা ঃ**
	▶ অনধিক ৩(তিন) জন।

বিধি	সময়, মূল্য, ইত্যাদি
৮(১৫)	**মূল্যায়ন কমিটির সদস্য-প্রতি ফি বা সম্মানী ঃ**
	১০ (দশ) কোটি টাকার উর্ধ্বের ক্রয়ের ক্ষেত্রেঃ ▶ প্রতি সভার জন্য সদস্য প্রতি সর্বাধিক ১০০০ (এক হাজার) টাকা ; ১ (এক) কোটি টাকার উর্ধ্ব হইতে ১০ (দশ) কোটি টাকা পর্যন্তক্রয়ের ক্ষেত্রে ঃ ▶ প্রতি সভার জন্য সদস্য প্রতি সর্বাধিক ৬০০ (ছয়শত) টাকা ; ১০ (দশ) লক্ষ টাকার উর্ধ্ব হইতে ১ (এক) কোটি টাকা পর্যন্তক্রয়ের ক্ষেত্রে ঃ ▶ প্রতি সভার জন্য সদস্য প্রতি সর্বাধিক ৩০০ (তিনশত) টাকা হারে; সভা আহ্বানকারী ক্রয়কারী সকল সদস্যকে ফি বা সম্মানী প্রদান করিবে।
	যে মূল্যের চুক্তির ক্ষেত্রে একই মন্ত্রণালয় বা বিভাগ বা এজেন্সীর অধীনস্থ অপরাপর ক্রয়কারীসমূহের কর্মকর্তাকে মূল্যায়ন কমিটির বহিঃসদস্য হিসাবে অন্তর্ভুক্ত করা যাইবে ঃ
৯ (২)(ক)	পণ্য এবং সংশ্লিষ্ট সেবা ঃ ▶ ১৫ (পনের) লক্ষ টাকা পর্যন্তউন্মুক্ত ও সীমিত দরপত্র পদ্ধতিতে ক্রয়; ▶ ৫ (পাঁচ) লক্ষ টাকা পর্যন্তসরাসরি দরপত্র পদ্ধতিতে ক্রয়; ▶ ৫ (পাঁচ) লক্ষ টাকা পর্যন্তকোটেশন প্রদানের অনুরোধ জ্ঞাপন পদ্ধতিতে ক্রয়।
৯ (২)(ক)	**কার্য এবং ভৌত সেবা ঃ**
	▶ ৩০ (ত্রিশ) লক্ষ টাকা পর্যন্তউন্মুক্ত ও সীমিত দরপত্র পদ্ধতিতে ক্রয়; ▶ ১০ (দশ) লক্ষ টাকা পর্যন্তসরাসরি দরপত্র পদ্ধতিতে ক্রয়; ▶ ৫ (পাঁচ) লক্ষ টাকা পর্যন্তকোটেশন প্রদানের অনুরোধ জ্ঞাপন পদ্ধতিতে ক্রয়।
৯(২)(খ)	সেবাসমূহ ঃ
	▶ ৫০ (পঞ্চাশ) লক্ষ টাকা পর্যন্তসর্বনিম্ন ব্যয়ভিত্তিক নির্বাচন পদ্ধতিতে বুদ্ধিবৃত্তিক ও পেশাগত সেবা ক্রয়; ▶ ৫ (পাঁচ) লক্ষ টাকা পর্যন্তএকক উৎস ভিত্তিক নির্বাচন পদ্ধতিতে বুদ্ধিবৃত্তিক ও পেশাগত সেবা ক্রয়; ▶ ২ (দুই) লক্ষ টাকা পর্যন্তকোটেশন প্রদানের অনুরোধ জ্ঞাপন পদ্ধতিতে জরুরী ও অদৃষ্টপূর্ব সেবা ক্রয়।

বিধি	সময়, মূল্য, ইত্যাদি
১৬(১১)	**ক্রয়-পরিকল্পনা সিপিটিইউ'র ওয়েবসাইটে প্রকাশ ঃ**
	▶ ১ (এক) কোটি টাকা বা তদূর্ধ্ব মূল্যের কার্য, পণ্য এবং সংশিষ্ট সেবা ক্রয়ের ক্ষেত্রে; ▶ ৫০ (পঞ্চাশ) লক্ষ টাকা বা তদূর্ধ্ব মূল্যের ভৌত সেবা ক্রয়ের ক্ষেত্রে; ▶ ৫০ (পঞ্চাশ) লক্ষ টাকা বা তদূর্ধ্ব মূল্যের বুদ্ধিবৃত্তিক ও পেশাগত সেবা ক্রয়।
১৮(১)(গ)	**প্রাক-দরপত্র সভার কার্যবিবরণী বিতরণের সময় ঃ**
	▶ অনধিক ১ (এক) সপ্তাহ
১৯(১) এবং ১১৭(১০)	**দরপত্র ও প্রস্তাবের বৈধতার মেয়াদ ঃ**
	▶ সাধারণত ৬০ (ষাট) হইতে ১২০ (একশত বিশ) দিন
২১(২)	**দরপত্র বা প্রস্তাবের বৈধতার মেয়াদ বৃদ্ধির অনুরোধ জ্ঞাপনের সময় ঃ**
	▶ দরপত্র বা প্রস্তাবের বৈধতার মেয়াদ উত্তীর্ণের ন্যূনতম ১০ (দশ) দিন পূর্বে।
২২(৩) ও (৫)	**দরপত্র জামানতের পরিমাণ ঃ**
	▶ লট-বাই-লট বা আইটেম-বাই-আইটেমভিত্তিক দরপত্রের ক্ষেত্রে ৫(পাঁচ)-টির কম লট বা আইটেমের ক্ষেত্র ব্যতিরেকে, সর্বক্ষেত্রেই দাপ্তরিক প্রাক্কলিত মূল্যের ৩% (শতকরা তিন ভাগ) এর মধ্যে নির্দিষ্ট পরিমাণে।
২২(৪)	**লট-বাই-লট বা আইটেম-বাই-আইটেমভিত্তিক দরপত্রের ক্ষেত্রে দরপত্র জামানতের পরিমাণ ঃ**
	▶ লট বা আইটেমভিত্তিক দরপত্র আহ্বানের ক্ষেত্রে ৫ (পাঁচ)-টির কম লট বা আইটেমের জন্য একটি দরপত্র জামানতের মাধ্যমে উদ্ধৃত মোট মূল্যের ন্যূনতম ২% (শতকরা দুই ভাগ)।
২৭(১)	**কার্য-সম্পাদন জামানতের (Performance Security) পরিমাণ ঃ**
	▶ বিভাজ্য পণ্যের (divisible commodities) ক্ষেত্রে চুক্তিমূল্যের ৫% (শতকরা পাঁচ ভাগ); ▶ পণ্য ও সংশিষ্ট সেবার ক্ষেত্রে চুক্তিমূল্যের ১০% (শতকরা দশ ভাগ); ▶ কার্যের ক্ষেত্রে চুক্তিমূল্যের ১০% (শতকরা দশ ভাগ), যদি অগ্রিম অর্থ প্রদানের ব্যবস্থা থাকে; ▶ কার্যের ক্ষেত্রে চুক্তিমূল্যের ৫% (শতকরা পাঁচ ভাগ) হইতে ১০% (শতকরা দশ ভাগ), যদি অগ্রিম অর্থ প্রদানের ব্যবস্থা না থাকে। ▶ ভৌত সেবার ক্ষেত্রে চুক্তিমূল্যের ৫% (শতকরা পাঁচ ভাগ) হইতে ১০% (শতকরা দশ ভাগ)।

বিধি	সময়, মূল্য, ইত্যাদি
২৭(২)	**ফ্রন্ট লোডিং (Front Loading) এর ক্ষেত্রে কার্য-সম্পাদন জামানতের পরিমাণ ঃ**
	▸ চুক্তিমূল্যের সর্বাধিক ২০% (শতকরা বিশ ভাগ)
২৮(১)	**কার্য ও ভৌত সেবা ক্রয় চুক্তির ক্ষেত্রে অনুমিত রক্ষণযোগ্য অর্থের (Retention Money) পরিমাণ ঃ**
	▸ অগ্রিম প্রদান করা না হইয়া থাকিলে এবং ১০% (শতকরা দশ ভাগ) কার্য-সম্পাদন জামানত দাখিল করা হইয়া থাকিলে, অনুমিত রক্ষণযোগ্য অর্থ কর্তনের আবশ্যকতা নাই; ▸ অগ্রিম প্রদান করা না হইয়া থাকিলে, বিধি ২৭(২) এ বর্ণিত ক্ষেত্র ব্যতীত, অনুমিত রক্ষণযোগ্য অর্থ এবং কার্যসম্পাদন জামানতের পরিমাণ সর্বমোট ১০% (শতকরা দশ ভাগ) এর অধিক হইবে না।
২৮(৩)	**অনুমিত রক্ষণযোগ্য অর্থ (Retention Money) বা ব্যাংক গ্যারান্টি ফেরত প্রদানের সময় ঃ**
	▸ ত্রুটি সংশোধন সংক্রান্ত্সনদ জারীর ২৮ (আটাশ) দিনের মধ্যে
৩২	**গৃহীত আবেদনপত্র, দরপত্র বা প্রস্তাব ক্রয়কারীর হেফাজতে রাখিবার সময়সীমা ঃ**
	▸ অনধিক ২ (দুই) কার্যদিবস
৩৫(১)	**সকল দরপত্র বা প্রস্তাব বাতিল সংক্রান্ত বিষয়ে দরপত্রদাতা বা আবেদনকারীগণকে অবহিতকরণের সময় ঃ**
	▸ ক্রয়কারী কার্যালয় প্রধান কর্তৃক সিদ্ধান্ত গ্রহণের ৭ (সাত) দিনের মধ্যে
৩৬(৪)(ক)	**চুক্তি সম্পাদন নোটিশ (NOA) জারীর সময় ঃ**
	▸ অনুমোদন প্রাপ্তির ৭ (সাত) কার্যদিবসের মধ্যে এবং দরপত্র বা প্রস্তাবের বৈধতার মেয়াদ উত্তীর্ণের পূর্বে।
৩৬(৫)	**যে মূল্যমানের ক্রয়ের জন্য ত্রৈমাসিক প্রতিবেদন প্রয়োজন ঃ**
	▸ ১ (এক) কোটি টাকা এবং তদূর্ধ্ব মূল্যের পণ্য ও সংশিষ্ট সেবা এবং কার্য ও ভৌত সেবা ক্রয়ের ক্ষেত্রে; ▸ ৫০ (পঞ্চাশ) লক্ষ টাকা এবং তদূর্ধ্ব মূল্যের বুদ্ধিবৃত্তিক ও পেশাগত সেবা ক্রয়ের ক্ষেত্রে।
৩৭(১) ১২৬(৩)	**সিপিটিইউ এর ওয়েবসাইটে চুক্তির সম্পাদন নোটিশ প্রকাশ ঃ**
	▸ ১ (এক) কোটি টাকা এবং তদূর্ধ্ব মূল্যের পণ্য ও সংশিষ্ট সেবা ক্রয়ের ক্ষেত্রে এবং কার্য ও ভৌত সেবা ক্রয়ের ক্ষেত্রে; ▸ ৫০ (পঞ্চাশ) লক্ষ টাকা এবং তদূর্ধ্ব মূল্যের বুদ্ধিবৃত্তিক ও পেশাগত সেবা ক্রয়ের ক্ষেত্রে ।

বিধি	সময়, মূল্য, ইত্যাদি
৩৭(১) এবং (২)	**সিপিটিইউ এর ওয়েবসাইটে চুক্তি সম্পাদন নোটিশ প্রকাশের সময়কালঃ**
	▸ চুক্তি সম্পাদন নোটিশ জারীর ৭ (সাত) দিনের মধ্যে এবং কমপক্ষে ১ (এক) মাসের জন্য
৩৭(৩) এবং ১২৬(২)	**ক্রয়কারীর নোটিশ বোর্ডে এবং ওয়েবসাইটে (যদি থাকে) চুক্তি সম্পাদন নোটিশ প্রকাশ ঃ**
	▸ ১ (এক) কোটি টাকার নিম্নের পণ্য এবং সংশিষ্ট সেবা এবং কার্য ও ভৌত সেবা ক্রয়ের ক্ষেত্রে ; ▸ ৫০ (পঞ্চাশ) লক্ষ টাকার নিম্নের বুদ্ধিবৃত্তিক ও পেশাগত সেবা ক্রয়ের ক্ষেত্রে।
৩৯(৩)	**ক্রয়কারী কর্তৃক প্রত্যাশিত কার্য সমাপ্তির (Intended Completion Date) তারিখ সম্প্রসারণ ঃ**
	▸ কার্য সমাপ্তির মূল সময়সীমার ২০% (শতকরা বিশ ভাগ) পর্যন্ত ▸ কার্য সমাপ্তির মূল সময়সীমার ২০% (শতকরা বিশ ভাগ) এর অধিক হইলে ক্রয়কারী কার্যালয় প্রধানের অনুমোদন প্রয়োজন হইবে।
৩৯(৪)	**ক্রয়কারী কর্তৃক প্রত্যাশিত কার্য সমাপ্তির (Intended Completion Date) সময়সীমা বর্ধিতকরণের সিদ্ধান্ত গ্রহণের সময়ঃ**
	▸ সময় বর্ধিতকরণের আবেদনপ্রাপ্তির ২১ (একুশ) দিনের মধ্যে
৩৯(১৮)	**অনুমোদনকারী কর্তৃপক্ষ কর্তৃক চুক্তি সংশোধন ঃ**
	▸ অনুমোদিত 'variations' জনিত কারণে মূল চুক্তিমূল্যের ১৫% (শতকরা পনের ভাগ) পর্যন্ত তবে উহা ১ (এক) কোটি টাকার অধিক হইবে না।
৩৯(২২)	**ঠিকাদারকে মূল্য পরিশোধ করার সময় ঃ**
	▸ প্রতিটি সনদ (certificate) ইস্যুর তারিখের ২৮ (আটাশ) দিনের মধ্যে
৩৯(২৯)	**ঠিকাদারের প্রাপ্য চূড়ান্ত মূল্য পরিশোধের সনদ (certificate) প্রদানের সময়ঃ**
	▸ পূর্ণাঙ্গ ও সঠিক হিসাব প্রাপ্তির ৫৬ (ছাপ্পান্ন) দিনের মধ্যে
৩৯(২৯)	**ত্রুটিজনিত দায়ের তালিকা (Defects Liability Schedule) জারীর সময়সীমা ঃ**
	▸ ঠিকাদার কর্তৃক চূড়ান্ত মূল্য পরিশোধের অনুরোধের তারিখ হইতে ৫৬ (ছাপ্পান্ন) দিনের মধ্যে।
৩৯(৩৩)	**ক্রয়কারী কর্তৃক কার্য ও সাইট অধিগ্রহণের সময় ঃ**
	▸ প্রকল্প ব্যবস্থাপক কর্তৃক কার্য সমাপ্তির সনদ জারীর ৭ (সাত) দিনের মধ্যে।

বিধি	সময়, মূল্য, ইত্যাদি
৪৩(১)	**ক্রয়কারী কর্তৃক ক্রয় সংক্রান্ত রেকর্ডপত্র সংরক্ষণ কাল ঃ**
	▶ কমপক্ষে ৫(পাঁচ) বৎসর; ▶ বিশেষ ক্ষেত্রে ক্রয়কারী কার্যালয় প্রধান বা তৎকর্তৃক ক্ষমতাপ্রাপ্ত কর্মকর্তার অনুমোদন গ্রহণক্রমে ৫(পাঁচ) বৎসরের অধিক ।
৪৬(১)	**ক্রয় প্রক্রিয়া-উত্তর পুনরীক্ষণ (Procurement Post Review) ঃ**
	▶ একটি নির্দিষ্ট অর্থ বৎসরে ক্রয়কারী কর্তৃক সম্পাদিত মোট ক্রয়ের পরিমাণ ১০ (দশ) কোটি টাকার অধিক হইলে।
৪৬(১) এবং (৬)	**ক্রয় প্রক্রিয়া-উত্তর পুনরীক্ষণের (Procurement Post Review) সময় ঃ**
	▶ প্রত্যেক অর্থ বৎসর সমাপ্তির ৯ (নয়) মাসের মধ্যে
৪৬(৩)	**ক্রয় প্রক্রিয়া-উত্তর পুনরীক্ষণে (Procurement Post Review) সম্পাদিত চুক্তির (Awarded Contracts) অন্তর্ভুক্তির ন্যূনতম সংখ্যা ও মূল্য ঃ**
	▶ কোন অর্থ বৎসরে সম্পাদিত মোট চুক্তি সংখ্যার ন্যূনতম ১৫% (শতকরা পনের ভাগ), যাহা নিরপেক্ষ পরামর্শক কর্তৃক এমনভাবে নির্ধারণ করিতে হইবে যেন উহা সম্পাদিত চুক্তিসমূহের মোট মূল্যের ৩০% (শতকরা ত্রিশ ভাগ) এর কম না হয়।
৫২(৩)(খ)	**তালিকাভুক্তিকরণ কমিটি (Enlistment Committee) গঠনঃ**
	▶ কমপক্ষে ৩ (তিন) জন সদস্য, যাহাদের মধ্যে— ▶ ১ (এক) জন ক্রয়কারীর অর্থ ইউনিট; ▶ ১ (এক) জন উহার কারিগরী ইউনিট হইতে; এবং ▶ ১ (এক) জন সদস্য ক্রয়কারীর কার্যালয় বহির্ভূত হইতে পারে।

বিধি	সময়, মূল্য, ইত্যাদি
৫২(৩)(ঘ)	**ক্রয়কারী কর্তৃক সরবরাহকারী ও ঠিকাদারগণের তালিকা হালনাগাদ করিবার লক্ষ্যে বার্ষিক সভা আহ্বানের বিষয় অবহিতকরণ ঃ**
	► সভা অনুষ্ঠানের কমপক্ষে ৭ (সাত) দিন পূর্বে বিজ্ঞাপনের মাধ্যমে।
৫৪(২)	**যৌথ উদ্যোগ সংক্রান্ড়চুক্তি সম্পাদনে ব্যবহার্য নন-জুডিসিয়াল স্ট্যাম্পের মূল্যমান ঃ**
	► ৩০০ (তিন শত) টাকা বা সরকার দ্বারা নির্ধারিত মূল্যমানের।
	অভিযোগসমূহের প্রশাসনিক পুনরীক্ষণের (Administrative Review) সময় ঃ
৫৭(১)	► যে পরিস্থিতির কারণে অভিযোগের উদ্ভব হইয়াছে তদ্বিষয়ে অবগত হইবার ৭ (সাত) পঞ্জিকা দিবসের মধ্যে;
৫৭(৪)	► অভিযোগ প্রাপ্তির ৫ (পাঁচ) কার্য দিবসের মধ্যে;
৫৭(৫)	► অভিযোগ দায়েরের পর অতিবাহিত পঞ্চম কার্য দিবস হইতে পরবর্তী ৩(তিন) কার্যদিবসের মধ্যে;
৫৭(৬)(ক)	► ৩ (তিন) কার্যদিবসের মধ্যে;
৫৭(৬)(খ)	► অভিযোগ প্রাপ্তির ৫ (পাঁচ) কার্য দিবসের মধ্যে;
৫৭(৭)	► অভিযোগ প্রাপ্তির ৭ (সাত) কার্য দিবসের মধ্যে;
৫৭(৮)	► অভিযোগ প্রাপ্তির ৫ (পাঁচ) কার্য দিবসের মধ্যে;
৫৭(৯) এবং	► লিখিত সিদ্ধান্ড়প্রাপ্তির ৩ (তিন) কার্য দিবসের মধ্যে;
৫৭(১২)	► লিখিত সিদ্ধান্ড়প্রাপ্তির ৭ (সাত) কার্য দিবসের মধ্যে।
	রিভিউ প্যানেল বরাবরে অভিযোগ দায়েরের নিমিত্ত নিবন্ধন ফি এবং ফেরতযোগ্য নিরাপত্তা জামানত এর পরিমাণ ঃ
৫৭(১২)(গ)	► ১(এক) কোটি টাকার নিম্নের চুক্তিমূল্যের ক্ষেত্রে, নিবন্ধন ফি (registration fee) ১০,০০০ (দশ হাজার) টাকা এবং নিরাপত্তা জামানত (security deposit) ৫০,০০০ (পঞ্চাশ হাজার) টাকা হইবে; ► ১(এক) কোটি টাকা হইতে ৫(পাঁচ) কোটি টাকার নিম্নের চুক্তিমূল্যের ক্ষেত্রে, নিবন্ধন ফি ১৫,০০০(পনের হাজার) টাকা এবং ফেরতযোগ্য নিরাপত্তা জামানত ১,০০,০০০(এক লক্ষ) টাকা হইবে; ► ৫(পাঁচ) কোটি টাকার উর্ধ্ব হইতে ১০(দশ) কোটি টাকা পর্যন্ড় চুক্তিমূল্যের ক্ষেত্রে, নিবন্ধন ফি ২০,০০০(বিশ হাজার) টাকা এবং নিরাপত্তা জামানত ২ (দুই) লক্ষ টাকা হইবে; ► ১০(দশ) কোটি টাকার উর্ধ্বের চুক্তিমূল্যের ক্ষেত্রে, নিবন্ধন ফি ২৫,০০০(পঁচিশ হাজার) টাকা এবং নিরাপত্তা জামানত ৫ (পাঁচ) লক্ষ টাকা হইবে; ► দরপত্র উন্মুক্তকরণের পূর্বে কোন বিষয়ে অভিযোগের ক্ষেত্রে, নিবন্ধন ফি ১০,০০০(দশ হাজার) টাকা এবং নিরাপত্তা জামানত ৫০,০০০(পঞ্চাশ হাজার) টাকা হইবে।

বিধি	সময়, মূল্য, ইত্যাদি
৫৮(২)	**রিভিউ প্যানেলের জন্য নির্বাচিত সুবিদিত বিশেষজ্ঞগণের সংখ্যা ঃ**
	▶ আইন বিষয়ক বিশেষজ্ঞ অনধিক ১০(দশ) জন; ▶ ক্রয়কার্যে কারিগরী জ্ঞানসম্পন্ন বিশেষজ্ঞ অনধিক ১০ (দশ) জন; ▶ চুক্তি ব্যবস্থাপনায় অভিজ্ঞ বিশেষজ্ঞ অনধিক ১০ (দশ) জন।
৫৮(২)(খ)	**রিভিউ প্যানেলের সংখ্যা ঃ**
	▶ ৩ (তিন) হইতে ৫ (পাঁচ) টি রিভিউ প্যানেল।
৫৮(৪)	**রিভিউ প্যানেলের সদস্য-প্রতি ফি বা সম্মানী ঃ**
	▶ প্রতি সভার জন্য সদস্য প্রতি ২৫০০ (দুই হাজার পাঁচশত) টাকা হারে প্রতিটি অভিযোগ পুনরীক্ষণের (Review) জন্য, তবে সর্বাধিক ৫ (পাঁচ) টি সভার জন্য উক্ত ফি বা সম্মানী প্রদেয় হইবে।
৫৯(১)	**রিভিউ প্যানেল নির্বাচনের সময়সীমা ঃ**
	▶ ৫ (পাঁচ) কার্য দিবসের মধ্যে।
৬০(২)	**রিভিউ প্যানেল কর্তৃক অভিযোগ নিস্পত্তির সময়সীমা ঃ**
	▶ রিভিউ প্যানেল তৎকর্তৃক অভিযোগ প্রাপ্তির ১২ (বার) কার্য-দিবসের মধ্যে উহার লিখিত সিদ্ধান্তপ্রদান করিবে।
৬১(৪)	**উন্মুক্ত দরপত্র পদ্ধতির অধীনে অভ্যন্তরীণ ক্রয়ের ক্ষেত্রে পণ্য সরবরাহ, কার্য সম্পাদন বা ভৌত সেবার জন্য বিজ্ঞাপন পত্রিকায় প্রকাশের তারিখ হইতে দরপত্র প্রণয়ন ও দাখিলের সময় ঃ**
	▶ ৩০ (ত্রিশ) লক্ষ টাকা পর্যন্তক্রয়ের ক্ষেত্রে ন্যূনতম ১৪ (চৌদ্দ) দিন; ▶ ৩০ (ত্রিশ) লক্ষ টাকার উর্ধ্বের এবং ৫(পাঁচ) কোটি টাকা পর্যন্তক্রয়ের ক্ষেত্রে ন্যূনতম ২১ (একুশ) দিন; ▶ ৫ (পাঁচ) কোটি টাকার উর্ধ্বের ক্রয়ের ক্ষেত্রে ন্যূনতম ২৮ (আটাশ) দিন; ▶ বিপর্যয়কর কোন ঘটনা মোকাবিলার জন্য জরুরী ক্রয়ের ক্ষেত্রে ন্যূনতম ১৪ (চৌদ্দ) দিন; ▶ পুনঃদরপত্র আহ্বানের ক্ষেত্রে ন্যূনতম ১৪ (চৌদ্দ) দিন ।
৬৩(২)	**তালিকাভুক্ত সরবরাহকারী বা ঠিকাদারদের নিকট হইতে সীমিত দরপত্র পদ্ধতির অধীনে ক্রয়ের ক্ষেত্রে মূল্যসীমা ঃ**
	▶ অনধিক ১৫ (পনের) লক্ষ টাকা মূল্যের পণ্য ও সংশিষ্ট সেবা এবং একক সেবাদানমূলক চুক্তি; ▶ অনধিক ৩০ (ত্রিশ) লক্ষ টাকা মূল্যের কার্য ও ভৌত সেবা।

বিধি	সময়, মূল্য, ইত্যাদি
৬৪(৫)	**সীমিত দরপত্র পদ্ধতির আওতায় পত্রিকায় বিজ্ঞাপন প্রকাশের তারিখ হইতে দরপত্র প্রণয়ন ও দাখিলের সময় ঃ**
	▶ ন্যূনতম ১৪ (চৌদ্দ) দিন; ▶ পুনঃদরপত্র আহ্বানের ক্ষেত্রে ৭ (সাত) দিনে হ্রাস করা যাইতে পারে; ▶ বিধি ৬৩(খ) ও (গ) অনুযায়ী ন্যূনতম ৭ (সাত) দিন; ▶ জাতীয় দুর্যোগের ক্ষেত্রে ক্রয়কারী কার্যালয় প্রধানের অনুমোদন সাপেক্ষে ৭ (সাত) দিনের কম সময়।
৬৬(৫)	প্রথম পর্যায়ে কারিগরী প্রস্তাব দাখিলের জন্য সময় ঃ
	▶ পত্রিকায় বিজ্ঞাপন প্রকাশের তারিখ হইতে ন্যূনতম ৪২(বিয়ালিশ) দিন।
৬৭(৫)	**দুই পর্যায় বিশিষ্ট দরপত্র পদ্ধতির ক্ষেত্রে প্রথম পর্যায়ের দরপত্র মূল্যায়ন প্রতিবেদন দাখিলের সময় ঃ**
	▶ ৭ (সাত) দিন।
৬৮(৩)	**দুই পর্যায় বিশিষ্ট দরপত্র পদ্ধতির ক্ষেত্রে দ্বিতীয় পর্যায়ের দরপত্র প্রণয়ন ও দাখিলের সময় ঃ**
	▶ ২১ (একুশ) দিন।
৬৯(১) এবং (৬)(ক) ও (গ)	**কোটেশন প্রদানের অনুরোধ জ্ঞাপন পদ্ধতি প্রয়োগের মাধ্যমে পণ্য ও সংশ্লিষ্ট সেবা এবং কার্য ও ভৌত সেবা ক্রয়ের আর্থিক মূল্যসীমা ঃ**
	▶ **রাজস্ব বাজেটের অধীন ক্রয়ের ক্ষেত্রে ঃ** পণ্য ও সংশ্লিষ্ট সেবা ক্রয়ের জন্য প্রতিটি ক্ষেত্রে অনধিক ১(এক) লক্ষ টাকা; তবে বৎসরে সর্বোচ্চ ৩(তিন) লক্ষ টাকা। কার্য ও ভৌত সেবা ক্রয়ের জন্য প্রতিটি ক্ষেত্রে অনধিক ২(দুই) লক্ষ টাকা; তবে বৎসরে সর্বোচ্চ ৫(পাঁচ) লক্ষ টাকা।
	▶ **উন্নয়ন বাজেটের অধীন ক্রয়ের ক্ষেত্রে ঃ** পণ্য ও সংশ্লিষ্ট সেবা ক্রয়ের জন্য প্রতিটি ক্ষেত্রে অনধিক ২(দুই) লক্ষ টাকা; তবে বৎসরে সর্বোচ্চ ৫(পাঁচ) লক্ষ টাকা। কার্য ও ভৌত সেবা ক্রয়ের জন্য প্রতিটি ক্ষেত্রে অনধিক ৩(তিন) লক্ষ টাকা; তবে বৎসরে সর্বোচ্চ ১০(দশ) লক্ষ টাকা।

বিধি	সময়, মূল্য, ইত্যাদি
৬৯(৬)(খ)	**জাতীয় পতাকাবাহী বাহনের জন্য ক্রয়ের ক্ষেত্রে ঃ**
	▶ প্রতিটি ক্রয়ের ক্ষেত্রে সর্বোচ্চ ৫(পাঁচ) লক্ষ টাকা।
৭১(৪)	**কোটেশন প্রদানের অনুরোধ জ্ঞাপন পদ্ধতির অধীন কোটেশন আহবানের ক্ষেত্রে সময়সীমা ঃ**
	▶ কোটেশন আহ্বানের তারিখ হইতে অনধিক ১০ (দশ) দিন।
৭৪(৫)	**ভেরিয়েশন অর্ডার (variation order), অতিরিক্ত কার্যাদেশ, পুনরাবৃত্ত ক্রয়াদেশ বা অতিরিক্ত পণ্য সরবরাহের আদেশ প্রদানের মূল্যসীমা ঃ**
	▶ মূল চুক্তি মূল্যের অনধিক ১৫% (শতকরা পনের ভাগ)।
৭৬ (১)	**সরাসরি চুক্তি (direct contracting) এর আওতায় জরুরী পরিস্থিতি, প্রাকৃতিক দুর্যোগ বা সংকট মোকাবেলায় পণ্য, কার্য ও সেবা ক্রয় ঃ**
(ঞ) এবং	▶ প্রতিটি ক্ষেত্রে অনধিক ২০ (বিশ) লক্ষ টাকা; তবে বৎসরে সর্বোচ্চ ৩০(ত্রিশ) লক্ষ টাকা।
(ট)	▶ প্রতিটি ক্ষেত্রে অনধিক ৫০ (পঞ্চাশ) হাজার টাকা; তবে বিশেষ ক্ষেত্রে ক্রয়কারী কার্যালয় প্রধানের পূর্বানুমোদনক্রমে সর্বোচ্চ ১(এক) লক্ষ টাকা।
৭৭	**পণ্যের অতিরিক্ত সরবরাহ এবং পুনরাবৃত্ত ক্রয়াদেশ এর ক্ষেত্রে মূল্যসীমা ঃ**
	▶ মূল চুক্তি মূল্যের অনধিক ১৫% (শতকরা পনের ভাগ)।
৭৮(৩)	**ভেরিয়েশন অর্ডার এবং অতিরিক্ত কার্য ও ভৌত সেবা ক্রয়ের মূল্যসীমা ঃ**
	▶ মূল চুক্তি মূল্যের অনধিক ১৫% (শতকরা পনের ভাগ)।
৭৯(১)	**ভেরিয়েশন অর্ডার বা অতিরিক্ত কার্যাদেশ দাবী করার সময়সীমা ঃ**
	▶ Variation order বা অতিরিক্ত কার্যাদেশের প্রয়োজনীয়তা সম্পর্কে অবহিত হওয়ার ৭(সাত) পঞ্জিকা দিবসের মধ্যে।
৭৯(২)(গ)	**ভেরিয়েশন অর্ডার এবং অতিরিক্ত কার্যাদেশ প্রক্রিয়াকরণের সময়সীমা ঃ**
	▶ ভেরিয়েশন অর্ডার প্রণয়ন হইতে অনুমোদন পর্যন্ড় ৩০ (ত্রিশ) দিনের অধিক হইবে না।
৮০(৪)(খ)	**প্রকল্পের আওতায় কার্যের ক্রমপুঞ্জিত বৃদ্ধি ঃ**
	▶ সমন্বয়কৃত (adjusted) মূল চুক্তি মূল্যের অনধিক ১০% (শতকরা দশ ভাগ)।

বিধি	সময়, মূল্য, ইত্যাদি
৮১	**সরাসরি নগদ ক্রয়ের বাৎসরিক মোট পরিমাণ ঃ**
	▶ প্রতি ক্রয়ের ক্ষেত্রে অনধিক ১৫,০০০ (পনের হাজার) টাকা, কিন্তু বৎসরে অনধিক ২ (দুই) লক্ষ টাকা।
৮২	**ফোর্স একাউন্ট (Force Account) এর অধীন বাৎসরিক মোট ক্রয়ের পরিমাণ ঃ**
	▶ প্রতিটি ক্ষেত্রে অনধিক ২(দুই) লক্ষ টাকা।
৮৩ (১)(ক)	**আন্তর্জাতিক প্রতিযোগিতার মাধ্যমে পণ্য এবং সংশ্লিষ্ট সেবা এবং কার্য ও ভৌত সেবা ক্রয়ের দরপত্র প্রস্তুত ও দাখিলের সময়সীমা ঃ**
	▶ উন্মুক্ত দরপত্র পদ্ধতির ক্ষেত্রে, পত্রিকায় বিজ্ঞাপন প্রকাশের তারিখ হইতে ৪২ (বিয়ালিশ) দিনের কম হইবে না; ▶ পুনঃদরপত্র আহ্বানের ক্ষেত্রে, পত্রিকায় বিজ্ঞাপন প্রকাশের তারিখ হইতে ২৮ (আটাশ) দিনের কম হইবে না; ▶ দুই পর্যায় বিশিষ্ট দরপত্র পদ্ধতির ক্ষেত্রে, পত্রিকায় বিজ্ঞাপন প্রকাশের তারিখ হইতে প্রথম পর্যায়ের জন্য ৪২ (বিয়ালিশ) এবং দ্বিতীয় পর্যায়ের জন্য ২১ (একুশ) দিনের কম হইবে না।
৮৩(১)(ঙ) এবং ৯৮(২১)(ঙ)	**বাংলাদেশী সরবরাহকারী ও ঠিকাদারগণের স্থানীয় অগ্রাধিকার (domestic preference) ঃ**
	▶ পণ্যের ক্ষেত্রে সরবরাহ মূল্যের (delivered price) অনধিক ১৫% (শতকরা পনের ভাগ); ▶ কার্যের ক্ষেত্রে চুক্তি মূল্যের অনধিক ৭.৫% (শতকরা সাড়ে সাত ভাগ)।
৮৮(১) ৮৮(২)	**জাতীয় পতাকাবাহী বাহন ও বৈদেশিক মিশনসমূহ কর্তৃক ক্রয় ঃ**
	▶ প্রতিটি ক্ষেত্রে সর্বোচ্চ ৫(পাঁচ) লক্ষ টাকা। ▶ প্রতিটি ক্ষেত্রে সর্বোচ্চ ১০(দশ) লক্ষ টাকা।
৯০(২)(গ)	**স্থানীয় ও আঞ্চলিক পত্রিকায় বিজ্ঞাপন প্রকাশ ঃ**
	▶ দাপ্তরিক প্রাক্কলিত মূল্য যখন ৫ (পাঁচ) লক্ষ টাকা বা তাহার নিম্নে ।
৯০(২)(ঝ)	**যে সকল মূল্যের ক্রয় সংশ্লিষ্ট নোটিশ সিপিটিইউ'র ওয়েবসাইটে প্রকাশ করিতে হইবে ঃ**
	▶ পণ্য ও সংশ্লিষ্ট সেবা এবং কার্য ও ভৌত সেবার দাপ্তরিক প্রাক্কলিত মূল্য যখন ১ (এক) কোটি টাকা বা তাহার উর্ধ্বে; ▶ বুদ্ধিবৃত্তিক ও পেশাগত সেবার দাপ্তরিক প্রাক্কলিত মূল্য যখন ৫০ (পঞ্চাশ) লক্ষ টাকা বা তাহার উর্ধ্বে; ▶ বিজ্ঞাপন যুগপৎ সিপিটিইউ এবং পত্রিকায় প্রেরণ করিতে হইবে।

বিধি	সময়, মূল্য, ইত্যাদি
৯১(১)	**প্রাক-যোগ্যতা নির্ধারণের ক্ষেত্রে ন্যূনতম মূল্যসীমা ঃ**
	▶ ৩৫ (পঁয়ত্রিশ) কোটি টাকার অধিক মূল্যের নির্মাণ কার্য; ▶ ৩ (তিন) কোটি ৫০ (পঞ্চাশ) লক্ষ টাকার অধিক মূল্যের রক্ষণাবেক্ষণ কার্য; ▶ ১৫ (পনের) কোটি টাকার অধিক মূল্যের প্লান্ট ও যন্ত্রপাতি সরবরাহ ও স্থাপন; ▶ ৩৫ (পঁয়ত্রিশ) কোটি টাকার অধিক মূল্যের কোন স্থাপনার নকশা তৈরী ও অবকাঠামো নির্মাণ কার্য; ▶ ৩ (তিন) কোটি ৫০ (পঞ্চাশ) লক্ষ টাকার অধিক মূল্যের নির্দিষ্ট নকশা ও মাপে যন্ত্রপাতি তৈরী (custom designed equipment); ▶ ৩৫ (পঁয়ত্রিশ) কোটি টাকার অধিক মূল্যের ব্যবস্থাপনা চুক্তি।
৯১ (৪)	**আবেদনকারীদের প্রাক-যোগ্যতার আবেদনপত্র প্রণয়নের সময়সীমা ঃ**
	▶ কমপক্ষে ২১ (একুশ) দিন।
৯১(৭)	**ক্রয়কারী কর্তৃক যে সময়ের পূর্বে প্রাক-যোগ্যতার দলিলের উপর আবেদনকারীর নিকট হইতে স্পষ্টীকরণের অনুরোধপত্র গ্রহণ করা হইবে ঃ**
	▶ আবেদনপত্র দাখিলের সর্বশেষ সময়সীমার ৭ (সাত) কার্যদিবসের পূর্ব পর্যন্ত
৯১(৮)	**ক্রয়কারী যে সময়ের মধ্যে আবেদনকারীর নিকট হইতে প্রাক-যোগ্যতার দলিলের উপর স্পষ্টীকরণের অনুরোধ পত্রের জবাব প্রদান করিবেন ঃ**
	▶ ৫ (পাঁচ) কার্যদিবসের মধ্যে।
৯৩(৯)	**প্রাক-যোগ্য আবেদনকারীর সংখ্যা ঃ**
	▶ ন্যূনতম ৩ (তিন) জন।
৯৩(১৮)	**প্রাক-যোগ্য আবেদনকারী কর্তৃক উহার আকার বা গঠন প্রক্রিয়ার কোন পরিবর্তনের বিষয়ে ক্রয়কারীকে অবহিতকরণের সময় ঃ**
	▶ দরপত্র আহ্বানের তারিখের পর অনধিক ১৪ (চৌদ্দ) দিনের মধ্যে।
৯৪(১১)	**প্রাক-দরপত্র সভার কার্য-বিবরণী বিতরণের সময় ঃ**
	▶ সভা অনুষ্ঠিত হইবার ৫ (পাঁচ) দিনের মধ্যে।

বিধি	সময়, মূল্য, ইত্যাদি
৯৫(২) ১১৭(১৯)	**ক্রয়কারী কর্তৃক দরপত্র বা প্রস্তাব দলিলের স্পষ্টীকরণ এবং ক্ষেত্র মত দলিলের সংশোধন বা সংযোজন (addendum) জারী করিবার সময়সীমা ঃ**
	▸ ৫ (পাঁচ) কার্যদিবসের মধ্যে।
৯৫(৩)	**দরপত্রদাতা কর্তৃক দরপত্র দলিলের সংশোধন ও সংযোজন প্রাপ্তিস্বীকারের সময় ঃ**
	▸ ৩ (তিন) কার্যদিবসের মধ্যে।
৯৫(৪)	**সংশোধন, সংযোজন বা স্পষ্টীকরণের জন্য অনুরোধের উত্তর প্রাপ্ত না হইলে, দরপত্রদাতা কর্তৃক ক্রয়কারীকে অবহিত করার সময় ঃ**
	▸ দরপত্র দাখিলের জন্য প্রদত্ত সময়ের দুই-তৃতীয়াংশ সময় অতিক্রান্ত হইবার পরে।
৯৫(৬)	**দরপত্র দলিলের সংশোধনজনিত কারণে সময়সীমা বর্ধিত করণ ঃ**
	▸ দরপত্র প্রণয়নের জন্য এক-তৃতীয়াংশের কম সময় অবশিষ্ট থাকা অবস্থায় সংশোধন করা হইলে ▸ সময়সীমা ন্যূনতম ৩ (তিন) দিন বৃদ্ধি করিতে হইবে।
৯৬(১১)(ক)	**যে মূল্যের পণ্য ও সংশিষ্ট সেবা এবং কার্য ও ভৌত সেবা ক্রয়ের নিমিত্ত একাধিক স্থানে (multiple dropping) দরপত্র দাখিল করা যাইবে ঃ**
	▸ ক্রয়ের দাপ্তরিক প্রাক্কলিত মূল্য যখন ৩০ (ত্রিশ) লক্ষ টাকা এবং উহার উর্ধ্বে; ▸ দরপত্র দাখিলের সময়সীমা উত্তীর্ণ হওয়ার ৩ (তিন) ঘন্টার মধ্যে প্রধান স্থানে দাখিল করিতে হইবে।
১০১(৪)	**দরপত্র মূল্যায়ন কমিটি (TEC) কর্তৃক অনুমোদনকারী কর্তৃপক্ষের জিজ্ঞাসার জবাব প্রদানের সময় ঃ**
	▸ প্রাপ্তির ৫(পাঁচ) কার্যদিবসের মধ্যে।
১০২(৩) এবং (৪)	**কৃতকার্য দরদাতা কর্তৃক চুক্তি সম্পাদন নোটিশ (NOA) গ্রহণের লিখিত সম্মতিপত্র প্রদানের সময় ঃ**
	▸ চুক্তি সম্পাদন নোটিশ জারীর ৭ (সাত) কার্যদিবসের মধ্যে।

বিধি	সময়, মূল্য, ইত্যাদি
১০২(৭)	**কৃতকার্য দরদাতা কর্তৃক কার্য সম্পাদন জামানত (Performance Security) দাখিলের সময় ঃ**
	▶ জাতীয় পর্যায়ের দরপত্রের ক্ষেত্রে, চুক্তি সম্পাদন নোটিশ প্রাপ্তির তারিখ হইতে ১৪ (চৌদ্দ) দিনের মধ্যে, কিন্তু চুক্তি সম্পাদন নোটিশে নির্দিষ্টকৃত তারিখের পরে নহে; ▶ আন্তর্জাতিক প্রতিযোগিতার ক্ষেত্রে, চুক্তি সম্পাদন নোটিশ জারীর ২৮(আটাশ) দিনের মধ্যে।
১০২(১১)	**কৃতকার্য দরদাতা কর্তৃক চুক্তি স্বাক্ষরের সময় সীমা ঃ**
	▶ চুক্তি সম্পাদন নোটিশ জারীর তারিখ হইতে ২৮ (আটাশ) দিনের মধ্যে। ▶ আন্তর্জাতিক দরপত্রের ক্ষেত্রে চুক্তি সম্পাদন নোটিশ ইস্যুর ২৮ (আটাশ) দিনের মধ্যে।
১০৪(ক)	**ন্যূনতম ব্যয়ভিত্তিক পরামর্শক নির্বাচন (Least Cost Selection) ঃ**
	▶ অনধিক ৫০ (পঞ্চাশ) লক্ষ টাকা।
১০৪(ঘ)(২)(আ)	**একক উৎসভিত্তিক পরামর্শক নির্বাচন (Single Source Selection) ঃ**
	▶ পরামর্শক প্রতিষ্ঠানের (ফার্ম) জন্য সর্বাধিক ১০ (দশ) লক্ষ টাকা; ▶ ব্যক্তি পরামর্শকের জন্য সর্বাধিক ৫(পাঁচ) লক্ষ টাকা।
১০৪(ঘ)(৮)	**বুদ্ধিবৃত্তিক ও পেশাগত সেবার ক্ষেত্রে variation order এর মূল্যসীমা ঃ**
	▶ মূল চুক্তি মূল্যের অনধিক ১৫% (শতকরা ১৫ ভাগ)
১১৩ (২)	**বুদ্ধিবৃত্তিক ও পেশাগত সেবা ক্রয়ের নিমিত্ত আগ্রহ ব্যক্তকরণ পত্র প্রণয়ন ও দাখিলের সময় ঃ**
	▶ অভ্যন্তরীণ ক্রয়ের ক্ষেত্রে কমপক্ষে ১৪ (চৌদ্দ) দিন; ▶ আন্তর্জাতিক ক্রয়ের ক্ষেত্রে কমপক্ষে ২১ (একুশ) দিন।
১১৫(৩)	**সংক্ষিপ্ত তালিকাভুক্ত পরামর্শকের সংখ্যা ঃ**
	▶ কমপক্ষে ৪ জন এবং অনধিক ৭ জন আবেদনকারী, তবে ৬ জন অধিকতর কাম্য।
১১৭ (১৯)	**বুদ্ধিবৃত্তিক ও পেশাগত সেবা ক্রয়ের নিমিত্ত প্রস্তাব প্রণয়ন এবং দাখিলের সময় ঃ**
	▶ অভ্যন্তরীণ ক্রয়ের ক্ষেত্রে ন্যূনতম ২৮ (আটাশ) দিন; ▶ আন্তর্জাতিক ক্রয়ের ক্ষেত্রে ন্যূনতম ৪২ (বিয়াল্লিশ) দিন।

বিধি	সময়, মূল্য, ইত্যাদি
১২৭(৫)(খ)	**পেশাগত অসদাচরণ, অপরাধ ইত্যাদি বিষয়ে ক্রয়কারী কার্যালয় প্রধান কর্তৃক সিদ্ধান্ত প্রদান বা কমিটি গঠনের সময়সীমা ঃ**
	▸ সংশিষ্ট প্রতিবেদন প্রাপ্তির ৫ (পাঁচ) কার্য দিবসের মধ্যে।
১২৭(৫)(গ)	**ক্রয়কারী কার্যালয় প্রধানের নিকট কমিটি কর্তৃক সুপারিশসহ প্রতিবেদন প্রেরণ করিবার সময়সীমা ঃ**
	▸ ক্রয়কারীর নিকট হইতে সংশিষ্ট প্রতিবেদন প্রাপ্তির ৫ (পাঁচ) কার্য দিবসের মধ্যে।
১৩০(ঙ)	**সিপিটিইউ কর্তৃক সরকারের নিকট বার্ষিক প্রতিবেদন পেশ ঃ**
	▸ আর্থিক বৎসর শুরুর ৭ (সাত) মাসের মধ্যে।

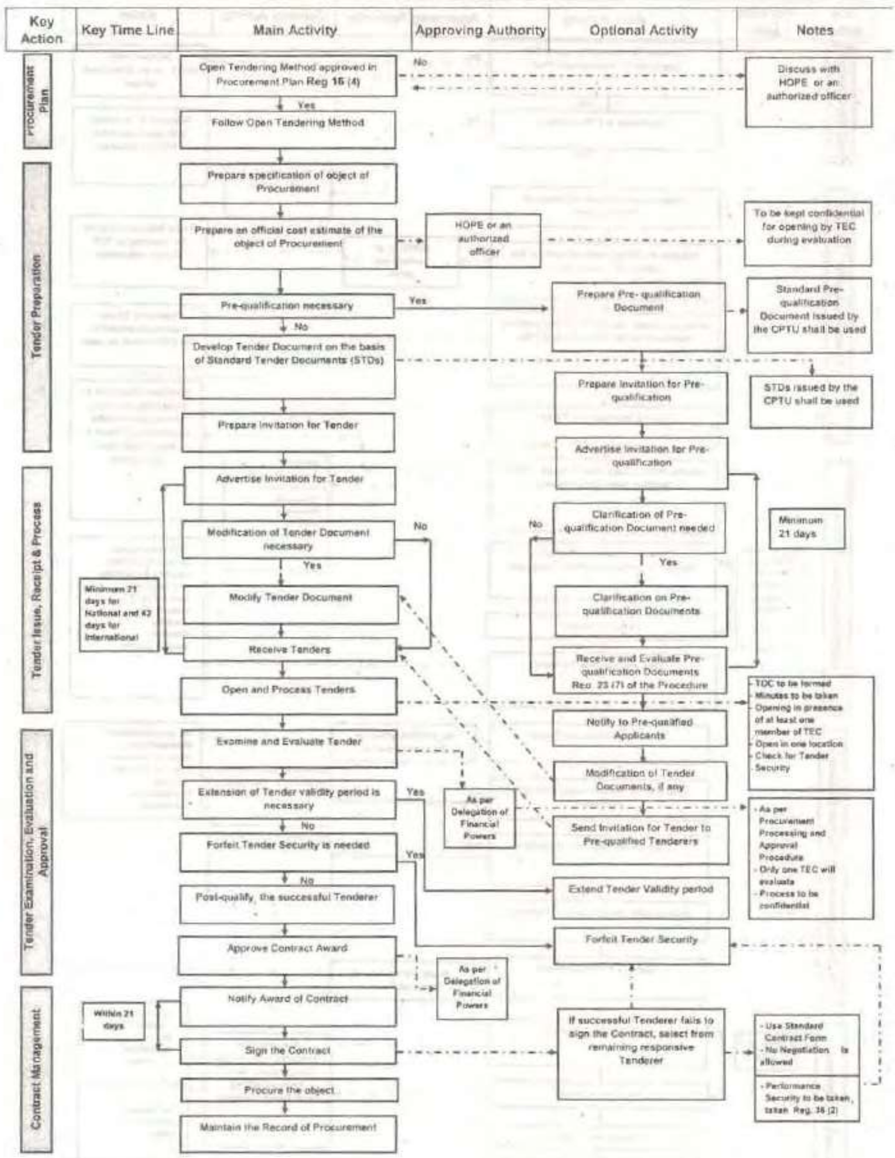
তফসিল-৩
অংশ-ক ঃ [বিধি ৮(১৪) দ্রঃ]
Procurement Processing and Approval Timetable)

Approval Procedur / Approving Authority	Technical Sub-committee (TSC) [If required]	Tender Evaluation Committee (TEC)/ Proposal Evaluation Committee (PEC)*	Project Director/Project Manager/Authorized Officer/ Head of Procuring Entity (HOPE)	Board of Directors	Ministry Minister/ Secretary	Cabinet Committee on Government Purchase (CCGP)	Total Period when Technical Sub-Committee is	
							Not Required	Required
Project Director (PD), or Project Manager (PM), or Authorized Officer (AO)	2 weeks →	2 weeks →	1 week Approval ↓ & 1 week issue of NOA	NA	NA	NA	4 weeks	6 weeks
Head of Procuring Entity (HOPE)	2 weeks →	3 weeks →	2 week Approval ↓ & 1 week issue of NOA	NA	NA	NA	6 weeks	8weeks
Board of Directors	3 weeks →	3 weeks →	2 weeks CE Scrutiny & observation ⇄ & 1 week issue of NOA	2 weeks Approval by Board	NA	NA	8 weeks	11 weeks
Ministry/Minister	3 weeks →	3 weeks →	2 weeks HOPE/ Scrutiny & observation ⇄ & 1 week issue of NOA		2 week Secretary Recommendation ↑↓ 1 week Minister Approval	NA	9 weeks	12 weeks
Cabinet Committee on Government Purchase (CCGP) A. simple Cases	3 weeks →	3 weeks →	2 weeks HOPE Scrutiny & observation ⇄ & 1 week issue of NOA		3 weeks Secretary Scrutiny & observation ↓↑ 1 week Minister Recommendation ⇄	As required for expeditious decision before expiry of tender validity period	10+ weeks	13+ weeks
B. Complex Cases	4 weeks →	4 weeks →	2 weeks HOPE Scrutiny & observation ⇄ & 1 week issue of NOA		3 weeks Secretary Scrutiny & observation ↓↑ 1 week Minister Recommendation ⇄	As required for expeditious decision before expiry of tender validity period	11+ weeks	15+ weeks

Note : 1. For aided project/programme where prior review of a development partner is required at any stage of Procurement processing and approval the time required for such review shall be added to the above time table.
2.* For all cases of evaluation of consultancy proposals one week's time in addition to above time table shall be allowed to the PEC for evaluation/negotiation etc.

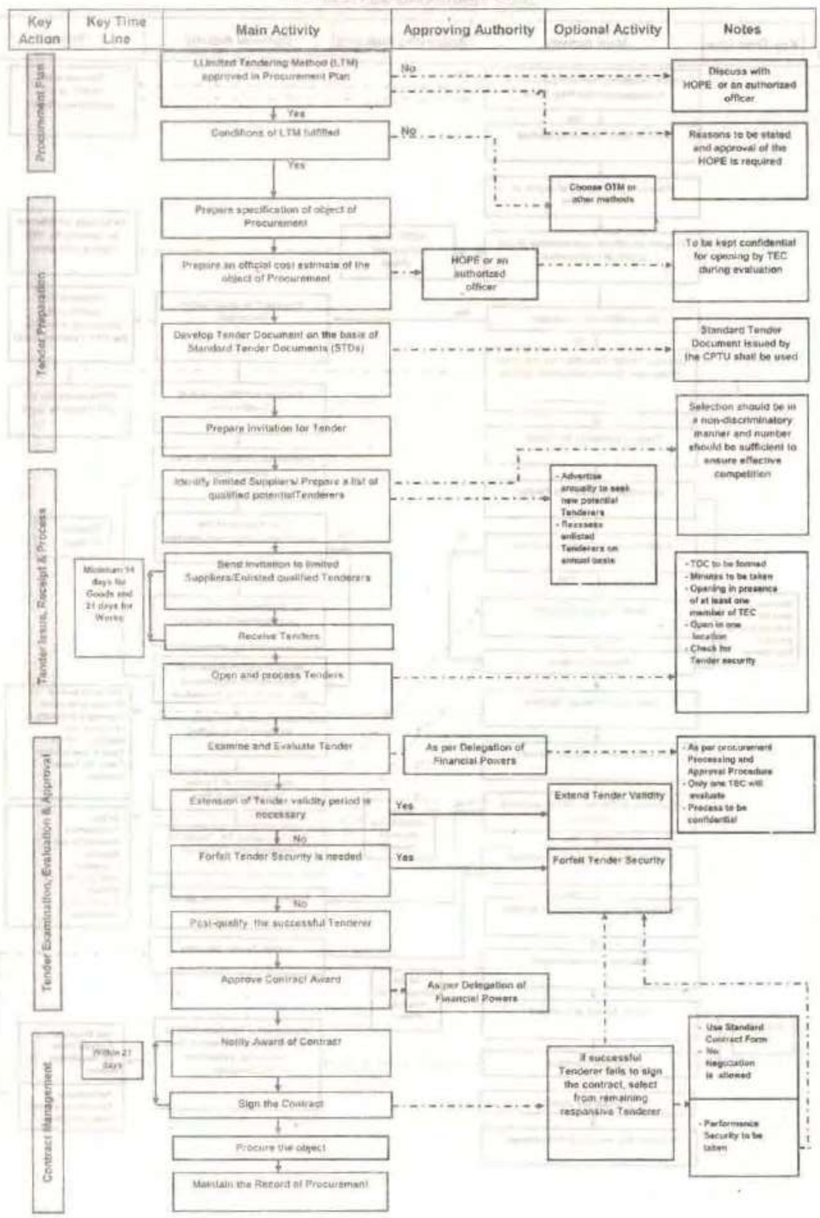
অংশ-খ ঃ [বিধি ৬১(৭) দ্রঃ]

OPEN TENDERING METHOD



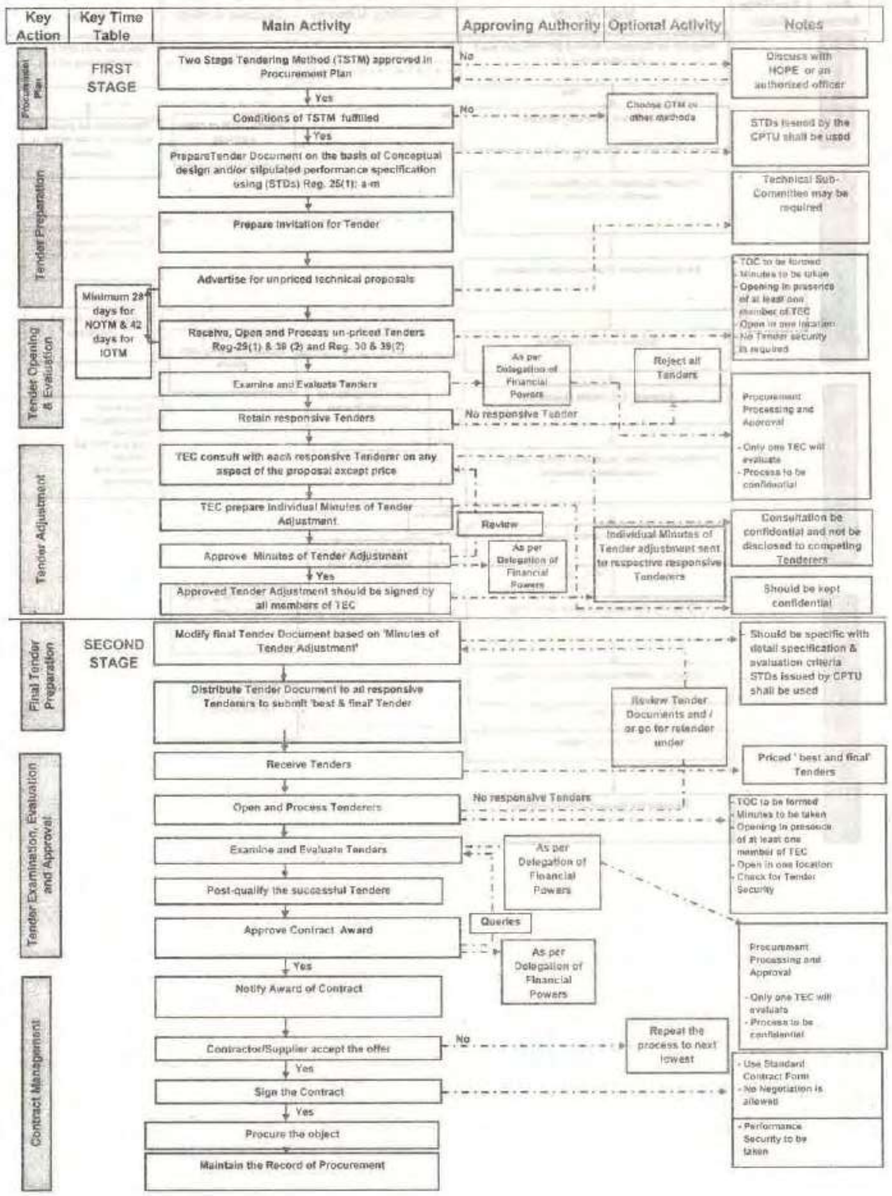
অংশ-গ ঃ [বিধি ৬২(২) দ্রঃ]

LIMITED TENDERING METHOD



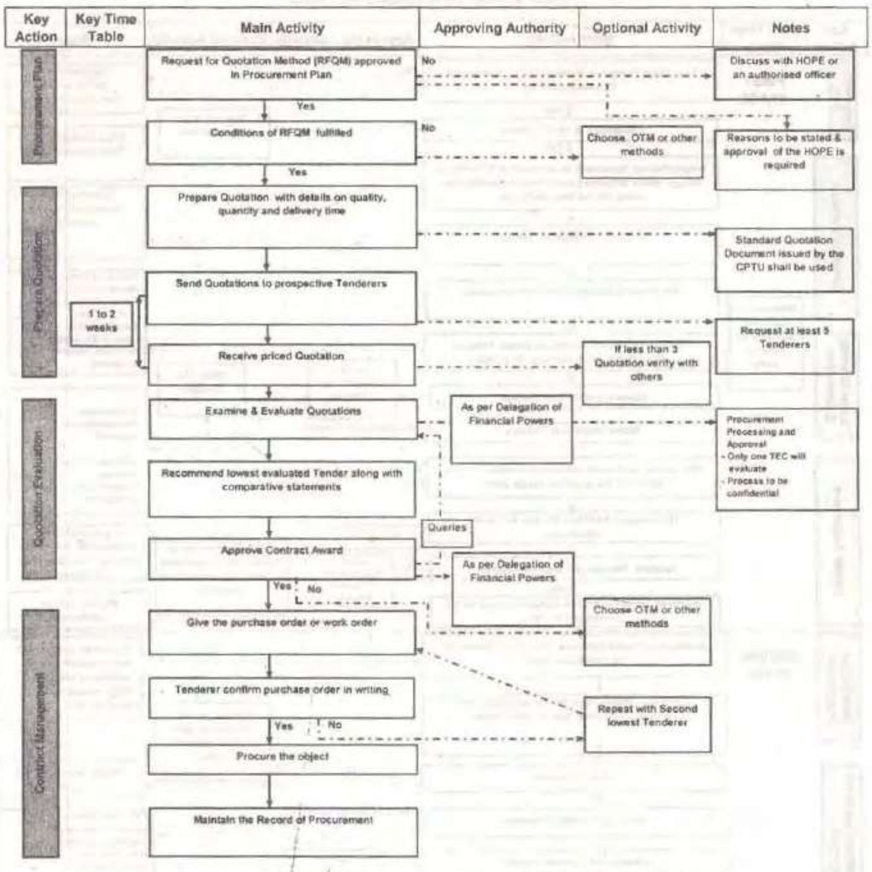
অংশ-ঘ ঃ [বিধি ৬২(২) দ্রঃ]

TWO STAGE TENDERING METHOD



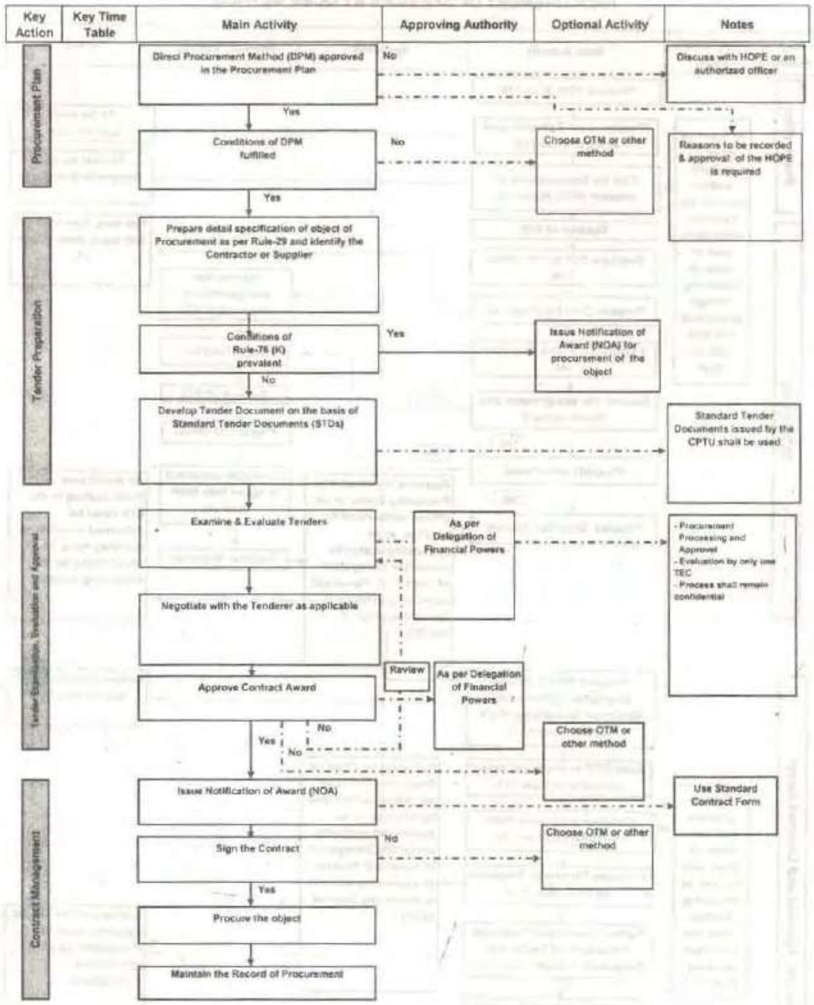
অংশ-ঙ ঃ [বিধি ৬২(২) দ্রঃ]

REQUEST FOR QUOTATION METHOD



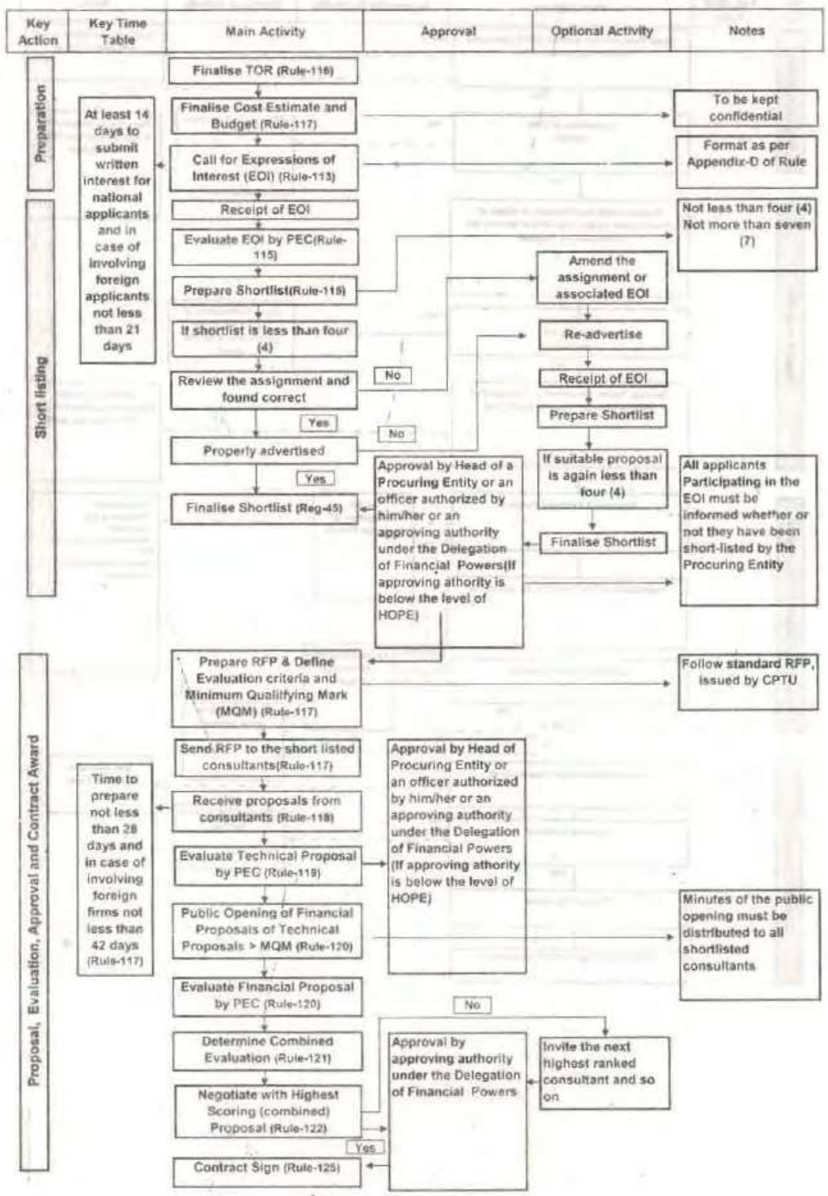
অংশ-চ ঃ [বিধি ৬২(২) দ্রঃ]

DIRECT PROCUREMENT METHOD



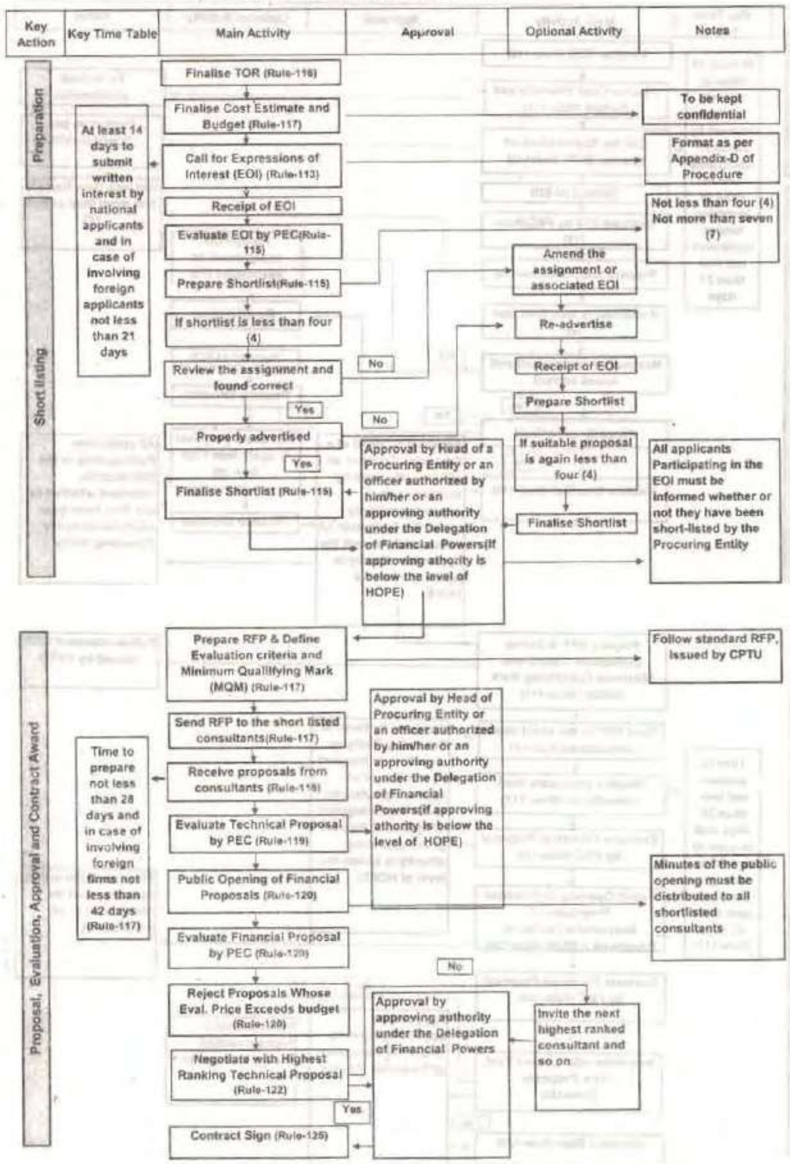
অংশ-ছ : [বিধি ১০৫ (২) দ্রঃ]

PROCUREMENT OF SERVICES BY QCBS METHOD



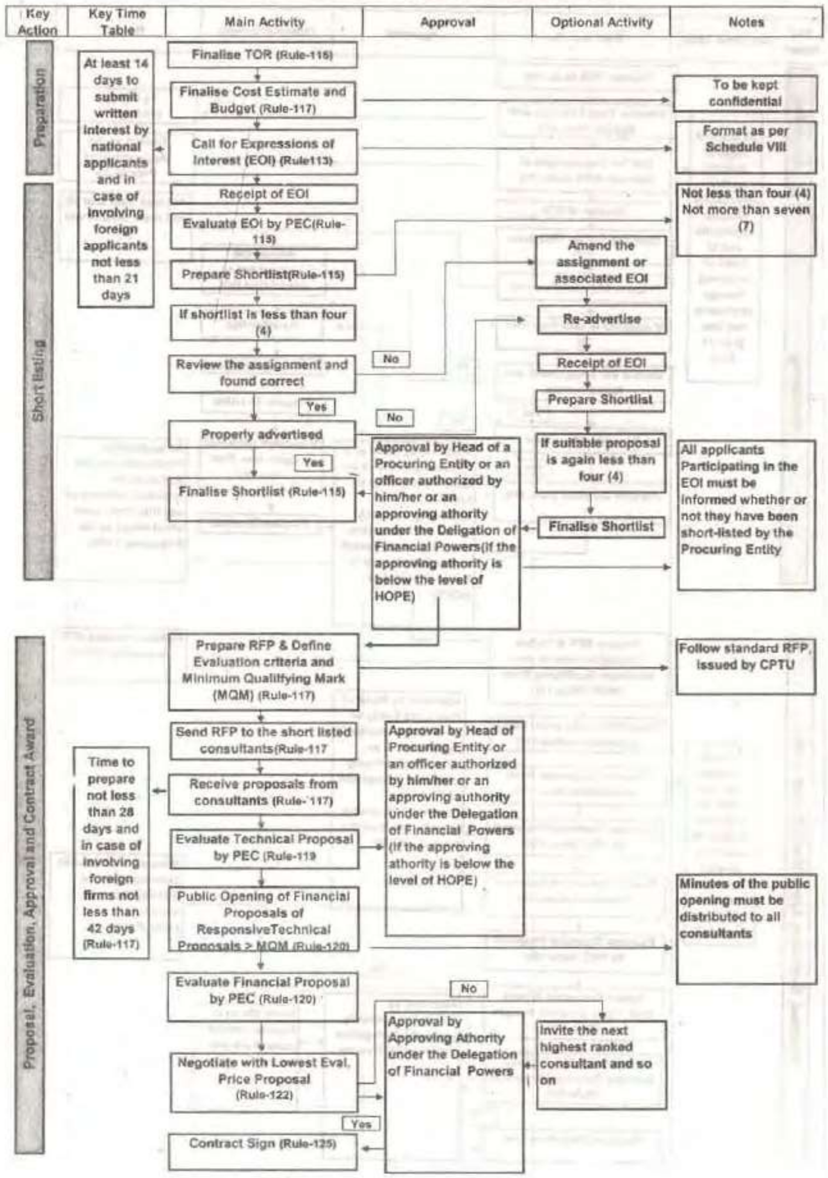
অংশ-জ ঃ [বিধি ১০৬ (২) দ্রঃ]

PROCUREMENT OF SERVICES BY SFB METHOD



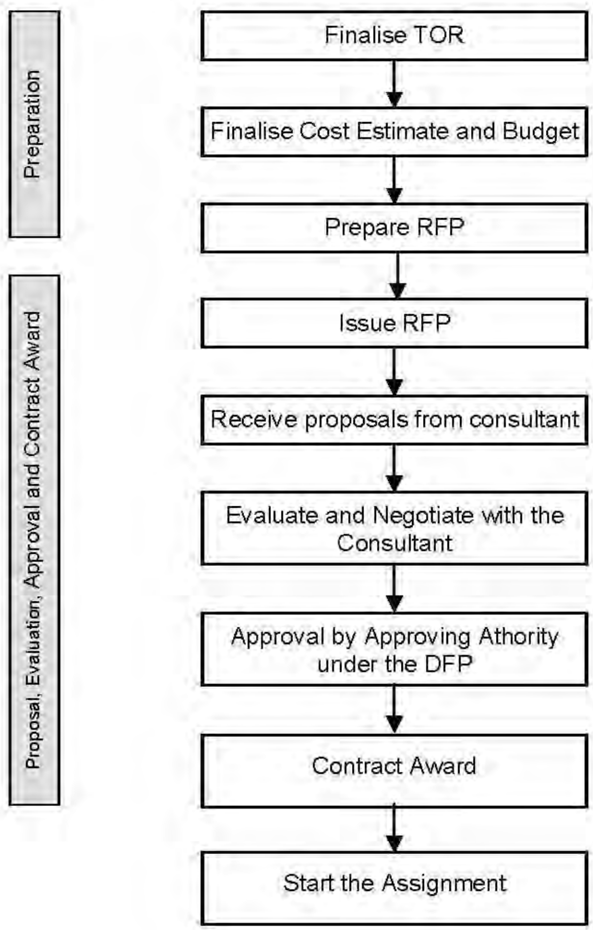
অংশ-ক ঃ [বিধি ১০৭ (২) দ্রঃ]

PROCUREMENT OF SERVICES BY LCS METHOD



অংশ-ঞ ঃ [বিধি ১১০(৭)দ্রঃ]

PROCUREMENT OF SERVICES BY SSS METHOD



তফসিল-৪

অংশ-ক ঃ [বিধি ৮(১৮) দ্রঃ]

Procurement Processing and Approval Procedure for Goods or Works

PROCURING ENTITY AND DESCRIPTION OF PROCUREMENT						
Ministry / Division						
Agency						
Procuring Entity						
Name of the Project (if applicable)						
Source of Funds (tick relevant boxes)	Government	☐	Development	☐	Revenue	☐
	Project Aid	☐				
	Own Funds	☐				
Brief Description of Goods or Works						
PROCUREMENT METHOD						

SCHEDULE OF ACTIVITIES

Sl No	Activity (if not applicable indicate N/A)	Planned Date (as per flow chart)	Actual Date	If any Delay Indicate No. of days
A	**PRE-QUALIFICATION**			
A1	Date of Advertisement of Invitation			
A2	Date of Submission of Applications			
A3	Date of Pre-Qualification meeting (if any)			
A4	Date of Submission of Evaluation Report with Recommended List			
A5	Date of Approval of List			
B	**TENDER FOR GOODS OR WORKS**			
B1	Date of Advertisement of Invitation for Tenders			
B2	Date of Issue of Tender Document (if different from B1 above)			
B3	Date of Pre-Tender meeting			
B4	Date of submission of Tenders			

B5	Date of Opening of Tenders (if different from B4)			
B5	Date of Submission of Technical Sub-Committee Report, where applicable			
B6	Date of Submission of Evaluation Report			
B7	Date of Approval for Award of Contract			

SCHEDULE OF ACTIVITIES IN PPPAP PROCESS

Date of submission of Tender Evaluation Report to the approving authority	Planned Date (as per flow chart)		Actual Date	Delay (in days)
Project Director Project Manager Authorised Officer	Received			
	Approved/ Reviewed			
	Forwarded			
Head of Department / Directorate Head / Chief Executive of a - Corporation - Autonomous Body - Semi-Autonomous Body	Received			
	Approved/ Reviewed			
	Forwarded			
Board of Directors	Received			
	Approved/ Reviewed			
	Forwarded			
Ministry / Division	Received			
	Approved/ Reviewed			
	Forwarded			
CCGP	Received			
	Approved/ Reviewed			
	Forwarded			
Date of Issue of the Notification of Award (NOA) for Goods or Works				
Signature of Chairperson of Tender Evaluation Committee (TEC)				
Name and Designation of Chairperson of Tender Evaluation Committee (TEC)				

অংশ-খ ঃ [বিধি ৮(১৮) দ্রঃ]

Procurement Processing and Approval Procedure for Services (Firms)

PROCURING ENTITY AND DESCRIPTION OF PROCUREMENT						
Ministry / Division						
Agency						
Procuring Entity						
Name of the Project (if applicable)						
Source of Funds (tick relevant boxes)	Government	☐	Development	☐	Revenue	☐
	Project Aid	☐				
	Own Funds	☐				
Brief Description of Services						
PROCUREMENT METHOD						

SCHEDULE OF ACTIVITIES				
Sl No	Activity (if not applicable indicate N/A)	Planned Date (as per flow chart)	Actual Date	If any Delay Indicate No. of days
C	**EXPRESSION OF INTEREST (FIRMS)**			
C1	Date of Advertisement of request for EOI			
C2	Date of Receipt of EOIs			
C3	Date of Submission of Recommended Short-listed Firms			
C4	Date of Approval of Recommended Short-listed Firms			
C5	Date of Issue of (RFP)			
C6	Date of Submission of Proposals			
C7	Date of Submission of Evaluation Report for Technical Proposals			
C8	Date of Approval of Evaluation of Technical Proposals			
C9	Date of Opening of Financial Proposals			
C10	Date of Completion of Combined Evaluation			

C11	Date of Submission of combined Evaluation Report			
C12	Date of completion of Negotiations			
C13	Date of Approval for Award of Contract			

SCHEDULE OF ACTIVITIES IN PPPAP PROCESS

Date of submission of Proposal Evaluation Report to the approving authority	Planned Date (as per flow chart)		Actual Date	Delay (in days)
Project Director Project Manager Authorised Officer	Received			
	Approved/ Reviewed			
	Forwarded			
Head of Department / Directorate Head / Chief Executive of a - Corporation - Autonomous Body - Semi-Autonomous Body	Received			
	Approved/ Reviewed			
	Forwarded			
Board of Directors	Received			
	Approved/ Reviewed			
	Forwarded			
Ministry / Division	Received			
	Approved/ Reviewed			
	Forwarded			
CCGP	Received			
	Approved/ Reviewed			
	Forwarded			
Date of Issue of the Notification of Award (NOA)				
Signature of Chairperson of Tender Evaluation Committee				
Name and Designation of Chairperson of Tender Evaluation Committee				

অংশ-গ ঃ [বিধি ৮(১৮) দ্রষ্টব্য]

Procurement Processing and Approval Procedure for Services (Individuals)

PROCURING ENTITY AND DESCRIPTION OF PROCUREMENT						
Ministry / Division						
Agency						
Procuring Entity						
Name of the Project (if applicable)						
Source of Funds (tick relevant boxes)	Government	☐	Development	☐	Revenue	☐
	Project Aid	☐				
	Own Funds	☐				
Brief Description of Services						
PROCUREMENT METHOD						
SCHEDULE OF ACTIVITIES						

Sl No	Activity (if not applicable indicate N/A)	Planned Date (as per flow chart)	Actual Date	If any Delay Indicate No. of days
D	**EXPRESSION OF INTEREST (INDIVIDUAL)**			
D1	Date of Advertisement of request for EOI			
D2	Date of Receipt of EOI			
D3	Date of Evaluation of EOI			
D4	Date of Interview of Selected Individuals			
D5	Date of Evaluation of Final Selection List			
D6	Date of Submission of Evaluation Report			
D7	Date of Approval of Consultants			

SCHEDULE OF ACTIVITIES IN PPPAP PROCESS

Date of submission of Proposal Evaluation Report to the approving authority	Planned Date (as per flow chart)		Actual Date	Delay (in days)
Project Director Project Manager Authorised Officer	Received			
	Approved/ Reviewed			
	Forwarded			
Head of Department / Directorate Head / Chief Executive of a - Corporation - Autonomous Body - Semi-Autonomous Body	Received			
	Approved/ Reviewed			
	Forwarded			
Board of Directors	Received			
	Approved/ Reviewed			
	Forwarded			
Ministry / Division	Received			
	Approved/ Reviewed			
	Forwarded			
CCGP	Received			
	Approved/ Reviewed			
	Forwarded			
Date of Issue of the Notification of Award (NOA)				
Signature of Chairperson of Tender Evaluation Committee				
Name and Designation of Chairperson of Tender Evaluation Committee				

অংশ-ঘ ঃ [বিধি ৯৭(৪)(ছ) দ্রঃ]

Steps for Opening Tenders

(1) Check and confirm the deadline for submission and opening of Tenders;

(2) Collect all Tenders received in accordance with the procedures set in the Invitation for Tender (IFT);

(3) Make sure that Tender Opening Committee (TOC) members are present;

(4) Check presence of intending participating Tenderers or their authorized representatives;

(5) Open the Tender box/sealed containers whatsoever on the date and time declared in the IFT;

(6) Sort-out the Tenders in accordance with the IFT and Group/Package;

(7) Enter the names of Tenderers (Tender-wise and Group/Package-wise) in the Tender Opening Sheet (TOS) maintained by the office opening the Tenders;

(8) During the process under Step (7) above mark Tender Serial Numbers (TSN) and encircle TSN with red-ink on the sealed cover of the Tender;

(9) Open envelopes marked "WITHDRAWAL" and read out and the corresponding tender shall not be opened, but returned to Tenderer. If the withdrawal envelope does not contain a copy of the power of attorney or a letter of authorised confirming the signature of the person duly authorised to sign on behalf of the Tenderer, the corresponding tender will be opened;

(10) Information relevant to withdrawals or modifications by the Tenderers may be clearly noted under 'Remarks' in col. 7 of the TOS;

(11) Next open envelopes marked "SUBSTITUTION" and read out the letter and exchange the substituted tender with the corresponding tender being substituted. The substituted tender shall not be opened, but returned to Tenderer. No Tender substitution shall be permitted unless the corresponding substitution notice contains a valid authorisation to request the substitution and is read out at Tender opening.

(12) Open Envelopes marked "MODIFICATION" and read out the letter. No Tender modification shall be permitted unless it contains a valid authorisation;

(13) Tear-open the sealed Tenders one by one (tender-wise and Group/ Package-wise) and again mark and encircle TSN with red-ink on the Tender (original and copies) with full dated signature of the Chairperson and other members of the Tender Opening Committee;

(14) Immediately after tear-opening the Tenders, put TSN chronologically on the document duly encircled by red-ink as earlier done in Step (8) above;

(15) Read-aloud the tender prices quoted by the Tenderer;

(16) Discounts offered by any tenderer in accordance with the Tender Document shall be read out and recorded under 'Remarks' in Col. 7 of the TOS;

(17) Check the requisite documents, requirements etc., and the Tender Security, in particular. Write the amount of Tender Security in column-3 of the Tender Opening Sheet (TOS);

(18) Put the TSN on the Tender Security (Bank Guarantee/Pay Order/Bank Draft) with red-ink duly encircled and initialled by the Chairperson of the Tender Opening Committee (TOC);

(19) Record the missing documents or any incompleteness and major or minor deviations in the appropriate location/pages of the Tender Document as a whole;

(20) If there is no correction in a particular page, write comment at the bottom of that page that "no correction in this page" or so, as appropriate;

(21) If there is any correction or overwriting in a particular page and duly initialled by the tenderer, encircle and initial that particular correction with red-ink. If there is more than one such correction and initial by the tenderer, repeat the procedures. And at the bottom of that particular page write comment that "one correction in this page with initial", "two corrections in this page with initials" and so on, as appropriate;

(22) If there is correction in a particular page but not duly initialled by the tenderer, encircle and initial that particular correction with red-ink. And at the bottom of that particular page write comment that "one correction in this page without initial" "two corrections in this page without initial" and so on, as appropriate;

(23) All red-ink encircled figures and words of the corresponding items and rates must be initialled by the Chairperson and other members of the TOC;

(24) If there is any item in the Bill of Quantities against which the tenderer has not quoted any rate and/or amount i.e. kept blank, put question mark in that blank space and at the bottom of the page write comment that "No rate and/or amount quoted for item no ……….. in this page";

(25) Obtain signature of the Tenderers and/or their authorized representatives in the TOS;

(26) Make sure after opening of the Tenders that all the members and the Chairperson of the TOC including the Tenderers or their authorized representatives who attended the Tender Opening have signed the TOS;

(27) TOS must be faxed or mailed or sent out to the appropriate authority immediately upon completion of Tender Opening.

তফসিল-৫

অংশ-ক ঃ [বিধি ১৬(৮) দ্রঃ]

Total Procurement Plan for Development Project / Programme

This part identifies the packages for Goods, Works and Services that are required under the development project/programme. It identifies each Procurement package, giving it a unique code and considers the expected cost of the package (as per the DPP/TPP), as well as the anticipated dates when the Procurement package will be supplied.

A separate Schedule, completed as shown below, should be provided for Goods, Works and Services.

Col No	Activity	Note
1	Package Number	In ascending numerical order. (e.g. GD1, GD2, GD3; WD1, WD2, WD3; or SD1, SD2, SD3 etc)
2	Description of Procurement Package	Brief description of the Procurement package, expressed in quantifiable terms. (as per DPP/TPP)
3/4	Unit/ Quantity	The unit of supply. (e.g. 1, set, sqm, lump sum) The quantity of the unit required (e.g. 1,2,3 etc; or 1,500 etc)
5	Procurement Method & Type	Procurement Method (e.g. OTM (NCT); LTM (NCT), DP, etc.)
6	Contract Approving Authority	State here the approving authority that gave approval to the Tender / Proposal Evaluation Report.
7	Source of Funds	Source of Funds (GoB or Own) or Development Partners (IDA, ADB, EU etc)
8	Estimated cost in Tk million	Express the anticipated cost in Taka million as per the DPP/TPP. e.g. 50 Lakh would be 5 million, 1 Crore 50 Lakh 10 thousand would be 150 million 10 thousand
	Indicative Dates	These are the three key dates of any Procurement activity, the date at which the Procuring Entity invites Tenders, the date at which a Contract is expected to be signed and the expected date of completion of the Contract.

Col No	Activity	Note
9	Pre-Qualification / Expression of Interest	Not generally used in Goods, so this shaded column is left blank Pre-Qualification (if applicable) may be used in Works. EOI is used in Services
10	Invitation for Tender / Proposal	State the anticipated date when the Advertisement will be placed and when the Tender Document will be ready for issue. For Services this is the issue date of the RFP
11	Signing of Contract	State the anticipated date when the Contract will be signed.
12	Completion of Contract	State the anticipated date when the Contract will be completed, excluding any warranty period or defects liability period.

অংশ-খ

Annual Procurement Plan for Development & Revenue Budgets

Time bound Procurement assists a Procuring Entity to effectively plan its Procurement requirements and is an important and useful tool used to monitor the progress of Procurement (a) to ensure that it does not go astray; (b) to ensure that early problems with slippage can be dealt with promptly; and (c) can form a useful Annual Plan for Procurement.

A separate Schedule, completed as follows, should be provided for Goods, Works and Services. Also a separate schedule should be used for Development or Revenue Budget.

Col No.	Activity	Note
1 2 3 /4 5 6 7 8	Package Number Description of Procurement Item Unit & Quantity Procurement Method & Type Contract Approving Authority Source of Funds Estimated Cost In Tk. Million	To be copied from the Total Procurement Plan for Development Project / Programme for those packages required in this financial year. In the case of Procurement using funds from the Revenue Budget the Columns shall be completed based upon information in the Revenue Budget.
9	Time Code for Process	In the first row on each form examples have been given to assist the Procuring Entity in completion of the Forms
10	Not Used (Goods)	Column 10 does not apply for Goods Procurement
10	Pre-Qualification (Works)	If Pre-Qualification is used then enter the anticipated process time in the "Planned Days" Column 11. Include time for Advertising, Responding to Advert, Evaluation and Approval (this may be as high as 80—90 days in some cases).
10	Advertise EOI	Determine the time it will take from issue of EOI, receiving responses, evaluation and approval to Issue of RFP date and enter the number of days in the "Planned Days" box in Column 11.

Col No.	Activity	None
11 11 11	Advertising Tender Advertising Tender Issue RFP	Always show "0" in the "Planned Days" box in Column 11. Always show "0" in the "Planned Days" box in Column 11. Always show "0" in the "Planned Days" box in Column 10.
12	Opening of Tender / Proposal	
13	Evaluation of Tender / Proposal	The date for each activity will automatically be calculated and appear in the "Planned Dates" box.
14	Approval of Award	
15	Notification of Award	
16	Signing of Contract	Now determine the number of days it is expected that each activity will take place and enter the time for that activity in the relevant "Planned Days" box. Use the Public Procurement Processing & Approval Procedures (PPPAP) to determine the minimum dates applicable to each Procurement package method.
17	Completion of Contract	Planned Dates & Planned Days : For each Procurement package, consider the Date on which the Goods, Works or Services are required to be completed and enter the date in Planned Dates (Column 17). Then show the expected duration of the Contract (in Days) in Planned Days immediately under the above Date (Column 17).
18	Total Time (in Days)	This is automatically calculated by adding together all the pre-determined number of "Planned Days", it will change if any of the Planned Days are changed.

অংশ-গ ঃ

ANNUAL PROCUREMENT PLAN

Ministry / Division
Agency
Procuring Entity Name & Code
Project / Programme Name & Code

Package No	Description of Procurement Package GOODS	Unit	Quantity	Procurement Method & Type	Contract Approving Authority	Source of Funds	Estd. Cost in Million Tk.	Time Code for Process	Not Used in GOODS	Invite/ Advertise Tender	Tender Opening	Tender Evaluation	Approval to Award	Notification of Award	Signing of Contract	Total time to Contract Signature	Time for Completion of Contract
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
GD 1	Purchase of ten (10) steel fabricated water towers	No.	10	OTM (ICT)	Ministry	ADB	215	Planned Dates		06-Jan-06	17-Feb-06	31-Mar-06	05-May-06	12-May-06	09-Jun -06		10- Jun-07
								Planned Days		0	42	42	35	7	28	154	365
								Actual Dates									
GD 2	Purchase of 8 (eight) Motor Vehicles, 1500 cc	No	8	LTM National	HOPE	GOB	65	Planned Dates		21-Dec-06	04-Jan-07	08-Feb-07	22-Feb-07	01-Mar-07	29-Mar-07		30-Apr-07
								Planned Days		0	14	35	14	7	28	98	32
								Actual Dates									
GD 3																	
GD 4																	
	Total Value of Goods Procurement						Total: 280										

ANNUAL PROCUREMENT PLAN

Budget: Revenue

Ministry / Division
Agency
Procuring Entity Name & Code

Package No	Description of Procurement Package GOODS	Unit	Quantity	Procurement Method & Type	Contract Approving Authority	Source of Funds	Estd. Cost in Million Tk.	Time Code for Process	Not Used in GOODS	Invite/Advertise Tender	Tender Opening	Tender Evaluation	Approval to Award	Notification of Award	Signing of Contract	Total time to Contract Signature	Time for Completion of Contract
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
GR 1	Purchase of twenty (20) metal filing cabinets4-drawer	No	20	OTM (NCT)	Authorised Officer	GOB	6	Planned Dates		21-Feb 04	06-Mar-04	20-Mar-04	27-Mar-04	03-Apr-04	01-May-04		15-Jun-04
								Planned Days		0	14	14	7	7	28	100	15
								Actual Dates									
GR 2	Purchase of 25 twenty five (25) Motor Cycles, 110 CC	No	25	DPM National	HOPE	GOB	3	Planned Dates		14-Jan-04	04-Feb-04	18-Feb-04	25-Feb-04	03-Mar-04	31-Mar-04		30-Apr-04
								Planned Days		0	21	14	7	7	28	77	30
								Actual Dates									
GR 3																	
GR 4																	
	Total Value of Goods Procurement						Total: 9										

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ANNUAL PROCUREMENT PLAN

Budget: Development

Ministry / Division
Agency
Procuring Entity Name & Code
Project / Programme Name & Code

Package No	Description of Procurement Package WORKS	Unit	Quantity	Procurement Method & Type	Contract Approving Authority	Source of Funds	Estd. Cost in Million Tk.	Time Code for Process	Advertise Prequel (if applicable)	Invite/Advertise Tender	Tender Opening	Tender Evaluation	Approval to Award	Notification of Award	Signing of Contract	Total time to Contract Signature	Time for Completion of Contract
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
WD 1	Construction of 5 (five) concrete bridges	No.	5	OTM (ICT)	Board of Director's	ADB	120	Planned Dates		10-Mar-06	21-Apr-06	02-Jun-06	30-Jun-06	07-Jul-06	04-Aug-06		31-May-07
								Planned Days		60	42	42	28	7	28	307	300
								Actual Dates									
WD 2	Construction of 2 (two) flood regulators	No	2	OTM	HOPE	GOB	60	Planned Dates		06-Jun-06	04-Jul-06	25-Jul-06	08-Aug-06	15-Aug-06	12-Sep-06		31-Mar-07
								Planned Days	0	0	28	21	14	7	28	98	200
								Actual Dates									
WD 3	AND SO ON																
WD 4	AND SO ON																
	Total Value of Works Procurement						Total: 180										

ANNUAL PROCUREMENT PLAN

Budget: Revenue

Ministry / Division
Agency
Procuring Entity Name & Code

Package No	Description of Procurement Package WORKS	Unit	Quantity	Procurement Method & Type	Contract Approving Authority	Source of Funds	Estd. Cost in Million Tk.	Time Code for Process	Advertise Prequel (if applicable)	Advertise Tender	Tender Opening	Tender Evaluation	Approval to Award	Notification of Award	Signing of Contract	Total time to Contract Signature	Time for Completion of Contract
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
WR 1	Renovation of Engineer's Workshop	Sqm	100	LTM National	Authorised	GOB	3.0	Planned Dates		25-Aug-03	08-Sep-03	22-Sep-03	29-Sep-03	06-Oct-03	03-Nov-03		10-Jun-04
								Planned Days	0	0	14	14	7	7	28	70	220
								Actual Dates									
WR 2	Repair & Maintenance of Hydraulic Structures	No	2	RFQ National	Project Manager	GOB	0.2	Planned Dates		06-Mar-04	13-Mar-04	18-Mar-04	21-Mar-04	26-Mar-04	31-Mar-04		15-Apr-04
								Planned Days	0	0	7	5	3	5	5	25	15
								Actual Dates									
WR3	AND SO ON																
WR4	AND SO ON																
1	Total Value of Works Procurement						Total: 3.2										

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ANNUAL PROCUREMENT PLAN

Budget: Development

Ministry / Division
Agency
Procuring Entity Name & Code
Project / Programme Name & Code

Package No	Description of Procurement Package SERVICES	Unit	Quantity	Procurement Method & Type	Contract Approving Authority	Source of Funds	Estd. Cost in Million Tk.	Time Code for Process	Advertise EOI	Issue RFP	Technical Proposal Opening	Technical Proposal Evaluation	Financial proposal Opining & Evaluation	Negotiation	Approval	Signing of Contact	Total time to Contract Signature	Time for Completion of Contract
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
SD 1	Study and design of Hydro-power Dam including preparation of Tender Document, Bills of Quantities and Drawings	m/m	200	QCBS International	CCGP	ADB	57	Planned Dates		13-Sep-05	25-Oct-05	29-Nov-05	14-Dec-05	19-Dec-05	30-Jan-06	20-Feb-06		15-Jun-07
								Planned Days	0	40	42	35	15	5	42	21	205	480
								Actual Dates										
SD 2	Construction management of city water supply system	m/m	100	LCS National	HOPE	GOB	4	Planned Dates		23-Aug-06	20-Sep-06	12-Oct-06	27-Oct-06	01-Nov-06	01-Nov-06	22-Nov-06		10-Jun-07
								Planned Days	0	40	28	22	15	5	0	21	131	200
								Actual Dates										
SD 3																		
SD 4																		
	Total Value of Services Procurement						Total: 61											

ANNUAL PROCUREMENT PLAN

Budget: Revenue

Ministry / Division
Agency
Procuring Entity Name & Code

Package No	Description of Procurement Package SERVICES	Unit	Quantity	Procurement Method & Type	Contract Approving Authority	Source of Funds	Estd. Cost in Million Tk.	Time Code for Process	Advertise EOI	Issue RFP	Proposal Opening	Proposal Evaluation	Opining Financial Proposal	Negotiation	Approval	Signing of Contact	Total time to Contract Signature	Time for Completion of Contract
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
SR1	Technical Assistance to IMED for evaluation of certain completed projects	m/m	25	QCBS National	Ministry	GOB	4.5	Planned Dates		21-Sep-03	19-Oct-03	15-Nov-03	30-Nov-03	05-Dec-03	02-Jan-04	16-Jan-04		15-Apr-04
								Planned Days	0	45	28	27	15	5	28	14	162	90
								Actual Dates										
SR2	Study on Ground Water depletion within Dhaka City Corporation	m/m	50	FBS National	HOPE	GOB	1.0	Planned Dates		18-Aug-03	15-Sep-03	07-Oct-03	22-Oct-03	27-Oct-03	27-Oct-03	17-Nov-03		15-May-04
								Planned Days	0	40	28	22	15	5	0	21	131	180
								Actual Dates										
SR3	AND SO NO																	
SR4	AND SO NO																	
	Total Value of Services Procurement						Total: 5.5											

তফসিল-৬

[বিধি ৩৭ (১) দ্রঃ]

Format for Reporting Contract Award

(for Tk 100 million and above for Goods & Works Contracts)
(for Tk 5 million and above for Service Contracts)

[This is the website format which requests only the data needed to complete The Contract Award Notification Sheet]

GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH				
1	Ministry/Division	< select >		V
2	Agency	< select >		V
3	Procuring Entity Name	< type in name >		
4	Procuring Entity Code	Not used at present		
5	Procuring Entity District	< select >	V	
6	Contract Award for	< select >	V	
7	Invitation / Proposal Ref. No			
KEY INFORMATION				
9	Procurement Method	< select >	V	
FUNDING INFORMATION				
10	Budget and Source of Funds	< select >	V	
11	Development Partners (if applicable)	< type in name >		
PARTICULAR INFORMATION				
12	Project / Programme Code (if applicable)	< use MOF code >		
13	Project / Programme Name (if applicable)	< use MOF name >		
14	Tender / Proposal Package No.	< type in name >		
15	Tender / Proposal Package Name	< type in name >		
16		Date		
17	Date of Advertisement	< select > V		
18	Date of Notification of Award	< select > V		
19	Date of Contract Signing	< select > V		
20	Proposed Date of Contract Completion	< select > V		
21	No. of Tenders / Proposals Sold	< type in Number >		
22	No. of Tenders / Proposals Received	< type in Number >		
23	No. of Responsive Tenders / Proposals	< type in Number >	Add reasons for non-responsiveness	
INFORMATION ON AWARD				
24	Brief Description of Contract	< type in details >		
25	Contract Price	< type in details >		
26	Name of Supplier / Contractor / Consultant	< type in details >		
27	Location of Supplier / Contractor / Consultant	< type in details >		
28	Location of Delivery / Works / Consultancy	< type in details >		
29	Is the Contract awarded to the Person with the lowest priced Tender ?		< select >	
30	If no, state brief reasons	< type in details >		
31	Was the Performance Security provided in due time?		< select >	
32	If no, state reasons			
33	Was the Contract signed in due time?		< select >	
34	If no, state reasons	< type in details >		
PROCURING ENTITY DETAILS				
35	Name of Authorised Officer	< type in name >		
36	Designation of Authorised Officer	< type in name >		

< select > These fields in the website are "pop-up" fields and the procuring entity will only have to select the correct name, address or date in order to complete the form.
< type in name / details > These fields are to be completed by typing in the relevant data.

তফসিল-৭

[বিধি ৩৭ (৩) দ্রঃ]

NOTIFICATION OF AWARD
(Goods or Works)

Contract No: Date:

To:

[Name of Contractor]

This is to notify you that your Tender dated *[insert date]* for the execution of the Works/ for the supply of Goods and related Services *[delete as appropriate]* for *[name of project / Contract]* for the Contract Price of Tk. *[state amount in figures and in words]* as corrected and modified in accordance with the Instructions to Tenderers, has been approved by *[name of Procuring Entity]*.

You are thus requested to take following actions:

i. accept in writing the Notification of Award within seven (7) days of its issuance pursuant to ITT Sub-clause XX.

ii. furnish a Performance Security in the specified format and in the amount of Tk *[state amount in figures and words]*, within fourteen (14) days of issuance of this letter but not later than *(specify date)*, in accordance with ITT Clause XX.

iii. sign the Contract within twenty eight (28) days of issuance of this letter but not later than *(specify date)*, in accordance with ITT Clause XX.

You may proceed with the execution of the Works/ supply of Goods and related Services [delete as appropriate] only upon completion of the above tasks. You may also please note that this Notification of Award shall constitute the formation of this Contract which shall become binding upon you.

We attach the draft Contract and all other documents for your perusal and signature.

Signed

Duly authorised to sign for and on behalf of *[name of Procuring Entity]*

Date:

NOTE: Tender Validity Date is critical to Notification of Award and fulfilment of subsequent obligations

তফসিল ৮

অংশ-ক ঃ [বিধি ৪৩ (৪) দ্রঃ]

Records of Procurement to be Maintained by a Procuring Entity

(1) The records of Procurement of Goods, Works and Services made through each contract shall be maintained separately.

(2) In case of more than one contract falling under a particular package, the files or records shall be systematically maintained on each contract basis and arranged or grouped together on the basis of each package. For example, if one package of goods consists of 3 lots and for each lot a separate contract has been concluded, then there should be three files for 3 contracts and papers relating to each contract shall be maintained in the relevant contract files. All the three contract files relating to the particular package shall be maintained together as a group or package. If in a goods package, say Package No. G1 there are 3 contracts then the contract files shall indicate as G1: Contract -1 (3), G1: Contract 2 (3), G1: Contract 3 (3). All the 3 contracts shall be serially maintained under one package. The file number may include ---/----/Procurement/ G1: Cont-1 (3)/2004-06. The indicated years are the file opening and closing years.

(3) The file should be opened indicating the year when it is opened and the year when it should be closed. In other words it should include year of commencement and year of completion of contractual obligations.

(4) A particular Contract file may have more than one Part file. Part file shall be indicated in the file number as Part-1, Part-2 say for example: -----/-------/G1: Cont.1 (3) Part-1/2004 -06.

(5) The checklist of records format shall be placed at the top of every file whether it is a part file or not. The format of the checklist should be filled in stating the records maintained in a particular file. Where part file is opened, some of the columns of the checklist of records will remain blank concerning the records not maintained in a particular part file.

(6) The concerned officer of the Procuring Entity should indicate in writing in the format in which part file or main file the records appearing blank are available.

(7) If relevant papers relating to a particular Procurement are maintained by more than one branch of the Procuring Entity, the relevant branch shall transfer the records to the main Procurement file.

(8) If it is not possible to transfer the records and documents, the concerned department(s) shall maintain the documents/records relating to the Procurement for the period stated in the Regulations and the Procedures. The concerned Procurement Officer shall ensure the relevant branch is complying with the requirement and the Procedures of the Regulation 9. This situation may arise in case of documents/records maintained by the Accounts Branch who may retain the original documents for audit or other purposes.

(9) The pages of the file shall be numbered serially. The entire file should be preserved in a manner so that no page should miss. The pages in the file should be bounded if possible.

(10) The attached format and the records mentioned therein shall be placed as part of the records on top of the papers of each file.

(11) The file shall be given a number and maintained systematically so that it can be located immediately whenever required.

(12) The file shall have a title page. The title shall mention the project name object of Procurement Package Number etc. An example of a title page of a file is attached.

File No : ………………/……../ G1: Cont. 1(3) Part 1/2004-6

Date of opening : 2004
Date of closing : 2006

Subject : Procurement of Goods under Public Procurement Reform Project

Package No : G1

Contract No : G1: Cont.(1)(3)

Advertisement No ………………………………date……………

Specify object of Procurement and Quantity ………………………………

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Records and Documents to be maintained

Description (object
of Procurement) :
Package No. :
Contract No. :

Sl No.	Minimum Records and documents to be maintained	State briefly where appropriate or state yes or No Refer: Col-2.	Reference of file page no/part file No Refer; Col-3
1	2	3	4
01	Brief description of Goods and related Services/ Works and Physical Services, intellectual and Professional Services.		
02	Method of Procurement used (State if Open Tendering Method, Limited Tendering Method, Direct Procurement Method, Two Stage Tendering Method, Request for Quotations Method etc).		
03	Justification for choosing a method other than open tendering with the level of approval obtained (State method adopted/authority approving the method or sub-method).		
04	An invitation for pre-qualification, if any.		
05	Copies of the published advertisements for pre-qualification, if any.		
06	A copy of pre-qualification document or request for EOI or other solicitation documents.		
07	Records of selection of pre-qualified persons/ firms, if any or short listed Applicants.		
08	Invitation for Tender/Letter of Invitation with copy of Advertisement notice in newspapers, if any.		
09	Documents regarding sale of tender.		
10	Clarification issued, if any, and to whom addressed.		
11	Addendum issued		
12	Names and addresses of the Tenderers/ Consultants that submitted Tenders/ quotations/proposals.		
13	List of persons present during tender opening, date and place of opening.		
14	Minutes of the tender opening.		

1	2	3	4
15	Tender, Quotation or Proposal/ documents submitted by each Tenderer/Consultant.		
16	Evaluation criteria stipulated and applied.		
17	Report on Tender, Proposal or Quotation evaluation including comparison sheet.		
18	Records of approval of the TEC/PEC recommendations.		
19	Name and address of the Tenderer to whom the contract was awarded.		
20	Notification of Award		
21	The amount of contract price		
22	Contract documents		
23	Copy of performance guarantee document with Date and No.		
24	Delivery/acceptance documents/reports for goods.		
25	Completion report of Works and Services Number of lots delivered/ assignments completed.		
26	Location of delivery of goods/completion of Works		
27	Information on any decision to suspend or cancel proceedings after initiation.		
28	Documents in respect of any complaints to administrative authority with decision of the appropriate Authority/Secretary.		
29	Appeal to Review Panel Appeal petition to Review Panel		
30	Payment of registration fee for appeal		
31	Constitution of Review Panel by the CPTU		
32	Decision of the Review Panel with report		
33	Compliance of the decision of the Review Panel, if any.		
34	Records of payment against bills/invoices		
35	Bill of quantities for Works/measurement book submitted.		
36	Bill passing orders		
37	Bill payment records		
38	Mode of payment : cheque, cash etc.		
39	Acknowledgement of receipt of payment by Tenderer/Consultant		
40	All correspondences with Tenderers (Important correspondences)		

তফসিল-৯

অংশ ক ঃ [বিধি ৫৫ (১) দ্রঃ]

সারণী

(Consultant Conflicts of Interest: Range of Possible Cases)

Category of Consultant Conflicts	Example	Is the Consultant allowed to take part	Risk for Client: Consultant may	Mitigation of Risk
Supply of goods and works whose specifications were prepared by the consultants	Equipment, computers	No	Favor its associates	Disqualification of consultant and affiliates
Continuation assignments	Detailed design after feasibility study	Yes	Influence TOR, bias feasibility-study recommendations	TOR of continuation drafted by third party who validates feasibility
Conflicting assignments	Environmental audit of consultants' project design by the same consultants	No	Apply partiality in assessing its own designs	Disqualify the consultant
Related assignment other than continuation	Restructured study of a public asset after preparing privatization plan	Yes (permissible upon conditions)	Unduly influence TOR of related assignment	Have third party draft TOR, or disqualify the consultant
Related assignment for competing clients	Study of a project competing- with another client's project	No (permissible upon conditions)	Advice to client(s) may be biased	Disqualify the consultant, or both clients agree on scope of work

Category of Consultant Conflicts	**Example**	**Is the Consultant allowed to take part**	**Risk for Client: Consultant may**	**Mitigation of Risk**
Related unnecessary assignments	Study of superfluous alternatives	No	"Featherbedding" *	Disqualify the consultant
Unrelated useful assignments	Study of future projects	Yes	n.a	n.a.
Conflicting relationships	A consultant's staff has a family relationship with a client's staff involved in the selection process	No (permissible upon conditions)	Be unduly favored in the proposal evaluation process	Exclude the client's staff from the selection process, or disqualify the consultant
Conflicting relationships	The consultant includes a client employee in its technical proposal	No (permissible upon conditions)	Be unduly favored in the proposal evaluation process	The consultant shall attach to its proposal a client's certification stating that the involved client's employee is on leave without pay

* **Featherbedding** is the practice of requiring an employer to hire more workers than needed to handle a job

অংশ খ ঃ [বিধি ১১২ (৮) দ্রঃ]

অংশ ক ঃ **General Considerations for the Employment of Consultants**

(1) Appointment of Consultants, local or international, at times is a crucial element in the project cycle. Depending on the nature of a project, combination of both local and International Consultants in implementing any project or activity can be more useful and effective. A project may not be ready for financing without Consultant's Services. An aid agreement may not be effective till a Consultant is in place. A tender document may not be issued or even prepared without a Consultant. A system may not be introduced or reformed without the Services of Consultant. At the conceptual or project preparation stage it is to be thoroughly scrutinized to identify the areas where the Services of the Consultant is necessary if the technology involved is complex and not locally available and the concerned agency has no experience. Therefore, where it is considered expedient that the service of a Consultant is required, appointment of local or International Consultants should be considered. However, the Procuring Entities should be selective in appointment of Consultants. International Consultants may be appointed when local expertise is not available. While using International Consultants arrangements should be made to ensure a mechanism for transfer of technology or expertise. Human resources development should form an integral part of any technical assistance programme.

(2) Consultants are generally appointed for the following purposes:

(a) Pre-investment Studies: These comprise the investigations that normally precede decisions to go forward with specific projects. These studies determine the investment needs and the type of interventions needed to attain the desired goal. These include identification of priority area of investment, need for policy adjustment, feasibility studies for project or programme, improvement of existing management practices etc.

(b) Preparation Services: These comprise the technical, economic or other assignment required to fully define a project and prepare it for implementation. These Services normally include the preparation of a project, collection of relevant Documents, information and data, setting objectives, identifying activities for attaining objectives, requirement of physical and financial resources, preparation of Procurement Documents.

(c) Implementation Services: These relate to actual implementation of the activities using resources already identified during preparation phase. Implementation shall follow the time chart already worked out and revised from time to time. Implementation may be of the nature of construction of a complex road, building or a bridge, procurement and installation of goods and equipment. It may be of the nature of reforming a system in order to improve efficiency and ensure better performance. This involves supervision, management, inspection and providing necessary technical Services.

(d) Technical Assistance: These comprise a wide range of intellectual and professional Services along with other support service, such as development and sector planning and institution building, including organization and management (O&M) studies, staffing requirement and training needs and assistance in the implementation of study recommendations.

(3) Technical Assistance Projects have a clearly stated policy to build local capacity in course of execution of the projects. The objective is to facilitate transfer of knowledge and technology through the interaction between international and Local Consultants during the implementation of the project.

(4) For each position created in consulting service appropriate attention should be made to compatible international/ local positions. International Consultants can be of any national of eligible countries including Bangladesh.

a. Association of Consultants with International & Local Consulting Firms:

(1) For development projects implemented in Bangladesh by the GOB with the support of development partners, may require the engagement of international consulting firms. Each international consulting firm is encouraged to seek participation and obtain full range of expertise by associating with local consulting firm(s) or entities in a joint venture or sub-consultancy, as appropriate.

(2) International consulting firms may include national Consultants in their payroll and are entitled to apply their Fees/Charges for the Local Consultants provided they are recruited as their team.

(3) The local consulting firms will have Local Consultants in their payroll and are entitled to apply their Fees/Charges on the Local Consultants working for them.

(4) If a Bangladeshi firm is short-listed to compete with international firms, it may use the Services of both international and local Consultants and is entitled to apply Fees/Charges for both categories of Consultants.

(5) In a joint participation of international and local consulting firms member firms will mutually decide the payroll arrangements.

b. Billing Rates and Modus Operandi:

(1) Billing rates shall be calculated on staff-month basis. The billing rates of consulting firms usually consist of staff remuneration, social charges, overhead charges, and the Consultant's fee.

(2) The billing rate will vary depending on the nature of the consulting firm. As guidance, an example of typical billing rate calculation is provided below:

Item	Component	International/ National Firm
1	Staff Remuneration	
2	Social Charges	40% of Remuneration
3	Overhead	60—100% of Remuneration
4	Consultant's Fee	10—15% of (1+2+3)

অংশ গ ঃ [বিধি ১১২ (৮) দ্রঃ]

General Considerations for Employment of Bangladeshi Nationals as Individual Consultants in Aided Projects

1. Employment of Bangladeshi Nationals as Consultants in Foreign Aided Projects: All Ministries, Divisions and Government agencies including local authorities shall, subject to agreement with the development partners employ qualified Bangladeshi nationals as Consultants, if available, in foreign aided projects under their execution.

2. Eligibility for applying for the posts of Consultants:

   (a) Any Bangladeshi national including persons in the service of the Republic or the local authorities/corporations (See Schedule M) may, if he/she is qualified for any post of Consultant, apply for the post.

   (b) No person who has been convicted by any Court of Law or dismissed from Services for misconduct shall be eligible for consideration for appointment to a post.

3. Educational qualifications and experience:

   (a) Broadly, the Bangladeshi Consultants shall be divided into three main groups, namely:

      (i) Junior Consultant;

      (ii) Consultant;

      (iii) Senior Consultant.

   (b) A guideline for educational qualifications and experiences of the Local Consultants is provided below, however, educational qualifications and experience will vary according to the nature and scope of assignment and a Procuring Entity, taking this into account, will specify the requirements. Preference should be given to a person with intellectual and professional knowledge and skill for the required service:

      (i) **Junior Consultant:** (i) Bachelor/ Masters degree or an equivalent (mention one depending on the type of assignment) for the following fields-medical/ engineering/ agriculture; and (ii) Masters degree or equivalent for other fields, with at least five (5) years of professional experience in the relevant field of assignment.

(ii) **Consultant:** (i) Bachelor/ Masters degree or an equivalent (mention one depending on the type of assignment) for the following fields: medical / engineering / agriculture; and (ii) Masters degree or equivalent for other fields, with at least ten (10) years experience in the relevant field of assignment with comprehensive intellectual and professional knowledge and skill.

(iii) **Senior Consultant:** (i) Bachelor/ Masters degree or an equivalent (mention one depending on the type of assignment) for the following fields- medical/ engineering/ agriculture; and (ii) Masters degree or equivalent for other fields, with at least fifteen (15) years experience in the relevant field of assignment with high level of intellectual and professional knowledge and skill Experience may be relaxed in the case of highly qualified person depending on the field of assignment.

4. Fee:

For an assignment, the Local Consultants' payments will be in commensurate with the qualification and expertise depending on the field of assignment. Guidance for fees is provided below at the current market price, which may require updating from time to time depending on the type of expertise required and competitors in the labour market:

Grade/ Group	**Monthly- Minimum Entry Fee (Tk.)**	**Monthly- Maximum Entry Fee (Tk.)**
Junior Consultant	60,000	75,000
Consultant	75,000	150,000
Senior Consultant	120,000	400,000

5. Advertisement procedure:

(a) Advertisement shall be made in accordance with Regulation 21 of the Public Procurement Regulations 2003 stating clearly the name of the post, brief job description, tenure of employment, required educational qualifications, experience, age limit (or relaxation, if any) and time for receiving Applications. However, for hiring individual Local Consultant the time for the submission of Applications may be reduced to two weeks.

(b) Persons who are already in employment shall send Application through proper channel, otherwise they shall not be considered for appointment.

অংশ ঘ ঃ [বিধি ১১২ (৯) দ্রঃ]

Terms and Conditions of Employment of Government Servants and Employees of Statutory Bodies, Local Authorities, Etc.

(1) The following terms and conditions of employment as Local Consultants shall apply to Government officials and civil servants including persons of autonomous bodies or corporations, namely;—

(a) The person (i) will be on leave of absence without pay; (ii) is not being hired by the agency if he/she was working for immediately before going on leave; and (iii) his/her employment will not give rise to any conflict of interest.

(b) On completion of his/her service on lien he/she shall be allowed seven day's time to join the post from which he/she was sent on lien and for these seven days, he/she shall be allowed his/her usual salaries and allowances of the post he/she joins. After assuming duties of the post of a Consultant, he/she shall inform in writing his/her parent Ministry, Division, or Government agency.

(c) All expenses in connection with his/her joining as Consultant to any organization / project and his/her return to join his/her parent department / organisation on completion of his/her lien period shall be borne by the Procuring Entity (organization using the Services as Consultant).

(d) During the period of this deputation the Consultant:

(i) shall be entitled to get his/her fees and allowance, leave, medical benefits, etc. from the Procuring Entity that employs him/her as Local Consultant as per its terms and conditions of employment;

(ii) shall not be entitled to any salary, leave salary, special pay, technical pay or any other allowances from his/her original Procuring Entity (Government of Bangladesh parent organization);

(iii) shall be liable to pay to his/her original Procuring Entity (Government of Bangladesh parent organization) in time all his/her debts and dues, such as, subscription or contributions to provident and pension funds, house building advances, car advances, subscription to benevolent fund and group insurance;

(iv) shall not be entitled to any medical allowance or other facilities for any member of his/her family from his/her original Procuring Entity ;

(v) shall be allowed to reside in the Government accommodation, if allotted to him/her for a period not exceeding one year and, for that period, he/she shall be liable to pay standard rent fixed by original Procuring Entity and pay all utility and other charges in accordance with standing rules, orders and instructions of the original Procuring Entity.

(vi) provided that, he/she resides in a Government accommodation, he/she may reside there for such further period as the Government may allow and he/she shall be liable to pay besides the standard rent all other dues in accordance with the rules of the Government;

(vii) shall bear subject to Government rules all charges in connection with the telephone, if any provided to him/her by his/her original Procuring Entity;

(viii) shall not be entitled to any transport facility, if any, provided to him/her by his/her original Procuring Entity;

(ix) shall obtain prior approval with respect to any change in the terms and conditions of his/her service which effect any provisions of this paragraph from the Ministry of Establishment and the concerned Ministry, Division or Government agency from where he/she went on lien;

(x) shall not join in any other project other than the one to which he/she has been sent on lien without the prior permission of his/her head of the organisation;

(xi) shall be liable to pay the amount of VAT deducted at source for consultancy service as per VAT Act and Rules.

(e) The period of lien if necessary, may be extended with the permission of the appropriate authority following standing rules and orders Government/ other organisation.

(2) The conditions mentioned in sub-paragraph (1) shall apply mutatis mutandis to an employee of a local authority.

(3) Permission:

Subject to standing rules and orders concerned Ministry, Division or Government Agency may accord permission to an employee.

তফসিল-১০

অংশ-ক ঃ [বিধি ৯০ (৫) দ্রঃ]

Invitation for Enlistment

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	GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH			
1	Ministry/Division	< select >		
2	Agency	< select >		
3	Procuring Entity Name	< type in name >		
4	Procuring Entity Code	Not used at present		
5	Procuring Entity District	< select >		
6	Invitation for	Enlistment	< select >	< select >
7	Invitation Ref No	< type in name >		
8	Date	< select >		
	KEY INFORMATION			
9	Procurement Method	Limited Tendering Method	< select >	
	FUNDING INFORMATION			
10	Budget and Source of Funds	< select >		
11	Development Partners (if applicable)	< type in name >		
	PARTICULAR INFORMATION			
12	Project / Programme Code (if applicable)	< use MOF code >		
13	Project / Programme Name (if applicable)	< use MOF name >		
		Date	Time	
18	Application Closing Date and Time	< select >	< select >	
19	Name & Address of the office(s)	Address		
	- Application Form Availability (Principal)	< type in name >		
	- Application Form Availability (Others)	< type in name >		
	- Receiving Application Form	< type in name >		
	INFORMATION FOR Applicant			
21	Eligibility of Applicant	< type in name >		
22	Brief Description of Goods or Works	< type in name >		
23	Brief Description of Related or Physical Services	< type in name >		
24	Price of Application Form (Tk)	< type in price >		
	PROCURING ENTITY DETAILS			
29	Name of Official Inviting Application	< type in name >		
30	Designation of Official Inviting Application	< type in name >		
31	Address of Official Inviting Application	< type in name >		
32	Contact details of Official Inviting Application	< Tel. No. >	< Fax No. >	< e-mail >
33	The procuring entity reserves the right to reject all Applications			

<select> : these fields are "pop-up" fields and the procuring entity will only have to select the correct name, address or date in order to complete the form.<type in name> : these fields are to be completed by typing in the relevant data.

অংশ-খ ঃ

Invitation for Pre-Qualification

[for use when there is a SINGLE lot in a package
This is the website format and as used for published advertisement.
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	GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH				
1	Ministry/Division	< select > V			
2	Agency	< select > V			
3	Procuring Entity Name	< type in name >			
4	Procuring Entity Code	Not used at present			
5	Procuring Entity District	< select > V			
6	Invitation for	< select > V	< select > V	< select > V	
7	Invitation Ref No	< type in name >			
8	Date	< select > V			
KEY INFORMATION					
9	Procurement Method	< select > V	< select > V		
FUNDING INFORMATION					
10	Budget and Source of Funds	< select > V			
11	Development Partners (if applicable)	< type in name >			
PARTICULAR INFORMATION					
12	Project / Programme Code (if applicable)	< use MOF code >			
13	Project / Programme Name (if applicable)	< use MOF name >			
14	Proposed Tender Package No.	< type in name >			
15	Proposed Tender Package Name	< type in name >			
		Date	Time		
18	Pre-Qualification submission Date and Time	< select > V	< select > V		
19	Name & Address of the office(s)	Address			
	- Selling Pre-Qual. Document (Principal)	< type in name >			
	- Selling Pre-Qual. Document (Others)	< type in name >			
	- Receiving Pre-Qual. Document	< type in name >			
20	Place / Date / Time of Pre-Qualification Meeting (Optional)	< type in name >			
		Date	Time		
		< select > V	< select > V		
INFORMATION FOR Applicant					
21	Eligibility of Applicant	< type in name >			
22	Brief Description of Goods or Works	< type in name >			
23	Brief Description of Related Services	< type in name >			
24	Price of *Pre-Qual.* Document (Tk)	< type in price >			
	Lot No	Identification of Lot	Location	Completion Time in Weeks / months	
25	1	< type in name >	< type in name >	<type in>	
PROCURING ENTITY DETAILS					
29	Name of Official Inviting Pre-Qualification	< type in name >			
30	Designation of Official Inviting *Pre-Qual.*	< type in name >			
31	Address of Official Inviting *Pre-Qual.*	< type in name >			
32	Contact details of Official Inviting *Pre-Qual.*	< Tel. No. >	< Fax No. >	< e-mail >	
33	The procuring entity reserves the right to --- deleted-- reject all Pre-Qualifications				

<select> : these fields are "pop-up" fields and the procuring entity will only have to select the correct name, address or date in order to complete the form.

<type in name> : these fields are to be completed by typing in the relevant data

অংশ-গ ঃ

Invitation for Pre-Qualification

*[for use when there are MULTIPLE lots in a package
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	GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH				
1	Ministry/Division	< select >	V		
2	Agency	< select >	V		
3	Procuring Entity Name	< type in name >			
4	Procuring Entity Code	Not used at present			
5	Procuring Entity District	< select >	V		
6	Invitation for	< select > V	< select > V	< select > V	
7	Invitation Ref No	< type in name >			
8	Date	< select >	V		
KEY INFORMATION					
9	Procurement Method	< select >	V	< select >	V
FUNDING INFORMATION					
10	Budget and Source of Funds	< select >	V		
11	Development Partners (if applicable)	< type in name >			
PARTICULAR INFORMATION					
12	Project / Programme Code (if applicable)	< use MOF code >			
13	Project / Programme Name (if applicable)	< use MOF name >			
14	Proposed Tender Package No.	< type in name >			
15	Proposed Tender Package Name	< type in name >			
		Date		**Time**	
18	Pre-qualification Closing Date and Time	< select >	V	< select >	V
19	Name & Address of the office(s)	**Address**			
	- Selling Pre-Qual. Document (Principal)	< type in name >			
	- Selling Pre-Qual. Document (Others)	< type in name >			
	- Receiving Pre-Qual. Document	< type in name >			
20	Place / Date / Time of Pre-Qualification Meeting (Optional)	< type in name >			
		Date		**Time**	
		< select >	V	< select >	V
INFORMATION FOR APPLICANT					
21	Eligibility of Applicant	< type in name >			
22	Brief Description of Goods or Works	< type in name >			
23	Brief Description of Related Services	< type in name >			
24	Price of *Pre-Qual.* Document (Tk)	< type in price >			
	Lot No	Identification of Lot	Location	Completion Time in Weeks /months	
25	1	< type in name >	< type in name >	<type in>	
26	2	< type in name >	< type in name >	<type in>	
27	3	< type in name >	< type in name >	<type in>	
28	4	< type in name >	< type in name >	<type in>	
POCURING ENTITY DETAILS					
29	Name of Official Inviting Pre-Qualification	< type in name >			
30	Designation of Official Inviting Pre-Qualification	< type in name >			
31	Address of Official Inviting Pre-Qualification	< type in name >			
32	Contact details of Official Inviting Pre-Qual.	< Tel. No. >	< Fax No. >	< e-mail >	
33	The procuring entity reserves the right to --- deleted-- reject all Pre-Qualifications				

<select> : these fields in the website are "pop-up" fields and the procuring entity will only have to select the correct name, address or date in order to complete the form.

<type in name> : these fields are to be completed by typing in the relevant data.

অংশ-ঘ ঃ

Invitation for Tenders

[For use when there is a SINGLE lot in a package]

	GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH				
1	Ministry/Division	< select > V			
2	Agency	< select > V			
3	Procuring Entity Name	< type in name >			
4	Procuring Entity Code	Not used at present			
5	Procuring Entity District	< select > V			
6	Invitation for	< select > V	< select > V	< select > V	
7	Invitation Ref No	< type in name >			
8	Date	< select > V			
KEY INFORMATION					
9	Procurement Method	< select > V	< select > V		
FUNDING INFORMATION					
10	Budget and Source of Funds	< select > V			
11	Development Partners (if applicable)	< type in name >			
PARTICULAR INFORMATION					
12	Project / Programme Code (if applicable)	< use MOF code >			
13	Project / Programme Name (if applicable)	< use MOF name >			
14	Tender Package No.	< type in name >			
15	Tender Package Name	< type in name >			
		Date			
16	Tender Publication Date	< select > V			
17	Tender Last Selling Date	< select > V			
		Date	Time		
18	Tender Submission Date and Time	< select > V	< select > V		
19	Tender Opening Date and Time (if different from 18)	< select > V	< select > V		
20	Name & Address of the office(s)	Address			
	- Selling Tender Document (Principal)	< type in name >			
	- Selling Tender Document (Others)	< type in name >			
	- Receiving Tender Document	< type in name >			
	- Opening Tender Document	< type in name >			
21	Place / Date / Time of Pre-Tender Meeting (Optional)	< type in name >			
		Date < select > V	Time < select > V		
INFORMATION FOR Tenderer					
22	Eligibility of Tenderer	< type in name >			
23	Brief Description of Goods or Works	< type in name >			
24	Brief Description of Related Services	< type in name >			
25	Price of Tender Document (Tk)	< type in price >			
	Lot No	Identification of Lot	Location	Tender Security Amount (Tk)	Completion Time in Weeks / Months
26	1	< type in name >	< type in name >	<type in>	<type in>
PROCURING ENTITY DETAILS					
30	Name of Official Inviting Tender	< type in name >			
31	Designation of Official Inviting Tender	< type in name >			
32	Address of Official Inviting Tender	< type in name >			
33	Contact details of Official Inviting Tender	< Tel. No.>	<Fax No.>	<e-mail>	
34	The procuring entity reserves the right to --- deleted-- reject all Tenders				

<select> : these fields are "pop-up" fields and the procuring entity will only have to select the correct name, address or date in order to complete the form.

<type in name> : these fields are to be completed by typing in the relevant date.

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অংশ-ঙ ঃ

Invitation for Tenders

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	GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH				
1	Ministry/Division	< select >			
2	Agency	< select >			
3	Procuring Entity Name	< type in name >			
4	Procuring Entity Code				
5	Procuring Entity District	< select >			
6	Invitation for	< select >	< select >	< select >	
7	Invitation Ref No	< type in name >			
8	Date	< select >			
	KEY INFORMATION				
9	Procurement Method	< select >		< select >	
	FUNDING INFORMATION				
10	Budget and Source of Funds	< select >			
11	Development Partners (if applicable)	< type in name >			
	PARTICULAR INFORMATION				
12	Project / Programme Code (if applicable)	< use MOF code >			
13	Project / Programme Name (if applicable)	< use MOF name >			
14	Tender Package No.	< type in name >			
15	Tender Package Name	< type in name >			
		Date			
16	Tender Publication Date	< select >			
17	Tender Last Selling Date	< select >			
		Date	Time		
18	Tender submission Date and Time	< select >	< select >		
19	Tender Opening Date and Time (if different from 18)	< select >	< select >		
20	Name & Address of the office(s)	Address			
	- Selling Tender Document (Principal)	< type in name >			
	- Selling Tender Document (Others)	< type in name >			
	- Receiving Tender Document	< type in name >			
	- Opening Tender Document	< type in name >			
21	Place / Date / Time of Pre-Tender Meeting (Optional)	< type in name >			
		Date	Time		
		< select >	< select >		
	INFORMATION FOR TENDERER				
22	Eligibility of Tenderer	< type in name >			
23	Brief Description of Goods or Works	< type in name >			
24	Brief Description of Related Services	< type in name >			
25	Price of Tender Document (Tk)	< type in price >			

	Lot No	Identification of Lot	Location	Tender Security Amount (Tk)	Completion Time in Weeks / Months
26	1	< type in name >	< type in name >	<type in>	<type in>
27	2	< type in name >	< type in name >	<type in>	<type in>
28	3	< type in name >	< type in name >	<type in>	<type in>
29	4	< type in name >	< type in name >	<type in>	<type in>

30	Name of Official Inviting Tender	< type in name >		
31	Designation of Official Inviting Tender	< type in name >		
32	Address of Official Inviting Tender	< type in name >		
33	Contact details of Official Inviting Tender	< Tel. No. >	< Fax No. >	< e-mail >
34	The procuring entity reserves the right to --- deleted-- reject all Tenders			

<select> : these fields are "pop-up" fields and the procuring entity will only have to select the correct name, address or date in order to complete the form.

<type in name> : these fields are to be completed by typing in the relevant data.

তফসিল-১১

অংশ-ক ঃ [বিধি ৯১ (১২) দ্রঃ]

Request for Expressions of Interest (Firm)

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	GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH				
1	Ministry/Division		< select >		V
2	Agency		< select >		V
3	Procuring Entity Name		< type in name >		
4	Procuring Entity Code		Not used at present		
5	Procuring Entity District		< select >		V
6	Expression of Interest for Selection of		< type in name >		
7	EOI Ref No		< type in name >		
8	Date		< select >		V
	KEY INFORMATION				
9	Procurement Method		< select >		V
	FUNDING INFORMATION				
10	Budget and Source of Funds		< select >		V
11	Development Partners (if applicable)		< type in name >		
	PARTICULAR INFORMATION				
12	Project / Programme Code (if applicable)		< use MOF code >		
13	Project / Programme Name (if applicable)		< use MOF name >		
			Date	Time	
14	EOI Closing Date and Time		< select > V	< select >	V
	INFORMATION FOR APPLICANT				
16	Brief Description of Assignment		< type in details >		
17	Experience, Resources and Delivery Capacity Req'd		< type in details >		
18	Other Details (if applicable)		< type in details >		
19	Association with foreign firms is		< select >		V
	Ref No	Phasing of Services	Location	Indicative Start Date	Indicative Completion Date
20	S1	< type in name >	< type in name >	< type in >	< type in >
	S2	< complete as required >	< type in name >	< type in >	< type in >
	S3	< complete as required >	< type in name >	< type in >	< type in >
	S4	< complete as required >	< type in name >	< type in >	< type in >
	PROCURING ENTITY DETAILS				
21	Name of Official Inviting Expressions of Interest		< type in name >		
22	Designation of Official Inviting Expressions of Interest		< type in name >		
23	Address of Official Inviting Expressions of Interest		< type in name >		
24	Contact details of Official Inviting Expressions of Interest		Tel. No. >	< Fax No. >	< e-mail >
25	The procuring entity reserves the right to –deleted- reject all EOI's				

< select > : these fields are "pop-up" fields and the procuring entity will only have to select the correct name, address or date in order to complete the form.

< type in name > : these fields are to be completed by typing in the relevant data.

অংশ-খ ঃ

Request for Expressions of Interest (Firm)

This letter will be self generated from the webpage Advertisement

1
2
3
5

Request for Expression of Interest (Firm)
For Selection of [6]

EOI Ref No: [7] Date: [8]

The [3] has been allocated public funds from the Government of the Peoples Republic of Bangladesh (GoB) toward the cost of the [13] and it intends to apply part of the proceeds of these funds to payments under the contract for the provision of consultancy Services for the project by a Consulting Firm (National).

The Services include [16]

The Experience, Resources and Delivery Capacity required are [17].

The [3] now invites eligible Applicants to indicate their interest in providing the Services. Interested Consultants are invited to provide information indicating that they are qualified to perform the Services (brochures, description of similar assignments, experience in similar operating conditions, availability of appropriate professional qualification and experience among staff, etc.).

An Applicant may associate with other Consultant(s) to enhance their qualifications. Association with foreign firms is [19], however this is not mandatory.

A Consultant will be selected using the selection sub-method in accordance with the Public Procurement Regulations 2003 and Public Procurement Procedures issued by the GoB. It is expected that the Services will be commenced on [20 (3)] at [20 (2)] and shall be completed on [20 (4)] at [21 (2)].
Interested Applicants may obtain further information by applying to the address below during normal office hours.
Expressions of Interest shall be submitted by [14(2)] on [14(1)], in sealed envelope delivered to [21], and be clearly marked "Request for Expressions of Interest for Selection of [6].

[25]

[21]
[22]
[23]
[24]

তফসিল-১২

অংশ-ক ঃ [বিধি ৯৬ দ্রঃ]

Tender Submission Form

(this form shall be completed and signed by the Authorised Signatory preferably on the Letter-Head pad of the Tenderer].

Date:

To:

[Contact Person]

[Name of Purchaser]

[Address of Purchaser]

Invitation for Tender No:	*[indicate IFT No]*
Tender Package No:	*[indicate Package No]*
Lot No:	*[indicate number of Lots]*

We, the undersigned, offer to supply in conformity with the Tender Document the following Goods and related Services:

In accordance with ITT Clauses XX, the following prices and discounts apply to our Tender:

The Tender Price is: (ITT Sub-Clause XX)	*[indicate currency and state amount in figures and in words]*
The unconditional discount for being awarded more than one lot in this package is: (ITT Sub-Clause XX)	*[indicate currency and state amount in figures and in words]*
The methodology for Application of the discount is:	*[state the methodology]*
The advance payment is: (GCC Sub-Clause XX)	*[state the amount based on percentage of the Tender Price]*

and we shall accordingly submit an Advance Payment Guarantee in the format shown in Form XX.

In signing this letter, and in submitting our Tender, we also confirm that:

(a) our Tender shall be valid for the period stated in the Tender Data Sheet (ITT Sub-Clause XX) and it shall remain binding upon us and may be accepted at any time before the expiration of that period;

(b) a Tender Security is attached in the form of a *[pay order / bank draft / bank guarantee]* in the amount stated in the Tender Data Sheet (ITT Sub-Clause XX) and valid for a period of 28 days beyond the Tender validity date;

(c) if our Tender is accepted, we commit to furnishing a Performance Security in the amount stated in the Tender Data Sheet (ITT Sub-Clause XX) in the format shown in Form XX and valid for a period of 28 days beyond the date of completion of our performance obligations;

(d) we have examined and have no reservations to the Tender Document, issued by you on *[insert date]*;

including Amendment(s) No(s) [*state numbers*] ,issued in accordance with the Instructions to Tenderers (ITT Clause XX). *[insert the number and issuing date of each amendment; or delete this sentence if no Amendments have been issued]*;

(e) we, including as applicable, any JVCA partner or specialist subcontractor for any part of the contract resulting from this Tender process, have nationalities from eligible countries, in accordance with ITT Sub-Clause XX;

(f) we are submitting this Tender as a sole Tenderer

or

we are submitting this Tender as the partner-in-charge of a JVCA, comprising the following other partners, in accordance with ITT Sub-Clause XX;

(delete one of the above as appropriate)

	Name of Partner	Address of Partner
1		
2		
3		
4		

(g) we are not a Government owned entity as defined in ITT Sub-Clause XX

or

we are a Government owned entity, and we meet the requirements of ITT Sub-Clause XX];

(delete one of the above as appropriate)

(h) we, including as applicable any JVCA partner, declare that we are not associated, nor have been associated in the past, directly or indirectly, with a consultant or any other entity that has prepared the design, specifications and other documents, in accordance with ITT Sub-Clause XX;

(i) we, including as applicable any JVCA partner or specialist subcontractor for any part of the contract resulting from this Tender process, have not been declared ineligible by the Government of Bangladesh on charges of engaging in corrupt, fraudulent, collusive or coercive practices, in accordance with ITT Sub-Clause XX;

(j) furthermore, we are aware of ITT Clause X concerning such practices and pledge not to indulge in such practices in competing for or in executing the Contract;

(k) we intend to subcontract an activity or part of the Works, in accordance with ITT Sub-Clause XX to the following Specialist Subcontractor(s);

Nature of the Supply or related service	Name and address of Specialist Subcontractor

(l) We, including as applicable any JVCA partner, confirm that we do not have a record of poor performance, such as abandoning the Works, not properly completing contracts, inordinate delays, or financial failure as stated in ITT Sub-Clause XX, and that we do not have, or have had, any litigation against us, other than that stated in the Tenderer Information (Form XX);

(m) We are not participating as Tenderers in more than one Tender in this Tendering process. We understand that your written Notification of Award shall become a binding Contract between us, until a formal Contract is prepared and executed;

(n) we understand that you reserve the right to accept or reject any Tender, to cancel the Tender proceedings, or to reject all Tenders, without incurring any liability to Tenderers, in accordance with ITT Clause XX.

(o) Commissions or gratuities, if any, paid or to be paid by us to agents relating to this Tender, and to contract execution if we are awarded the contract, are listed below:

Name and address of agent	Amount and Currency	Purpose of Commission or gratuity

(if none, state "none")

Signature:	*[insert signature of authorised representative of the Tenderer]*
Name:	*[insert full name of signatory]*
In the capacity of:	*[insert designation of signatory]*

Duly authorised to sign the Tender for and on behalf of the Tenderer

[If there is more than one (1) signatory add other boxes and sign accordingly].

Attachment 1: Written confirmation authorising the above signatory(ies) to commit the Tenderer, in accordance with ITT Sub-Clause XX;

Attachment 2: Copy of the JVCA Agreement, in accordance with ITA Sub-Clause XX *[if applicable]*.

অংশ-খ ঃ

Tender Submission Form

[This letter should be completed and signed by the Authorised Signatory preferably on the Letter-Head pad of the Tenderer].

Date:

To:

[Contact Person]

Name of Procuring Entity]

[Address of Procuring Entity]

Invitation for Tender No:	*[indicate IFT No]*
Tender Package No:	*[indicate Package No]*
This Package is divided into the following Number of Lots	*[indicate number of Lots]*

We, the undersigned, offer to execute in conformity with the Conditions of Contract and associated Contract documents, the following Works and Related Services:

In accordance with ITT Clauses 23 and 24, the following prices and discounts apply to our Tender:

The Tender Price is: (ITT Sub-Clause XX)	*[indicate currency and state amount in figures and in words]*
The unconditional discount for being awarded more than one lot in this package is: (ITT Sub-Clause XX)	*[indicate currency and state amount in figures and in words]*
The methodology for Application of the discount is:	*[state the methodology].*
The advance payment is: (GCC Sub-Clause XX)	*[state the amount based on percentage of the Tender Price].*

and we shall accordingly submit an Advance Payment Guarantee in the format shown in Form PW3A–XX.

In signing this letter, and in submitting our Tender, we also confirm that:

(o) our Tender shall be valid for the period stated in the Tender Data Sheet (ITT Sub-Clause XX) and it shall remain binding upon us and may be accepted at any time before the expiration of that period;

(p) a Tender Security is attached in the form of a *[pay order / bank draft / bank guarantee]* in the amount stated in the Tender Data Sheet (ITT Sub-Clause XX) and valid for a period of 28 days beyond the Tender validity date;

(q) if our Tender is accepted, we commit to furnishing a Performance Security in the amount stated in the Tender Data Sheet (ITT Sub-Clause XX) in the format shown in Form (PW3A-XX) and valid for a period of 28 days beyond the date of issue of the Certificate of Completion of the Works;

(r) we have examined and have no reservations to the Tender Document, issued by you on *[insert date];*
including Amendment(s) No(s) [*state numbers*] , issued in accordance with the Instructions to Tenderers (ITT Clause XX). *[insert the number and issuing date of each amendment; or delete this sentence if no Amendments have been issued];*

(s) we, including as applicable, any JVCA partner or specialist subcontractor for any part of the contract resulting from this Tender process, have nationalities from eligible countries, in accordance with ITT Sub-Clause XX;

(t) we are submitting this Tender as a sole Tenderer
or
we are submitting this Tender as the partner-in-charge of a JVCA, comprising the following other partners, in accordance with ITT Sub-Clause XX;

(delete one of the above as appropriate)

	Name of Partner	Address of Partner
1		
2		
3		
4		

(u) *we are not a Government owned entity as defined in ITT Sub-Clause XX*
or
we are a Government owned entity, and we meet the requirements of ITA Sub- Clause XX;
(delete one of the above as appropriate)

(v) we, including as applicable any JVCA partner, declare that we are not associated, nor have been associated in the past, directly or indirectly, with a consultant or any other entity that has prepared the design, specifications and other documents, in accordance with ITT Sub-Clause XX;

(w) we, including as applicable any JVCA partner or specialist subcontractor for any part of the contract resulting from this Tender process, have not been declared ineligible by the Government of Bangladesh on charges of engaging in corrupt, fraudulent, collusive or coercive practices, in accordance with ITT Sub-Clause XX;

(x) furthermore, we are aware of ITT Clause XX concerning such practices and pledge not to indulge in such practices in competing for or in executing the Contract;

(y) we intend to subcontract an activity or part of the Works, in accordance with ITT Sub-Clause XX, to the following Specialist Subcontractor(s);

Activity or part of the Works	Name and address of Specialist Subcontractor

(z) We, including as applicable any JVCA partner, confirm that we do not have a record of poor performance, such as abandoning the Works, not properly completing contracts, inordinate delays, or financial failure as stated in ITT Sub-Clause XX, and that we do not have, or have had, any litigation against us, other than that stated in the Tenderer Information (Form PW3A-XX);

(aa) We are not participating as Tenderers in more than one Tender in this Tendering process. We understand that your written Notification of Award shall become a binding Contract between us, until a formal Contract is prepared and executed;

(bb) we understand that you reserve the right to accept or reject any Tender, to cancel the Tender proceedings, or to reject all Tenders, without incurring any liability to Tenderers, in accordance with ITA Clause XX.

Signature:	*[insert signature of authorised representative of the Tenderer]*
Name:	*[insert full name of signatory]*
In the capacity of:	*[insert designation of signatory]*

Duly authorised to sign the Tender for and on behalf of the Tenderer

[If there is more than one (1) signatory add other boxes and sign accordingly].

Attachment 1: Written confirmation authorising the above signatory(ies) to commit the Tenderer, in accordance with ITT Sub-Clause XX;

Attachment 2: Copy of the JVCA Agreement in accordance with ITA Sub-Clause XX (*if applicable)*

অংশ-গ ঃ

Financial Proposal Submission Form

[*Location, Date*]

To: [*Name and address of Client*]

Dear Sirs:

We, the undersigned, offer to provide the consulting Services for [*Insert title of assignment*] in accordance with your Request for Proposal dated [*insert date*] and our Technical Proposal. Our attached Financial Proposal is for the sum of [*insert amount in words and figures*]. This amount is exclusive of local taxes, which we have estimated at *[insert amount in words and figures]*.

Our Financial Proposal shall be binding upon us subject to the modifications resulting from Contract negotiations, up to expiration of the validity period of the Proposal, i.e. before the date indicated in Clause XX of the Proposal Data Sheet.

Commissions and gratuities, if any, paid or to be paid by us to agents relating to this Proposal and Contract execution, if we are awarded the Contract, are listed as follows:

Name and Address of Agents	Amount	Purpose of commission or gratuity

We also declare that the Government of Bangladesh has not declared us or any Subconsultants for any part of the Contract, ineligible on charges of engaging in corrupt, fraudulent, collusive, or coercive practices. We furthermore, pledge not to indulge in such practices in competing for or in executing the Contract, and are aware of the relevant provisions of the Proposal Document (ITC Clause XX).

We understand you are not bound to accept any Proposal you receive.

Signed
In the capacity of:
Duly authorised to sign the proposal on behalf of the Applicant.
Date:

অংশ-ঘ ঃ

Technical Proposal Submission Form

[*Location, Date*]

To: [*Name and address of Client*]

Dear Sirs:

We, the undersigned, offer to provide the consulting Services for [*insert title of assignment*] in accordance with your Request for Proposal dated [*insert date*] and our Proposal. We are hereby submitting our Proposal, which includes the Technical Proposal, and the Financial Proposal sealed in two separate envelopes.

We are submitting our Proposal in association with: [*insert a list with full name and address of each associated Consultant, also specify, whether they are in joint venture or as sub consultants]*.

If negotiations are held during the period of validity of the Proposal, i.e., before the date indicated in Clause XX of the Proposal Data Sheet, we undertake to negotiate on the basis of the proposed staff. Our Proposal is binding upon us and subject to the modifications resulting from Contract negotiations.

......................**We undertake, if our Proposal is accepted, to initiate the consulting services related to the assignment not later than the date indicated in Clause XX of the Proposal Data Sheet.**

We also confirm that the Government of Bangladesh has not declared us, or any sub consultants for any part of the Contract, ineligible on charges of engaging in corrupt, fraudulent, collusive or coercive practices. We furthermore, pledge not to indulge in such practices in competing for or in executing the Contract, and we are aware of the relevant provisions of the Proposal Document (ITC Clause XX).

We understand you are not bound to accept any Proposal you receive.

We remain,

Yours sincerely,

Authorised Signature *[in full and initials*]	
Name and designation of Signatory	
Name of Firm	
Address	

তফসিল-১৩

[বিধি ১২৭ (১) দ্রঃ]

The Code of Ethics for Public Procurement

1. **Short title and commencement.** —This code may be called the Code of Ethics for Public Procurement, 2007.

2. **Application.** — (1) This Code shall apply to all Persons, whether they are directly or indirectly involved in public procurement activities.

   (2) This Code shall be considered as the basis for best practices of ethical behaviour for Persons engaged in public procurement within Bangladesh.

3. **Definitions.**—In this Code, unless there is anything repugnant in the subject or context—

   (a) "Competent Authority" means the Government or other authority to whom the relevany powers may be delegated by the Government;

   (b) "public servant" means a public servant as defined in Section 21 of the Penal Code, 1860 (Act XLV of 1860), and includes officers and staff of all Procuring Entities;

4. **General explanation.**—(1) Where the public servant is a female, reference to "he", "him", "his", "himself" in this Code shall be construed as reference to "she", "her" or "herself".

   (2) Where a Person is an individual then the references shown in (1) above shall apply to that Person. Where a Person is a body of individuals, a firm or a company, an association or an organisation whether incorporated or not, reference to "he", "him", "his" or "himself" shall be construed as reference to "it", "its" or "itself" as the case may be.

5. **General principles.** — (1) A Person shall always act professionally and selflessly, seeking to assist in enhancing efficiency, competition, transparency and accountability in public procurement in Bangladesh by—

   (a) complying with —

   (i) the Act, Rules, guidelines, orders or other documents concerning public procurement in Bangladesh; and

   (ii) any contractual obligations established between the Procuring Entity and a Person;

(b) maintaining the highest possible standard of integrity in all their dealings with public servants both within and outside the Procuring Entity;

(c) encouraging and developing the highest possible standards of professional competence amongst Persons, and those who work under their supervision and for whom they are responsible;

(d) enhancing the proficiency and reputation of public procurement by acquiring and maintaining current technical knowledge, following best procurement practices and establishing the highest standard of ethical behaviour;

(e) optimising the use of resources under their control and supervision to provide the minimum benefit to the Procuring Entity and the nation.

(2) A Person shall not allow himself to be deflected from the principles mentioned in this Code.

6. **Gifts.**— (1) Save as otherwise provided in this Code, no Person shall offer to any public servant, or any member of his family, any gift the receipt of which will place him under any form of official obligation to the donor of the gift.

(2). A Person may give to a public servant a gift of small intrinsic value such as business diaries, calendars, key rings or a ballpoint with the Person's company symbol provided that the value of such individual item does not exceed Tk. 500/-.

7. **Hospitality.** — (1) A Person shall not influence or put a public servant under any obligation by offering hospitality to influence the making of a procurement decision by that public servant as a consequence of accepting hospitality from a Person or any other private individual.

(2) A Person shall not encourage any meetings or entertainment to be held, the main purpose of which shall be to honour or praise a public servant.

8. **Unacceptable activities.**—(1) The following activities shall be considered unacceptable activities under this Code:

(2) A Person shall not offer to or secure for, or promise to secure for a public servant any foreign award, title or decoration.

(3) A Person shall not approach any public servant to secure for that public servant an invitation to visit a foreign country or for training abroad, unless such training has been formally approved in any procurement document or aid agreement.

(4) A Person shall not lend money to, or borrow money from, or place himself under any pecuniary obligations to any public servant with whom he has any procurement dealings.

(5) A Person shall not encourage a public servant to construct a building whether intended to be used for residential or commercial purpose, nor encourage a public servant in the buying or selling of valuable property, moveable and immovable, nor encourage a public servant to speculate in investments.

(6) A Person shall not encourage a public servant, or a member of his family, to engage in any trade in the area over which such public servant has jurisdiction, nor to undertake any employment of work, other than his official duties.

9. **Communication of official documents or information.**—(1) Save as provided otherwise in this Code, a Person shall not disclose directly or indirectly to any other Person, or any public servant, or a private individual, or to the press, other than those to whom he is authorised to communicate it, the contents of any document or information which has been entrusted in confidence to him by a public servant, or to which he had access owing to his involvement in the procurement proceedings or the content of the document.

(2) A Person shall disclose the contents of any official document or communicate any information which has come into his possession to another official only if so provided for, or as may be reasonably expected, during the performance of the procurement proceedings or contract in force at that time.

10. **Conflict of Interest.**—A Person finding a personal interest arising such that it may affect his impartiality in any matter relevant to his obligations at the point in time should consider this as a conflict of interest and shall therefore declare this personal interest immediately upon being aware of such interest to the public servant with whom he is dealing at that time.

(2) A conflict of interest may also be considered to exist if a Person is in any way closely related to, either as a friend or a relation or has a financial investment in a business with any public servant with whom he is dealing at that time.

11. **Obligations of a Person.** — A Person has an obligation to a Procuring Entity that in performing his obligations under any procurement activity or contract, he will comply with the Act, Rules, or other documents published by the Competent Authority.

(2) No Person shall indulge in corrupt, fraudulent, collusive or coercive practices, the nature of which is defined in Rule 127.

12. **Contravention of this Code.** — Contravention of this Code shall be construed as misconduct and may result in that Person being debarred from partaking in any future public procurement either indefinitely or for any period of time as determined by a Procuring Entity.

13. **Decisions and advice.** — Should a Person be unclear as to what is and what is not acceptable he should seek advice from the Head of the Procuring Entity, or as appropriate, the Competent Authority.

14. **This Code not to be in derogation of any law etc.** — Nothing in this Code shall derogate from the provisions of any law, or of any order of any competent authority, for the time being in force, relating to the conduct of a Person.

রাষ্ট্রপতির আদেশক্রমে

শেখ এ কে মোতাহার হোসেন
সচিব।

এ, কে, এম রফিকুল ইসলাম (উপ-সচিব), উপ-নিয়ন্ত্রক, বাংলাদেশ সরকারি মুদ্রণালয়, ঢাকা কর্তৃক মুদ্রিত।
মোঃ আখ্‌তার হোসেন (উপ-সচিব), উপ-নিয়ন্ত্রক, বাংলাদেশ ফরম ও প্রকাশনা অফিস,
তেজগাঁও, ঢাকা কর্তৃক প্রকাশিত।

Attachment II-6

New Subproject Screening Criteria

New Subproject Screening Criteria

Items for Screening	Purpose of Screening	Screening Criteria		
		Related proposal question No.	Remain on List	Remove from List
1) Completeness of Data	Assess the availability of data for accurate and fair selection	Overall	All the data use for screening and scoring are available	Not all the data use for screening and scoring are available
2) Size of Subproject Area	Assess the consistency with the Water Resource Development Policy	1.3	Subproject area is 201 to 1,000 ha	Subproject area is less than 200 ha or more than 1,001 ha
3) Environmental and Social Impacts	Assess the possible significant adverse impacts on the environment and society	2.8	-	-
a) Resettlement			Not required	Required
b) Land Acquisition			Less than 99 ha are required	More than 100 ha are required
c) Natural Conservation and/or Cultural Heritage			None	Present
4) Situation of Public Order and Security	Assess whether subproject can be implemented safely	2.9	Well-maintained public order and security.	There is a problem with public order and security.
5) WMCA	Assess the sustainability of O&M under WMCA	2.7	-	-
a) Organise WMCA			Wiling	Not willing
b) Deposit O&M fund			Willing	Not willing

New Subproject Scoring Criteria

<table>
<tr><th rowspan="2">Items for Scoring*</th><th rowspan="2">Purpose of Scoring</th><th colspan="2">Scoring Criteria</th></tr>
<tr><th>Related proposal question No.</th><th>Score</th></tr>
<tr><td>1) Size of Subproject Area</td><td>Priority given for the larger subproject area because of higher production volume</td><td>1.3</td><td><table><tr><td>Score</td><td>Subproject Area (ha)</td></tr><tr><td>5</td><td>801~1,000</td></tr><tr><td>4</td><td>601~800</td></tr><tr><td>3</td><td>401~600</td></tr><tr><td>2</td><td>201~400</td></tr></table></td></tr>
<tr><td>2) Existing Infrastructure</td><td>Priority given for a subproject located in no infrastructure support.</td><td>1.8</td><td><table><tr><td>Score</td><td>Infrastructure Support (Nos)</td></tr><tr><td>2</td><td>0</td></tr><tr><td>0</td><td>More than 1</td></tr></table></td></tr>
<tr><td>3) With Irrigation Development</td><td>Priority given for the irrigation function because of higher production volume and productivity.
When there are multiple answers, highest score will be applied.</td><td>2.1</td><td><table><tr><td>Score</td><td>Development Type by Function-base</td></tr><tr><td>5</td><td>Command Area Development (CAD)</td></tr><tr><td rowspan="2">4</td><td>Water Conservation</td></tr><tr><td>Tidal Irrigation</td></tr><tr><td rowspan="2">3</td><td>Drainage Improvement</td></tr><tr><td>Flood Management</td></tr></table></td></tr>
<tr><td>4) Potential beneficiaries of woman</td><td>Priority given for a subproject hold higher woman beneficiary ratio.</td><td>2.7
Number of potential members</td><td><table><tr><td>Score</td><td>Woman beneficiary ratio</td></tr><tr><td>3</td><td>more than 50 %</td></tr><tr><td>2</td><td>40 ~ 50 %</td></tr><tr><td>1</td><td>30 ~ 40 %</td></tr><tr><td>0</td><td>less than 30 %</td></tr></table></td></tr>
<tr><td>5) Land holding size</td><td>Priority given for a subproject located in small land holding size district.
Land holding size will be calculated by dividing subproject area (ha) by households.</td><td>2.2 to 2.6
Gross Area and Number of beneficiaries</td><td><table><tr><td>Score</td><td>Land holding size (ha/household)</td></tr><tr><td>4</td><td>less than 1.0</td></tr><tr><td>3</td><td>1.0 ~ 1.5</td></tr><tr><td>2</td><td>1.5 ~ 2.0</td></tr><tr><td>1</td><td>2.0 ~ 2.5</td></tr><tr><td>0</td><td>more than 2.5</td></tr></table></td></tr>
<tr><td>6) Land use</td><td>Priority given for a subproject holding high agriculture land and beel ratio because of higher production volume and productivity.
It will be calculated by dividing benefit area of agricultural land and beel by subproject area.</td><td>2.2 to 2.6
Gross Area and Benefit Area</td><td><table><tr><td>Score</td><td>Agriculture land and beel ratio</td></tr><tr><td>4</td><td>more than 70 %</td></tr><tr><td>3</td><td>55 ~ 70 %</td></tr><tr><td>2</td><td>40 ~ 55 %</td></tr><tr><td>1</td><td>25 ~ 40 %</td></tr><tr><td>0</td><td>less than 25 %</td></tr></table></td></tr>
<tr><td>7) Adverse Impact</td><td>Priority given for a subproject which will not impose adverse impact to people.</td><td>2.8</td><td><table><tr><td>Score</td><td>Adverse impact</td></tr><tr><td>2</td><td>No</td></tr><tr><td>0</td><td>Yes</td></tr></table></td></tr>
<tr><td colspan="3" align="right">Total</td><td>25</td></tr>
</table>

Attachment II-7

Small Scale Water Resources Subproject, Planning and Design Guidelines,

Methodology and Common Subproject Components

Local Government Engineering Department

Local Government Division
Ministry of Local Government, Rural Development and Cooperatives
Government of the People's Republic of Bangladesh

Small Scale Water Resources Development Project
in Greater Mymensingh, Sylhet and Faridpur Areas

SMALL SCALE WATER RESOURCES SUBPROJECT

PLANNING AND DESIGN GUIDELINES

METHODOLOGY AND COMMON SUBPROJECT COMPONENTS

June 2009

This document is an adapted version of the *Small Scale Water Resources Subproject Planning and Design Guidelines (updated March 2006)* developed under previous SSWRD Sector Projects of LGED.

The June 2009 adaptation of the SSWR Subproject Planning and Design Guidelines include (i) changes in names of development assistance agencies and project management offices as relevant to the JICA-assisted SSWRDP; (ii) modifications in Forms for identification, technical proposal preparation, pre-screening and multidisciplinary reconnaissance of subproject proposals in Exhibits 1 to 3; (iii) re-organization and updating the contents of **Exhbit-11**: Engineering Annex by (a) re-arranging the original contents into Appendix-A (Salient Data, Design and Impact of subprojects), Appendix-D (Structure Design Tables from Design Catalog) and Appendix-E (Determination of Design Basin WL) and (b) adding new Appendix-B (Data, Analysis and Design Calculations) and new Appendix-C (Maps and Drawings); (iv) incorporation of the separately existing *Supplementary Guide for Conducting Feasibility Analysis and Preparation on Appraisal Report* into the main document as **Exhibit-12:** Procedures for Field Investigation and Data

A Local Government Engineering Department Project
Supported by the Japan International Cooperation Agency
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ACRONYMS

ADB	Asian Development Bank
ADTA	Advisory Technical Assistance
BPPM	Beneficiary Participation and Project Management
BWDB	Bangladesh Water Development Board
DAE	Department of Agricultural Extension
DLIAPEC	District Level Inter-Agency Project Evaluation Committee
DOF	Department of Fisheries
EIA	Environmental Impact Assessment
FM	Flood Management (Subproject)
FMD	Flood Management and Drainage (Subproject)
HEC	Hydraulic Engineering Center, US Army Corps of Engineers
IEE	Initial Environmental Examination
JICA	Japan International Co-operation Agency
LGED	Local Government Engineering Department
NGO	Non-governmental organization
O&M	Operation and Maintenance
PMO	Project Management Office
PRA	Participatory Rural Appraisal
PWD	Public Works Department (datum)
SSWRDP	Small Scale Water Resources Development Project
SSWRDSP	Small Scale Water Resources Development Sector Project
SIEE	Summary Initial Environmental Evaluation
UAO	Upazila Agriculture Officer
UDCC	Upazila Development Coordination Committee
UE	Upazila Engineer
UFO	Upazila Fisheries Officer
UP	Union Parishad
USBR	United States Bureau of Reclamation
UZP	Upazila Parishad
WL	Water Level
WMCA	Water Management Cooperative Association
WRS	Water Retention Structure

GLOSSARY

Aman	Rice planted before or during the monsoon and harvested in October or November.
Aus	Rice planted in March or April and harvested in June or July.
Boro	Rice transplanted in December to February and harvested in April and May.
HYV	High Yield Variety (rice).
Kharif I	Cropping season during pre-monsoon (March - June).
Kharif II	Cropping season during monsoon (July - October).
Rabi	Cropping season during winter (October - March).
Beel	A natural depression which may vary in size from a few to several thousand hectares. Water collects in the depression and if not drained, the depression is uncultivable.

Borrow Pit Canal	Artificial channel excavated for the purpose of collecting (borrowing) fill material for the construction of flood embankment or road embankment.
Canal	Artificial channel excavated/constructed for the purpose of supply of water for: irrigation, drinking, industrial use and/or for navigation.
Channel	Natural channel; it maybe re-excavated for the purpose of drainage improvement.
Floodplain	Lower land along rivers and khals inundated during flood season by river floods.
Haor	Depression in floodplain located between or adjacent to rivers; term used for larger beels in NE Zone of Bangladesh.
Khal	Natural channel of smaller size (perennial or seasonal).
River	Natural channel of larger size (perennial or seasonal).
Regulator	Hydraulic structure equipped with slide gate(s) as primary closing device designed to check flood inflow into protected area and/or to conserve water inside the subproject area. Regulator structures are constructed in non-tidal zone.
Sluice	Hydraulic structure equipped with flap gate(s) as primary closing device on the riverside designed for automatic check of flood inflow into the protected area. The flap gates close under water pressure when water level in the river is higher than in the protected area (on country side). Sluices generally are used in tidal zone. Flap gates are also installed in structures in non-tidal zone on flashy rivers where there is danger of sudden flash flood entering the protected area, when the structure is located in remote places. Slide gates may also be installed on the countryside to conserve water in both tidal and non-tidal area.

Both, sluices and regulators are constructed across a channel/khal near its outfall. Their primary function is to prevent flood inflow into the protected area by means of complete closing of the gap in flood embankment or in higher ridge.Sluices and Regulators provide flood protection but do not improve drainage directly.

WRS	Water Retention Structures are hydraulic structures designed to conserve (retain) water in the subproject area for irrigation or other use. These are weir type structures with open space above gates or fixed-raised overflow sill designed for automatic control of water level inside the subproject area.

WRS are constructed across channel/khal at suitable location(s) along the channel to optimize benefits obtained from the water retention level and storage capacity of the channel.

UNITS

Hectare (ha)	10,000 square meters (1 ha = 2.47 acres = 247 decimals)
Kilometer (km)	1000 meters (1 km = 0.62 miles)
Meter (m)	100 cm (1 m = 3.28 feet = 39.36 inches)
Kilogram (kg)	1000 grams (1 kg = 2.204 pounds = 1.072 seers)
Quintal (q)	100 kg (1q = 107.24 seers = 2.68 mounds)
Ton (t)	1000 kg (1 ton = 26.81 mounds = 1072.4 seers = 2204 pounds)
Cubic feet per second (cfs)	28.3169 l/s = 0.0283169 m^3/s
Cubic meters per second (m^3/s)	35.3147 cfs

Note: *Only metric (MKS) units are to be used in Feasibility Study analysis and report.*

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EXHIBITS

FIGURES

1. INTRODUCTION

1.1 Background

1. This document outlines the feasibility study and detail design process and common subproject components for the JICA-supported Small Scale Water Resources Development Project (SSWRDP) of LGED in Greater Mymensingh, Sylhet and Faridpur Areas of Bangladesh. It is an adaptation of the Small Scale Water Resources Subproject Planning and Design Guidelines for the ADB supported Second SSWRDSP (version updated in March 2006) which was in turn an update of the Appraisal and SIEE Overview Report prepared in 1998 for the ADB-supported Small Scale Water Resources Development Sector Project (SSWRDSP). For reference, the structure of the report remains unchanged while its content has been adjusted to reflect lessons learned from the SSWRDSPs and to include recommendations of the various ADB review missions. The first part of the report addresses the methodologies and processes to be followed in preparing the Feasibility Study and IEE/EIA Reports for the individual subprojects. The second part presents common subproject components and basic design criteria to be followed during conducting subproject feasibility analysis.

1.2 Feasibility Study Reporting System

2. The feasibility study reporting system addresses three objectives:

(1) Provide general guidelines for preparation and document fully the feasibility study and IEE/EIA process of each subproject
(2) Produce a feasibility study and IEE/EIA report of useable size, and
(3) Efficiency of production and use for all system elements.

3. To achieve these objectives, a three-part appraisal documentation system will be used for each subproject:

(1) A *Feasibility Study and IEE/EIA Report*. These reports will be distributed to the respective LGED District Executive Engineers and JICA. This report follows a standardized format and is created by a standard word processing template linked to a subproject data spreadsheet. All “boilerplate” has been removed from this report and appears instead in the overview report.
(2) A *set of* finalized annexes, both *Engineering* and *Non-engineering,* containing the primary and secondary data collected, and detailed results of the technical analysis. The annexes will form part of the feasibility report and be annexed to it.
(3) This *Subproject Planning and Design Guidelines.* The guidelines include sections on methodology and common subproject components, and basic design criteria necessary for conducting feasibility analysis.

2. SUBPROJECT DEVELOPMENT PROCESS

2.1 Overview

4. A Flow Chart, depicting the steps involved in the identification and appraisal process for an individual subproject, is presented in **Figure 1** after the main text. The activities to be carried out under each step are outlined in the following paragraphs.

5. SSWRDP subprojects must be identified by local people, and initially processed through their elected representatives in the Union Parishad. The local farmers and fishermen who are familiar with water resources problems and have the first hand ideas how to alleviate the problems, work along with their community leader, UP Chairperson, on formulating a preliminary development plan. This plan, which is basically an identification of the water-related problems in the area, should have clearly defined improvement concept as perceived by the affected people. It should be completed in Bengali and signed by Union Parishad using the Subproject Identification Form **(Exhibit 1, Form 1)** and forwarded to the Upazila Engineer.

6. On receive of the Subproject Identification Form, the Upazila Engineer arranges field inspections and public meetings. Together with local peoples' representatives and leaders he visits the area to assess the problems and solutions, and records perceptions of the affected people inside and outside the area under the proposed plan.

7. When the Upazila Engineer is sure that the subproject has both technical and social potential, he collects more information and prepares a Subproject Technical Proposal, and along with the UP Chairperson presents the proposal at the Upazila Parishad/Upazila Development Coordination Committee meeting for acceptance. This meeting should include all Union Parishads that might be negatively affected by the proposed subproject. The Subproject Technical Proposal form **(Exhibit 2, Form 2),** completed in Bangla, comprises more detail social, fishery and agro-engineering information obtained from Upazila offices and during the local consultations.

8. Following acceptance of the proposal by the UZP/UDCC, the Upazila Engineer sends the proposal, including any amendments recommended by the UZP/UDCC meeting to the district LGED Executive Engineer.

9. Since the Subproject Technical Proposal shall provide basis for the subproject pre-screening analysis, which will decide whether the subproject proceeds to the next stage of investigation or is dropped, it should contain sufficient information and data regarding the subproject identification process, socio-economic and environmental data, physical requirements and benefits, social acceptance, and commitment to sustainable upkeep of the subproject.

10. The Executive Engineer reviews the subproject in the context of the district strategies and guidelines for SSWR interventions. If satisfied that the subproject will contribute to the development objectives of the district, the Executive Engineer forwards it to the Integrated Water Resources Management Unit (IWRMU) of LGED in Dhaka.

11. Following submission of subproject proposals to IWRMU in Dhaka each subproject will go through consecutive steps of analysis and reviews as listed below, before its acceptance and consequently start of the subproject implementation phase. However, it should be pointed out that processing of a subproject proposal can be terminated at any time when there becomes enough information to understand that the subproject would not be technically viable or it does not pass the subproject selection criteria.

» Pre-screening of the subproject proposal

- » Multidisciplinary field reconnaissance
- » Participatory Rural Appraisal
- » Field Data Collection
- » Feasibility Analysis
- » Feasibility Study and IEE/EIA Report Preparation
- » Submission to the Department of Environment for clearance
- » Clearance by the District Level Inter Agency Project Evaluation Committee
- » Detail Engineering Design.

12. Following successful completion of the subproject Feasibility Report (having obtained DLIAPEC clearance), which means the subproject has met the socio-economic and environmental selection criteria, a number of steps related to institutional development including registration of WMCA and collection of beneficiary contribution shall be under taken prior to start of construction. These are discussed in more detail in **Section 9** of this document.

2.2 Pre-Screening Subproject Proposals

13. The objective of pre-screening process is to:

(1) Make sure that the subproject identification procedures have been followed;
(2) Check the proposed subproject against the Project's selection criteria, and
(3) Assess initially the subproject's technical viability.

14. A subproject pre-screening form for the SSWRDP is provided as **Exhibit 3**. The IWRMU and Project Consultants staff will jointly carry out the pre-screening of subprojects, which involves carrying out the following activities:

- » Review and update the Subproject Index Map using the contour topographic maps available at the LGED;
- » Review of subproject concept using the available information to ensure that it is technically viable and socially acceptable;
- » Review of the requested components against the development concept to ensure that these support all the objectives of the subproject;
- » Verification of the proposed subproject for consistency with the National Water Management Plan;
- » Establishment of the subproject suitability to proceed to the next stage of study;
- » Completion of a prescribed pre-screening form for each subproject to ensure that there are no major problems; and
- » Identification of those areas that needed additional work.

2.3 Multi-disciplinary Field Reconnaissance

15. If the subproject proposal survives pre-screening, the IWRMU and Project Consultants will organize a multidisciplinary field reconnaissance. The multidisciplinary team should inspect the subproject area in the dry season but the IWRMU engineer should also inspect the subproject during other seasons. The multidisciplinary field reconnaissance team should include:

Water resources planning engineer
Agronomist
Fisheries specialist and/or Environmental specialist, and
Sociologist or Socio-economist.

16. The purpose of the field reconnaissance visit is to:

(1) Crosscheck the information and data submitted by the field offices and to verify the general subproject concept and conditions described in the subproject proposal, and
(2) Identify any required modifications and/or additional development potential.

17. The successful outcome of the reconnaissance review will trigger the start of the Participatory Rural Appraisal. At the same time, detailed data collection and surveys for feasibility study will be undertaken. The PRA and feasibility study will be done through contracts with eligible private sector firms/agencies.

2.4 Participatory Rural Appraisal

18. To obtain an independent "participatory" assessment of the subproject impacts and social viability the LGED will contract services of qualified NGO, institutes and/or consultancy firms to conduct PRA of potential subprojects. The PRA teams shall survey all subprojects those have 'passed' reconnaissance review.

19. The purpose of the PRAs is to obtain a comprehensive overview of the perceptions of different local interest groups (stakeholders) concerning water issues in the proposed subproject area. In this context, the overview component of the PRAs shall include:

» Inventory of local water resources and their present use;
» Perceptions of local interest groups on water related constrains in relation to domestic, agricultural, fisheries, transportation, environmental and other usage; and
» Perceptions of various local interest groups on solutions to remove the identified constrains, and their positive and negative impacts.

20. In addition to the above information, the PRA shall address the following six specific questions:

(1) If there is broad, popular support for the proposed subproject.
(2) If there is any opposition to the subproject as proposed, and if so, to quantify the opposition.
(3) The likely environmental impacts and possible mitigation measures that must be taken.
(4) Beneficiary willingness to assist with land acquisition and assume the costs associated with operation and maintenance.
(5) The PRA also includes a self-analysis of situation of the people in the subproject area as well as a basic description of the type of community and the interest groups present.
(6) If there are affected people, to quantify and group these persons and to assess the type of adverse impact and financial consequences for the affected people. Moreover, their ideas and suggestions for solutions should be explicitly included in the PRA report.

21. Each PRA team shall include a water resources engineer, a sociologist, an agronomist, a fisheries and environmental specialist. To facilitate interaction with local female stakeholders there will be one or more women in each PRA team. On average, two weeks should be spent on a proposed subproject; one week on fieldwork and one week on report writing. On completion of the investigation the PRA team shall hold debriefing meetings with the stakeholders and with the concerned LGED Upazila and district Engineers. **Exhibit 5** presents the PRA formats and the PRA report outline.

22. The results of the PRA including a paragraph on the situation regarding affected people will be summarized in a Feasibility Study and IEE/EIA Report, which will be a concise representation of the analysis and conclusions.

2.5 Data Collection

23. The LGED contracted consultants with experience in water development projects will undertake the data collection and surveys. The collected data and information, including the PRA will be used to prepare a comprehensive subproject feasibility study in accordance with established practice to determine the feasibility level investment costs and benefits.

24. Detail data requirements are covered in the following chapters of this report describing the feasibility analysis under five disciplines:

Engineering
Agriculture
Fisheries
Social
Environmental Assessment

2.6 Feasibility Analysis and Initial Environmental Examination

25. The objective of a feasibility study is to demonstrate that the proposed subproject is technically, economically, socially and environmentally viable. The required data, criteria and procedures to be followed in the course of the studies under respective disciplines are described in **Chapter 3** through **Chapter 8**. In general, the activities and tasks to be carried out under the feasibility study are as outlined below. The steps listed below logically follow one after the other, but this does not mean they should be carried out purely sequentially. Considerable overlap, interaction between the steps and repetition of analysis is expected. For example, an early initial environmental screening could find adverse impacts that would require modification of the subproject concept.

» Based on the collected field data the consultant reviews the subproject concept to ensure that the data supports the proposed intervention.
» Review of hydrological studies completed to date to determine the pre- and post-project water levels for flood management and drainage subprojects, and water availability for command area development subprojects. Details of the manner in which these studies should be carried out for various types of subprojects are provided in **Chapter 3**.
» Preparation of area-elevation curves with superimposed pre- and post-project water levels. The basis for the land elevation data is a 4″ to 1 mile (1:15,840) irrigation planning map with contours, and water levels are the basis for the pre- and post-project land classification.
» Agricultural impact analysis based on land classification in reference to average annual flood level (1:2.33-year). As a general rule, post-project cropping patterns and yields on a given land type are considered to be the same as the pre-project cropping patterns and yields. Thus, agriculture impacts are expected to result mainly from changes in the areas of the various land types. Details on how the agricultural analysis should be undertaken are provided in **Chapter 4**.
» A number of factors should be considered in assessing the impact of subproject works on fisheries. These may include negative as well as positive impacts:

- Subproject negative fisheries impacts (i.e. the "worst case" scenario) refer basically to floodplain area, which is defined by average monsoon inundation level, which in turn affect habitat extent, duration, and quality. These are considered as indicators of changes in fish production, employment in fishing, and subsistence fisher nutrition;
- Potential positive impacts inherent in the basic subproject design such as improvements in habitat quality related to re-excavation of drainage khals; increased (compensatory) employment of landless laborers in agriculture;
- The feasibility and potential impacts of any relevant add-on mitigating and compensating measures such as modifying structure designs and operating practices to minimize open water fisheries damage and measures to promote aqua-culture; and
- Net fisheries impacts (subproject negative impacts + subproject positive impacts + add-on mitigation/compensation impacts).

» Details on how the fisheries analysis should be undertaken are provided in **Chapter 5**.

» Review of social survey findings. The survey results should be verified against Bangladesh Bureau of Statistics Upazila and Union level data. To further supplement the understanding of the subprojects impact on poverty alleviation and equity, more detailed effect studies shall be carried in selected subprojects. The social survey instrument should be designed to provide the following information:

  Stratification of farmers within the subproject area according to farm size;
  Stratification of subproject affected people by occupation;

  The opinion of the various occupational groups within the subproject boundary on potential benefits and negative impacts of the proposed subproject;

  The opinion of the various occupational groups outside the subproject boundary on potential benefits and negative impacts from the proposed subproject.

» Details on how the social analysis should be undertaken are provided in **Chapter 6**.

» Review of initial environmental evaluation carried out on the basis of survey instruments specifically designed to provide selected information and on the basis of all the foregoing analysis. For details on conducting environmental studies see **Chapter 7**.

» Completion of financial and economic analysis. The financial and economic models including assumptions including cost parameters to be used are provided in **Chapter 8**.

26. The Project will give priority to proposed subprojects from poverty-stricken districts as defined and elaborated in poverty indices and included in poverty maps per region. To qualify for being implemented under the SSWRDP a subproject will meet the following criteria.

(1) The subproject must be in line with the Guidelines for Participatory Water Management (2001) and be evaluated by the District Level Interagency Project Evaluation Committee (DLIAPEC).

(2) More than 40% of the subproject benefit area will be ***operated*** by landless sharecroppers, and marginal or small farmers (up to 1.0 ha). Within a district, preference will be given to subprojects with higher percentages of land operated by these farmers and to subprojects located in food-deficit areas.

(3) No more than 30 percent of the households depend on subsistence capture fisheries.

(4) Each subproject will entail rehabilitating / upgrading an existing water control system, which may include new supplementary structures in existing systems.

(5) The benefited area served by the subproject must be more than 50 ha and must not exceed 1,000 ha.

(6) Each subproject must be technically feasible; economically viable (the economic internal rate of return [EIRR] should be more than 12%); and socially and environmentally sound (requiring no or minimal displacement of people and land acquisition, and not involving environmentally sensitive areas).

(7) The IEE or EIA study has been undertaken and appropriately approved after consulting the beneficiaries and those affected by the Project, concluding that the subproject is environmentally sound and that the negative consequences can be mitigated to an acceptable level.

(8) Interventions involving submersible embankments in the deeply flooded part of the Northeast region will not be considered unless it can be shown that the beneficiaries have the capacity of ensuring the sustainability of submersible embankments.

(9) Recurrent maintenance costs of each subproject (including re-excavation costs to maintain design performance of the subproject) will be covered by the O&M budget of the WMCAs based and agreed upon the principles of a contribution proportionate to the area of ***land owned/cultivated***, and

(10) To ensure sustainability, subprojects should not be taken in Char lands (unstable land in or along a river course) and other area vulnerable to river erosion and requiring significant river bank protection works (however, subprojects may be allowed in Char lands that have become significantly stable over the years).

2.7 Feasibility Study & IEE/EIA Report Preparation

27. Preparing the Feasibility Study and IEE/EIA Report consists mainly of assembling the appropriate information resulting from the analytical process described above into a concise document. The most important step at this stage is to assimilate the outcome of the agro-fishery-engineering and economic analysis with socio-economic findings supported by the PRA into a complete and consistent product.

28. The IEE/EIA Report will be sent to Department of Environment for clearance. IEE is required for all subprojects and EIA report for any subproject involving construction/re-sectioning of embankments. (For IEE and EIA Report format, see **Exhibit 9**, Appendix C and Appendix D).

29. A complete feasibility package, including Feasibility Study and IEE/EIA Report, will be forwarded to Executive Engineer for submission to, and clearance by, DLIAPEC.

2.8 Detail Design

30. Detailed engineering design will follow completion of the feasibility study process. In undertaking the detailed engineering design, extensive use will be made of various computer-based analytical tools consisting of spreadsheets designed for: hydrological analysis, hydraulic design, foundation and structural design (section and reinforcement), bill of quantities, and cost estimates. Hydraulic Engineering Center (HEC) and SSWRDSP developed software is available and shall be used where called for. In addition, a design catalogue prepared for the SSWRDSP and made available to designers in both digital and hard copy will be used in preparation of detail design drawings.

2.9 Operation and Maintenance

31. A preliminary O&M plan shall be prepared for each subproject. The plan should include list of all subproject components, operation plan and operation manual. The operation plan should comprise physical activities plan, resource mobilization, and financial plan. In planning maintenance of embankments emphasis should be placed on executing the work by women.

32. Preparation of a final version and updating of the O&M plans shall be the duty of the WMCA that represent the subproject beneficiaries.

3. ENGINEERING ANALYSIS FOR FEASIBILITY STUDY

3.1 Introduction

33. The purpose of the engineering analysis is to establish the optimal physical intervention(s) needed to support the subproject development concept in general, and to ascertain hydrological changes needed within the subproject area to improve conditions for agricultural production. This can be achieved only when the analysis are based on latest relevant data and information.

34. The engineering analysis should be carried out for all subprojects following a standard general format. The body of each subproject appraisal report shall comprise general information and salient data information supported by concise description and justification of the proposed development works as listed below. The detail analysis carried out and the expected changes following the subproject intervention should be summarized in Engineering Annex attached to the Feasibility Study Report (see **Exhibit 11**). The following information should be provided in Engineering Annex.

- » Figure 1, the Subproject Index Map, showing subproject boundaries, khals, beels, existing and proposed infrastructure, spot levels, and contours in meters PWD (converted from contours in feet shown on 4 inch to 1- mile topographic map (Irrigation Planning Map).
- » Figure 2, Base Map, showing location of the subproject in the LGED Upazila Base Map of scale 1:50,000. This map presents location of the subproject with a wider surroundings in the Upazila in relation to communication systems, markets, important town and places, etc.
- » Figure 3, the Regional Map showing location of the subproject within existing BWDB project/subproject (if applicable), hydrometric stations used in the analysis, main rivers and khals, and main roads and towns. (1:150,000 LGED District Base Map or 1:250,000 topographic map can be used as basis for preparation of Regional Map).
- » Subproject Name and ID Number
- » Subproject Location: District; Upazila; Union
- » Areas:
  Catchment area
  Gross subproject area
  Net benefited area
  Command area (for CAD subprojects)
- » Elevation-Area-Storage relation (Table and Graph)
- » Hydrological Regime
- » Present Problems within the Subproject Area
- » Development Concept.
- » Relevant Hydrological and Engineering Design data.

3.2 Conceptual Engineering Designs

35. The engineering intervention(s) required in a water development subproject depend on the existing problems in the subproject area. The problems, however, may vary according to topography, hydro-geological conditions, and/or the land use of a particular subproject area. The SSWRDP is an agriculture-oriented project with primary objective to increase agricultural production through improved soil/water conditions.

36. Taking into account the existing problems and the requirements identified in the course of implementing the previous SSWRDSPs, the SSWRDP subprojects have been grouped into four basic types of water management subprojects listed below. In case of multiple problems and benefits the four basic types when combined make eight common types of subprojects as described in **Exhibit 13**. All the subprojects may include new works as well as rehabilitation and/or upgrading works.

(1) Flood management. Rehabilitate and construct embankments and/or sluice/regulators to reduce the extent and duration of flooding of farmland.
(2) Drainage improvement. Re-excavate drainage channels to increase the capacity of drainage systems to benefit agriculture as well as fisheries and local navigation.
(3) Water conservation. Develop the water retention capacity of existing baors, beels, and channels to increase availability of irrigation water by installing water retention structures and by re-excavating the bed of water bodies and channels.
(4) Command area development Improve the existing irrigation schemes by providing better water distribution systems (improved canal network, lining of canals, installation of control structures, etc.) to extend the irrigated area.

3.3 Data Requirement

37. Collection of data for engineering designs can be divided into two phases: Phase 1 – collection of mainly secondary data for use in the initial stage of study together with an initial multidisciplinary field investigation to determine the subproject technical viability and financial feasibility based on parametric costs, and Phase 2 – collection of primary data for use in detail feasibility analysis and preparation of detail engineering designs. The collection of Phase 2 engineering data should commence when the preliminary analysis presented in a Concept Plan Report indicate that the subproject is feasible.

Phase 1 Engineering Data:

» Topographic maps (4 inch to 1 mile scale with 1ft contour interval)
» Design plan of existing water project (BWDB or LGED)
» Design sections of existing earthworks like roads, embankments and channels
» Design drawings of existing structures like bridges, culverts, sluices and regulators structures
» Existing sections of earthworks (if available)
» Description of present state of earthworks
» Description of present state of existing structures
» Hydrological Data
  Location and name of nearest water level stations
  Water level data from nearest (relevant) gauging stations
  Surveyed elevation of high flood level (HFL) marks of floods that occurred inside the subproject area and in the boundary channels within the last 5 years
  Elevation of average monsoon season water level within the subproject area
» Meteorological data
  Location of nearest weather stations
  Rainfall data from nearest stations
  Evaporation, temperatures, daylight and wind speed data.

From the above information the Consultant should be able to establish validity of water level data recorded at existing gauging stations for flood analyses in the subproject area. In case there are discrepancies and/or lack of correlation, temporary hydrometric station(s) should be set-up in the subproject and further study deferred until sufficient water level data are obtained.

Phase 2 Engineering Data:

» Established topographic survey benchmarks for the subproject works referenced to PWD datum
» Verified existing SOB and BWDB (PWD) Benchmarks in the area
» Water level records collected from temporary gauging stations referenced to PWD datum (if required)

- » Spot level survey to verify present land elevations against the topographic maps
- » Surveyed long sections along proposed embankments and channels
- » Surveyed cross-sections (at 100 m interval) of existing embankments and channels to be re-excavated; indicate land already acquired for the embankments
- » Surveyed long sections and cross sections of existing irrigation canals
- » Surveyed elevations of invert and major components of existing structures
- » Detail survey report on present state of existing structures to be rehabilitated; if available original design drawings and soil boring data should be collected
- » Plane Table surveys for proposed structures
- » Soil boring data for box type structures or WR structures (minimum 3 bore-logs 20 m deep are required; for pipe sluices and culverts soil boring is not required)
- » Soil boring data for alternative site soil(s), selected by the Executive Engineer, in case the encountered foundation is not sufficient, i.e., SPT value is less than 3 within 10 m below the foundation level. (If SPT at foundation level is more than 5 no treatment is required; foundation treatment or deep foundation is required for SPT less than 5)
- » Soil survey data for embankments to determine suitability of local material and/or location of potential sources for embankment fill material
- » Information about possibility of land availability and acquisition for earthworks and structures
- » Detail inventory of individuals and demarcation of land that is required for the subproject implementation.

38. The above information provides a general data requirement. Depending on the subproject type some data can be omitted and/or other data may need to be collected.

3.4 Anticipated Impacts of Various Engineering Interventions

Drainage Improvement (Dr)

39. Drainage improvement works are designed to remove the excess water from an area, and/or to reduce the time required to drain that water. This is usually achieved by excavating new channels or re-excavating existing silted channels.

40. Possible agricultural benefits that can be derived from improved drainage are:

- » Increased production of pulses and oilseeds in the rabi season since crops can be planted earlier.
- » Increased area under short duration crops (mustard, pulses, potatoes) between hyv Aman and hyv Boro.
- » Reduced crop damage in Kharif I (pre-monsoon) and in Kharif II (monsoon) seasons.
- » Additional land available for cropping where shallow swamplands (beels) are drained.

41. Though more difficult to quantify, excavation and re-excavation of drainage channels increase their water storage capacity and thereby improves fisheries habitat and water availability for irrigation.

Flood Management (FM)

Impact on Agriculture

42. The direct impact of flood management subproject is reflected in the reduced flood water levels within the protected area during the pre-monsoon and the monsoon seasons. The present (pre-subproject) and the projected (post-subproject) water levels are the basis for estimating agricultural benefits.

43. The FM subprojects have two-fold positive impact on agricultural production:

(1) Reduced crop damage due to floods, and
(2) Changed land types as a result of reduced flood depth.

44. The present crop damages from flood are estimated below the 1:10-year flood level. 1:10-year annual flood level should be used in high embankment subprojects and 1:10-year pre-monsoon flood level should be used in submersible embankment subprojects. Cultivable area inundated by the 1:10-year flood should be used for determining the area of pre-subproject flood damaged crops.

45. The present without subproject land type estimates are based on the average annual flood or 1:2.33-year annual flood elevation. The design basin level (monsoon) should be used as the post-subproject flood level. It should be noted that the land types do not change in submersible embankment subprojects.

46. To avoid errors that may arise from incorrect estimation of flood levels and/or subproject ground topography, the subprojects' crop damages from floods shall be crosschecked using primary data collected in three ways and verified with the benefited area defined above. For details see **Section 4:** Agricultural Analysis, subsection Data.

47. The criteria for estimating water level changes due to subproject intervention are given in table below.

48. As a result of flood management measures, like constructing embankments and drainage regulators, more land becomes free from flood and the overall depth and duration of flooding is reduced, which results in increased area of land suitable for cultivation of transplanted Aman.

49. In the design of subprojects having larger basins, monsoon flood routing (water balance) for the months from June through October is the most appropriate analytical methodology. This methodology requires 1 in 10 year daily rainfall inside the protected area and 1 in 10 year daily water levels for the adjacent river. In practice, however, the data frequently used are water levels for a particular year, which correspond to 1 in 10 year river water levels and the daily rainfall, which corresponds to that year.

Hydrological Design Criteria for Agricultural Analysis

Pre-Project Water Levels		Post-Project Water Levels		
Item	**Description**	**Description**	**Approximate Estimate**	**Detail Analysis**
Pre-Monsoon Flood Protection with Submersible Embankments in Haor Areas of Sylhet Basin (Land Type will not change)				
Pre-Monsoon Design Flood Levels	1:10-year Flood Level in the outfall river (at subproject site) in the month of May	Basin Water Level generated by the pre-monsoon Design Storm (5-day, 1:10-year storm)	May [(Mean Max WL + Mean Min WL)/2]+0.3 m	Basin Water Level determined from routing of the Pre-Monsoon Design Storm using suitable Drainage Rate corresponding to project acceptable crop damage criteria.
e-Monsoon Flood Protection with Submersible Embankments in Other Areas of Bangladesh (Land Type will not change)				
Pre-Monsoon Design Flood Levels	1:10-year Flood Level in the outfall river (at subproject site) in the month of June	Basin Water Level generated by the pre-monsoon Design Storm (5-day, 1:10-year storm)	In Tidal Area: June [(Mean Max HTL+ Mean Min LTL)/2]+0.3m In Non-Tidal Areas: June Mean WL + 0.3m	Basin Water Level determined from routing of the Pre-Monsoon Design Storm using suitable Drainage Rate corresponding to project accepted crop damage criteria.
Monsoon Season Flood Protection with High Embankments (Land Type will change according to Post-Project Basin Water Level)				
Monsoon Season Design Flood Levels	1:10-year Annual Flood Level in the outfall river (at subproject site)	Basin Water Level generated by the monsoon Design Storm (5-day, 1:10-year storm)	In Tidal Areas: July or August [(Mean Max HTL + Mean Min LTL)/2]+0.3m In Non-Tidal Areas: July or August Mean WL+ 0.3 m	1. If the outfall river level permits drainage: Basin Water Level determined from routing of the Monsoon Design Storm using suitable Drainage Rate corresponding to project accepted crop damage criteria. 2. If the outfall river water level is high: Basin Water Level determined from Water Balance analysis. (ref: para 49).

Notes:
1. The “Approximate Estimate” may be used at the pre-screening stage of subproject investigation.
2. Basin water levels determined from "Detail Analysis" using routing of Design Storms should be used in subproject feasibility analysis.

50. Generally flood management interventions, by protecting area with embankments and drainage sluices, are successful in protecting Boro crops from the pre-monsoon floods with submersible embankments; this type of intervention is called partial flood management. Also, it is possible to protect Aus and Aman crops grown along flashy rivers with high embankments; this type of intervention is called full flood management.

51. The full flood management interventions are successful in tidal areas, where cultivated lands are protected from saline water and tidal flooding by high embankments and structures like regulators and sluices provided for drainage of local runoff, and water management inside the protected area. During storm the rainwater is drained from the basin twice daily during low tide. In order to have sufficient discharge capacity to drain the design storm (1:10-year, 5-day rainfall), the structures are sized for the required drainage modulus (DM), while the basin water level does not exceed the allowable, or the design basin level in July or August.

52. In non-tidal zone, especially in deeply flooded areas like floodplains of big and medium rivers, which remain inundated from June to October, complete flood protection or full flood management (FM) is generally not possible because of accumulation of rainfall runoff and seepage through the embankments into the protected area. Under these conditions pump drainage is required for effective full flood management. However, a limited flood protection can be achieved by constructing high embankments in non-tidal zone. The degree of protection, or reduction in flood levels will depend on the subproject topography, hydrology (water levels in the outfall and surrounding rivers) and climatic data namely rain, evaporation and evapotranspiration in the area.

53. To verify technical feasibility and determine the post-subproject water levels, the following hydrological assumptions can be made for conducting water balance analysis. These are considered adequate to determine the water levels throughout the monsoon on monthly basis:

- Initial Storage in the subproject basin is considered to be an average water level in May based on long-term records from the outfall river or observed at the subproject site. This assumes that gates are open through the end of May.
- Accumulation of rainfall inside the subproject is 100% of average rainfall in June, July, August, and September based on the mean monthly rainfall from the nearest rainfall station.
- Water losses include average evaporation from 50% of the subproject catchment and evapotranspiration from the remaining 50% of the subproject catchment area.
- Post-subproject monthly water levels inside the subproject correspond to the initial storage level plus accumulated rainfall minus Eo and Eto, as above. The water levels are determined using the subproject elevation - storage volume data (rainfall-Eo/Eto in millimeters should be converted to cubic meters using the catchment area).

54. Depending on local conditions the post-subproject basin water level may be below or above the pre-subproject 1:2.33-year annual (or average) flood level. For practical purpose, considering the quality of data, if the difference between the calculated basin water level and the pre-subproject 1:2.33-year annual water level is less than (+ or-) 0.3 m it should be considered that there will be no change in land classes.

55. However, even if there is no change in land classes, the high embankments will benefit the area by protecting crops from higher than average monsoon floods (1:5-year, 1:10 year). This can be accomplished under proper flood management by closing regulator gates before rising peak floods and opening when the river level falls below the basin water level. Under this condition there will be smaller negative impact on fisheries.

Impact on Fisheries

56. Flood management subprojects are expected to have different impact on fisheries than that on agriculture. While reduced flood level, in general, has positive impact on agriculture it has negative impact on fisheries. However, the bases for estimating the impacts are different. While the flood protection *agricultural benefit* estimates include protected land defined by 1:10-year flood level, which is derived from extreme-short duration peaks that damage crops, the *fisheries damage* refers to flood plain area that is used by migrating fishes as grazing ground during flood season.

57. For seasonally flooded land to be considered fish grazing ground it has to remain inundated for a reasonable period of time. To eliminate any short duration inundated land, the floodplain fisheries have been defined as land that is inundated by annual average flood to more than 0.90 m depth, which corresponds to agricultural land types F2 and F3. The criteria for estimating changes in flood plain areas due to subproject intervention are given in table below.

Hydrological Design Criteria for Fisheries Analysis

Reference Pre-Subproject Water Level		Reference Post-Subproject Water Level		
Item	**Description**	**Description**	**Approximate Estimate**	**Detail Analysis**
Pre-Monsoon Flood Protection with Submersible Embankments (During monsoon flood plain area will not change)				
Present Floodplain Fish Habitat	Average (1:2.33-year) Annual Flood Level–0.90 m [Present area of F2 + F3 lands]	Future Floodplain Fish Habitat	No Change	Determine impact of restriction on migration and disruption of fish migration in April, May and June on annual fish production.
Monsoon Season Flood Protection with High Embankments (Flood plain fish grazing area will change according to effective basin water levels)				
Present Floodplain Fish Habitat	Average (1:2.33-year) Annual Flood Level–0.90 m [Present Area of F2 + F3 lands]	Future Floodplain Fish Habitat	Design Basin WL – 0.90 m [Post Subproject Area of F2 + F3 lands]	

Water Conservation(WC)

58. Assumed is that 100% of the irrigation water retained by a hydraulic structure is available for supplementary irrigation within the area of influence of the water body. The benefited area is evaluated by determining the amount of land that can be irrigated by the available water. Irrigation may be done by gravity or by lifts water by LLPs other means. Usually land situated below the level to which water is retained is considered to be commanded. Where contour maps are unavailable, this area is considered to extend up to 300 m on both sides of the channel along the length measured from the structure to the meeting point of the water retention level and the channel bed subject to the limit given by water availability consideration.

59. In addition to providing water for supplementary irrigation, the water conservation subprojects also increase the residual moisture available within the soil profile. This can facilitate cultivation of early rabi crops, though for the purpose of the impact analysis, this benefit is difficult to quantify and thus not factored into the overall benefit analysis.

Command Area Development (CAD)

60. The command area development subprojects include rehabilitation of existing and construction of new / additional infrastructure for water distribution within irrigation systems. The direct impact of CAD subprojects is reflected additional cultivable area brought under irrigation and/or improved water availability for timely irrigation.

61. The indirect impacts of CAD subprojects are increased irrigation water efficiency and improved water management, which result in reduced cost of crop production.

3.5 Determination of Subproject Benefited / Affected Area

Drainage Improvement Subprojects

62. To determine the benefited area of a drainage improvement subproject it is necessary to establish (i) the pre-subproject boundary of cultivable area presently affected by inadequate drainage and (ii) the post-subproject boundary of cultivable area affected by inadequate drainage (if any). The difference between these two figures gives the subproject's benefited area. In case of drainage of lowlands, the area reclaimed from the uncultivable lowland may increase the benefited area. In case of channel excavation or re-excavation the benefited area should include loss of cultivable land taken by the channel.

63. The pre- and post-subproject boundaries of respected areas should be demarcated and measured on the Subproject Index Map with contours. The area-elevation curve can be used only if the elevations of pre- and post-subproject water levels and the elevation of water bodies can be established.

Flood Management Subprojects

64. In general, the flood management subprojects can be typed as (1) full flood protection subprojects with high flood embankments and (2) partial flood protection subprojects with submersible embankments. As a refinement, controlled flooding can be included in both the types. In subprojects with high embankments flooding is controlled through operation of regulators. In submersible embankments subprojects flooding is controlled through operation of regulators and by compartmental or sector dikes (roads cum dikes) constructed at carefully planned locations and elevations.

65. The 1:10-year pre-subproject annual flood level defines the upper limit of benefited area of full flood protection subprojects, while the design basin level defines the lower limit of benefited area. Difference between the two areas within the subproject boundary gives the subproject gross benefited area. This area may include cultivable land, homesteads, roads and other lands that are negatively affected by flood.

66. The subproject net benefited area refers to cultivable land and it should include only the cultivable land within the demarcated gross benefited area of a subproject.

67. The Subproject Index Map with land elevation contours and topographical futures of the area should be used for demarcation and measurement of benefited areas.

Water Conservation Subprojects

68. Water conservation subprojects develop water storage capacity in baors, beels and/or existing channels to increase availability of irrigation water by installing water retention or regulator structures to regulate outflow from and water elevation inside the subproject.

69. Water conservation subprojects are designed for irrigation by gravity or using LLPs. The extent of benefited area on either sides of the storage channel depends on the distance water can be conveyed by the system adopted by farmers - gravity channels, LLPs, etc. However, irrigated area under the subproject will depend on available quantity of water in the storage (including perennial flow from upstream) and irrigation water requirement (including supplementary irrigation) in the command area lands. The meeting point of the design water retention level with the design bed elevation of the channel defines the longitudinal limit (distance) of the benefited area of the WRS.

Command Area Development Subprojects

70. The benefited area of a CAD subproject depends on the type and extent of works carried out. In general, if the subproject involves rehabilitation of a whole existing irrigation system the benefited area should include the whole subproject irrigated area. In case of only expanding existing command area by constructing additional irrigation canals the benefited area should include only the new or additional irrigated area.

71. Other cases may include rehabilitation of different components of the irrigation system like pumping station, main canals, secondary canals or cross drainage and other infrastructure. In this case the benefited subproject area will depend on how much of the net subproject irrigated area is affected by the proposed works.

4. AGRICULTURAL ANALYSIS

4.1 Introduction

72. The purpose of the agriculture portion of the feasibility study is to estimate the agriculture impacts of the subproject, that is, the difference between present and future-with-project agriculture inside the subproject area. Present and future-without-subproject assumed to be identical.

4.2 Data

73. The Consultant's agronomist and socio-economist shall collect primary agricultural data for each subproject. Their findings should be verified with information and future plans available at the office of Upazila Agricultural Extension Officer. Guidelines on agricultural survey methodologies will be provided and they will be required to attend short orientation course organized by the Project.

74. Primary data should be collected in three ways and crosschecked in the field between sources as much as possible. Collection methods to be used are:

- » farmer interviews,
- » direct visual observation of subproject agriculture, and
- » discussions with the block supervisors working in the subproject area.

75. Farmer interviews, following a structured questionnaire, will be taken in group discussions at different sites within the subproject area to determine:

- » present land utilization
- » present crop patterns on various land types
- » percent of area under each crop pattern
- » extent of crop damage due to flooding in different seasons, drought, and pest
- » date and area of crop damage
- » yield levels under normal and damaged conditions
- » percent of crop area under different methods of irrigation
- » crop planting and harvesting dates
- » application rates of fertilizers and manure
- » labor and draught power use
- » constraints to agricultural production
- » suggestions as to the nature of the interventions required to resolve the constraints
- » views on possible impacts of the proposed subproject infrastructure.

76. Three main secondary sources shall be used to augment and cross-check the field data:

- » *Upazila Land and Soil Use Guide*, Soil Resources Development Institute/Ministry of Agriculture 1991. Guides exist for all the project area Upazilas. Each guide includes an upazila map at a scale of 1:50,000 and provides information on soil associations, soil series, cultivated land type, present land use, limitation to crop production, opportunities for development, crop yield level, and type and status of soil.
  District Reconnaissance Soil Survey, Department of Soil Survey (now SRDI) early 1970s. This is a series of district guides. Each guide includes a map at scale of 1:125,000 and provides the same information as the upazila guide, though at a coarser resolution.
- » *Agroecological Regions of Bangladesh, Report 2*, Land Resource Appraisal of Bangladesh, 1988 (UNDP report DBD/8/035). Includes a map at a scale of 1:750,000 and provides information on physiography, agroecological zones and sub-zones, drainage and physical properties of the soils.

77. In addition, subproject engineering maps, prepared from 4 inch to 1 mile irrigation planning maps with contours or other available topographic maps, will be used.

78. Findings of the PRA and Consultants' studies will be used. **Exhibit 4** provides the set of Agricultural Data Survey Forma in Tables 4.1 through 4.6.

4.3 Agriculture Impact Analysis

79. The objectives and methods used for determining agricultural impacts of flood management and drainage subprojects are:

- » Establish crop patterns and production on each land type found within the subproject area.
- » Determine the area on which flood damage occurs under present subproject conditions.
- » Determine the changes in area under each land type based on new flood levels or on the provision of irrigation.
- » Predict changes in production levels by assuming that those cropping patterns presently found on a given land type would be found over the new area of that land type under post-project conditions. Yields are assumed to remain unchanged unless there is flood damage prior to the provision of the infrastructure. In this event, undamaged pre-project yields should be used in the post-project condition.
- » In cases where supplementary irrigation is provided for the kharif II crops (mainly transplanted Aman), under pre-subproject (droughty) conditions, reduced yields should be used. With the provision of supplementary irrigation, normal yields are predicted.
- » Where supplementary irrigation is provided concurrently with flood management and/or improved drainage, the post-project crop patterns on a given land type are a combination of pre-project crop patterns on the two or more land types from which the post-subproject land type is derived.
- » In cases where winter season (Boro) irrigation is made available, irrigated crops, usually Boro hyv rice or Wheat should be incorporated into the crop pattern in accordance with the volume of irrigation water made available.

80. Crop budgets[1] were prepared for 24 unique crops, and for 6 additional conditions for selected crops related to flood damage or drought[2]. Yield data and input application rates including labor and draught power were standardized for each crop based on the survey data provided by LGED field staff. This data was verified against that of secondary sources such as Bangladesh Bureau of Statistics.

[1] See **Exhibit 10**, Table 7

[2] National Water Plan estimates yield losses due to monsoon drought periods for hyv Aman in the northwest at 17% and in the southwest at 15%. Yield losses used in the crop budgets are 18% based on field data.

5. FISHERIES ANALYSIS

5.1 Introduction

81. The purpose of the fisheries analysis is to estimate the impact of the proposed subproject on fisheries; specifically, the difference between "present" and "future-with subproject" conditions. Because of limitations of generally available data, the "future-without subproject" is assumed to be the same as the "present". This approach, in many areas should lead to fairly conservative estimates of fisheries impacts since in much of the region fish production has been declining, probably due to habitat loss from infrastructure development (including water resources) and over-fishing.

5.2 Data

82. The Consultant's fisheries specialist will collect primary fisheries data. He should seek assistance of the LGED fisheries specialist, where available. **Exhibit 6** provides an example of the Fisheries Survey form to be used to obtain the data. Data sources include:

- » Group discussions with village leaders, representatives of the Union Parishad, fishermen, and farmers.
- » Direct visual observations of subproject fishery resources.
- » Discussions with Department of Fisheries (DOF) officials working within the subproject area.

83. Secondary data should be obtained from the following sources:

- » Fisheries Information Bulletin, Volume 3, No 1 Water Area Statistics of Bangladesh, Fisheries Resource Survey System, Department of Fisheries
- » Fish Catch Statistics of Bangladesh, Department of Fisheries
- » Fisheries Studies and Pilot Project, FAP 17, Final Report

84. To facilitate the feasibility analysis of impact of the subproject, the fisheries data and information should include:

- » List of open water fisheries inside and around subproject area;
- » Area, condition and location of fisheries inside the subproject
- » Present area of culture fisheries and permanent open water fisheries inside the subproject area
- » Estimated fish production in the identified fisheries
- » Demarcation of present floodplain[3] fisheries boundaries and fish migration routes/points shown on subproject planning map (4" to 1 mile topographic map)
- » Dates of fish migration through the identified routes
- » Fish marketing centers in the area
- » Reaction of fishing community to the proposed works.

[3] The DOF is using Floodland term

5.3 Analysis

85. The fisheries analysis should comprise:

- An assessment of subproject negative fisheries impacts (i.e., the "worst case" scenario), in terms of:
- Habitat extent (hectares of floodplain, hectares of seasonal and permanent water body) and duration (number of months flooded), estimated on the basis on pre- and post-subproject land types
- Habitat quality (mainly related to blockage of fish movement through embankments, closures, and water control structures), characterized in terms of proposed infrastructure interruption (intermittent or permanent) of fish movement
- Fish production, employment in fishing, and subsistence fisher nutrition.
- An assessment of potential positive impacts inherent in the basic subproject design such as improvements in habitat quality related to re-excavation of drainage khals; increased (compensatory) employment of landless laborers in agriculture
- An assessment of the feasibility and potential impacts of any relevant add-on mitigating and compensating measures such as modifying structure designs and operating practices to minimize open water fisheries damage and measures to promote aquaculture.
- An assessment of net fisheries impacts (subproject negative impacts + subproject positive impacts + add-on mitigation/compensation impacts).

86. It should be noted that nominal quantification is possible for the pre- and post-subproject habitat extent (for the various habitat types) and fish catch. The value of lost fish catch due to potential negative impacts of the subproject (i.e., the worst case scenario) is incorporated into the economic model. Where better data is unavailable, fish catch on floodplains (land presently flooded throughout monsoon season, which corresponds to the area of F2 + F3 lands) can be assumed to be 50 kg/ha, and in permanent water bodies 220 kg/ha. In general, without mitigation measures, it can be assumed that flood management infrastructures reduce these values by 50%. Thus the subproject impact should be taken as combination of changes in floodplain area and reduction in catch per ha of habitat.

87. In case of drainage improvement by re- and/or excavating drainage channels but without any structures across the channel, post-subproject fish catch should be assumed to be equal to pre-subproject catch.

88. Budgets should be prepared characterizing the unit fish catch in both the floodplain and in perennial water bodies[4]. The data reflected in the budgets should be based on discussions with (and data from) Department of Fisheries.

89. For floodplain fisheries, it can be assumed that:

- The pre-subproject level of effort is 30 person-days per hectare and it is expected to drop to 20 person-days per hectare under the with subproject scenario, mainly due to reduced fish yield. Nevertheless, it can be recognized that numerous variables affect the level of effort such as effective fishing days per year and depth of water body;
- Average fishing wage is assumed to be Tk 70 per person-day, which is comparable to farm labor (used in the financial analysis);
- No hired labor is used; all fishers are subsistence type and therefore labor value can be considered at zero, for the financial analysis;

[4] See **Exhibit 10**, Table 8a and Table 8b

- » Gear and craft cost estimated at 10 and 5 per cent of catch value under pre-subproject conditions. This cost will be reduced by 50 per cent under post-subproject conditions;
- » There will be no lease fee for floodplain fisheries; and
- » There will be no costs associated with guarding the fishery.

90. For perennial water bodies, it is assumed that:

- » Level of effort is 50 person-days per hectare (40 pd/ha with subproject);
- » Average fishing wage is assumed to be Tk 70 per person-day, which is comparable to farm labor (used in the financial analysis);
- » The perennial water bodies are generally leased to wealthier members of the community who do not provide their own labor and therefore all labor would be hired;
- » Gear and craft cost was estimated at 20 and 10 per cent of catch value under pre-and post-subproject conditions;
- » Lease fees per hectare under pre-subproject conditions are averaged to Tk 1000 per hectare of water body. The current fees should be reduced by 50 per cent in the post-subproject conditions (in proportion to the reduction of the catch); and
- » Fees to guard the fishery should be included.

6. SOCIAL ANALYSIS

6.1 Introduction

91. The overall objective of the social feasibility assessment for the subprojects is to assess whether a proposed subproject is *socially sound and institutionally viable*. This can be determined by assessing how *broad-based* is local public support for the subproject and if people agree to get organized in an association for the management of local water resources. The following social selection criteria[5] should be applied:

- » More than 40% of the subproject benefited area is operated by landless share croppers and marginal or small farmers owning less than 1.0 ha of land.
- » Local people must support the proposed subproject on the grounds that the subproject will benefit them.
- » The beneficiaries must be willing to form a Water Management Co-operative Association (WMCA).
- » The key persons (potential beneficiaries attending group discussion/interview) must commit themselves to paying before implementation 1.5% of the cost of structure and 3% of the cost of earthworks (5% for submersible embankment) toward annual operation and maintenance (O&M) expenses, and
- » Conditions for a feasible WMCA exist (no major social conflicts; affected area, number of beneficiaries and affected people, villages and Unions limited to a manageable size; community is not dominated by influential few individuals with different interests).

6.2 Data Collection

92. The data used in the analysis should generally be primary data collected from the field by the feasibility study Consultant. The primary data should be supplemented and verified with data from Bangladesh Bureau of Statistics. **Exhibit 7** provides a sample of the Socio-economic survey forms to be used for data collection.

93. In preparing the field survey, the following steps should be carried out by the feasibility study Consultant in close co-operation with the IWRMU and Project Consultants staff:

- » The subproject gross benefited area outlined on the Subproject Index Map and Upazila Base Map. (This information shall be provided to the Sociologist by the Water Resources Planning Engineer)
- » Areas that are potentially negatively affected by the subproject both inside and outside the subproject (water logging, blocking of navigation, etc.) demarcated on the maps.
- » An inventory of all the villages inside the subproject boundary, using the Subproject Index Map and information from the Upazila Statistical Officer and UP office. This inventory should include each village name, number of households and total population.
- » An inventory of all the villages outside the subproject boundary that might be affected negatively by the subproject.
- » All villages (inside and outside the subproject) where the PRA has identified the existence of conflicts and negative impacts, for verification of conflicts during the survey.

[5] These were defined at Project Appraisal and were reiterated in the Project Proforma.

94. The field investigation should commence with a visit to all villages inside the subproject for making inventory of the villages and identification of **sample villages** for detailed data collection. The inventory should include each village name, number of households, total population and comments about possible negative impact of the subproject. The number of sample villages should be based on subproject size as follows:

- At least 2 villages for subprojects of up to 100 ha, subject to availability
- At least 3 villages for subprojects between 101 and 300 ha, subject to availability
- At least 4 villages for subprojects between 301 and 700 ha subject to availability, and
- At least 5 or more villages for subprojects between 701 and 1,000 ha, subject to availability.

95. In addition to the subproject size criteria, sample villages should be selected to show, for example, different possible subproject impacts (positive and negative), villages from different parts of the subproject area, or villages with different types of people (economic situation, occupation, etc.). If more than 5% of the beneficiaries / landowners live in villages outside the subproject area, then these villages should also be selected as part of the sample villages.

96. The field data collection should be done from the selected sample villages following the procedures outlined below:

» Interviews should be conducted with groups of people (minimum 10 people) from the same interest group (e.g. farmers group and landless group including fishermen, boatmen) within the selected villages.

» In the interest groups mentioned above, at least 1/3 of the participants in one group should be women.

» The LGED District Community Participation Officer (Project Staff) and Upazila Community Organizer should be present during interviews.

» The interviews should start with team members introducing themselves as LGED staff and Project Consultant, then explaining the purpose of the interview, which is to record the opinions of the various interest groups about the proposed subproject. This should be followed by a brief description of the proposed subproject indicating the identified problems that have to be solved, proposed solutions and location of proposed infrastructure. The Subproject Index Map should be used to present the different elements of the proposed subproject.

97. The survey forms comprising Tables 7.1 through 7.6 presented in **Exhibit 7** should be used for collection of field data. Details of data acquisition and the data to be compiled in each table are described in Table below.

98. Key persons (potential beneficiaries who attend the group discussion/interview) inside[6] the subproject boundary should be asked whether they are willing to form a multi-purpose cooperative society.

99. The criteria that the key persons must commit to paying the cost of annual O&M as stated in **Section 6.1** above should be addressed by obtaining a consensus from the potential beneficiaries who attended the group discussions/interviews.

100. The feasibility study Consultants should review the available PRA reports on each assigned subproject. The PRA reports provide an important supplement to the more detailed data set that will be obtained from the questionnaires in **Exhibit 7**. The PRA reports assess qualitatively the extent of peoples' support for (or opposition to) the proposed subproject and thus its social and institutional viability. The Consultants should

[6] People living outside the subproject area, but owning land inside the subproject area should also be interviewed.

verify general PRA findings in the course of interviews with various groups, specifically the social aspects.

Tables	Person or group interviewed	Information to be collected	Purpose
Table 7.1	Upazila Statistical Officer, Secretary UP, and cross checking with interviewed people/groups.	Inventory of villages	To select sample villages
Table 7.2	Farmers with land > 0.2 ha (0.5 acre), inside SP boundary	Farm size distribution, HH occupation, etc. inside sample villages	To collect information about farm size distribution, HH occupation
Table 7.3	Landless [land < 0.2 ha (0.5 acre)] inside SP boundary	HH occupation inside sample villages, etc.	To collect information on land ownership, HH occupation, etc., and determine their poverty level.
Table 7.4	Various Groups inside the SP boundary, and cross checking with UP	Existence and status of Institutions, Organizations	To assess present levels of involvement and cooperation of local people in local organizational / institutional activities
Table 7.5	Interest Groups inside SP boundary	Their opinions on SP negative or positive impacts	To assess the level of support or opposition to the subproject
Table 7.6	Interest Groups outside SP boundary	Their opinions on SP negative or positive impacts	To assess the level of support or opposition to the subproject
Table 7.7	People from all occupation outside SP boundary	HH occupation and population of negatively affected villages, and their opinion on negative impact, etc.	To determine negative impact outside of SP boundary, and occupational profile of negatively impacted people.

101. In no case shall the feasibility study Consultant use the information in PRA reports without having satisfied themselves about the accuracy and validity of the information by using their own collected data and analysis.

6.3 Definition of Poverty Level

102. A poverty line should be drawn for the beneficiaries of the subproject by using the *Household Income Criteria of less than Tk. 634 per person per month*. In case of difficulties in obtaining reliable information about the household income, the following criteria can be used to assist in drawing the poverty level:

Household cultivating own or leased land less than 0.2 ha
Landless person working as farm laborer or non-farm worker
Household engaged in small fishing or petty business or small service.

Households to be considered below poverty level according to household incomes as below:

less than Tk 634 per 1 person per month
less than Tk 1,900/- per month for a family of 3
less than Tk 2,536/- per month for a family of 4
less than Tk 3,170/- per month for a family of 5, etc.

6.4 Analysis

103. The analysis involves compilation and verification of field data to ensure that subproject criteria are being met and to ensure that there are possible solutions to local disagreements, if any. Where the subproject selection criteria given in **Chapter 2.6**, **paragraph 26**, of this report are not met, or solution of local disagreement is not possible, subprojects should be recommended for deferral.

104. The selection criteria concerning benefited land operation by landless to small farmers should be applied in its stated form. That is, only those proposed subprojects in which more than 40 per cent of benefited area is operated by landless sharecroppers, and/or marginal or small farmers (owning up to 1.0 ha) can meet the selection criteria.

105. Analytical comments on collected data of 7 Tables of **Exhibit-7** and on overall viability of institution like Water Management Cooperative Association should be included in the report. In particular, succinct but clear analytical comments are expected on the following issues:

Rationale for selection of the sample villages (from Table 7.1)

Farm size distribution and HH occupation, according to farmers (land > 0.2 ha) inside subproject boundary (from Table 7.2)

Land ownership, HH occupation, etc. according to Landless (land < 0.2 ha) inside subproject boundary, and determination of poverty level (from Table 7.3)

Assessment of the present levels of involvement and cooperation of local people in local organizational / institutional activities (from Table 7.4)

Assessment of the level of support or opposition to the subproject by interest groups inside and outside subproject area (from Tables 7.5 and 7.6)

Assessment of the negative impact outside of subproject boundary, and occupational profile of negatively impacted people (from Table 7.7)

Assessment of the overall viability of institution like Water Management Cooperative Association (mainly from Table 7.4-7.7)

Assessment of willingness to form a multi-purpose cooperative society (WMCA). People interviewed should be asked about their opinion on this important issue (Table 7.2 to 7.5), and

Assessment of willingness to pay the cost of annual O&M as stated in **Section 6.1** above. People interviewed should be asked about their opinion on this important issue (Table 7.2 to 7.5).

106. The feasibility Consultant should also verify the PRA findings on Indigenous People[7], if present, and include their own observations about them in the report.

[7] Working definition of indigenous peoples (by ADB): Indigenous peoples should be regarded as those with social or cultural identity distinct from the dominant or mainstream society, which makes them vulnerable to being disadvantaged in the processes of development.

7. ENVIRONMENTAL PLANNING, ASSESSMENT AND MANAGEMENT

7.1 Introduction

107. The environmental study must be completed for each proposed subproject and the report sent to the Department of Environment for clearance. Recent field data and the subproject designs should be used to carry out the environmental assessment.

7.2 Data Requirement

108. General data requirement to carry out the environmental assessment including information and data that will be used as benchmarks for future impact monitoring is listed below. For collection of detail specific data the feasibility study Consultant should use a standard form, the Sample Questionnaire for Field Data Collection as shown in **Appendix B of Exhibit 9**.

Ground water quality and availability
Open water quality and availability
Soil characteristics
Aquatic habitat
Terrestrial habitat
Fisheries
Biological diversity
Navigation
Communication and ground transportation
Health and nutrition
Objects of cultural, religious and historic values.

7.3 Environmental Planning

109. Environmental planning refers to measures taken proactively to identify and avoid or address, early in the subproject cycle, environmental concerns including potential adverse impacts. Environmental planning activities should,

» address impact assessment & monitoring requirements to improve the overall subproject planning system and selected disciplinary planning methodologies
» explore environmental sustainability issues, and
» review and improve reporting for completeness, accuracy, and responsiveness to stakeholders.

7.4 Assessment of Environmental Feasibility

110. Specifically designed methods to obtain relevant information, based on the foregoing analysis, shall be applied for Environmental Assessment (EA). The objective of EA is to determine, on the basis of existing information, whether:

(i) Based on Initial Environmental Examination (IEE), enough is known to conclude that the subprojects' impacts are within acceptable limits and environmentally feasible.

(ii) Enough is known to conclude that subproject impacts are unacceptable and the subproject design must be modified or dropped, or

(iii) The existing information is inadequate to determine if impacts are acceptable. Therefore, Environmental Impact Assessment (EIA) including detailed field studies is required. In this case, the EA would include a TOR for the EIA focused on the areas of uncertainty or concern.

111. The SSWRDP subprojects falling in (i) shall be cleared to proceed. As there is no provision to undertake EIA, subprojects falling in (ii) shall be deferred for further review. Similarly, subprojects under (iii) may be dropped or made feasible depending on the outcome of EIA results prepared in consultation with the subproject planners.

112. The IEE/EIA procedures include the following steps (for details see **Exhibit 9**):

» Reconnaissance visit and scoping of important environmental components (IECs).
» Collection of field information for IEE/EIA and data for impact monitoring.
» Analysis of impacts and preparation of IEE/EIA report including outline of environmental management plan (EMP).

7.5 Environmental Management

113. Environmental management refers to activities related to subproject environmental performance during construction and operation. Environmental management therefore relates to the preparation and implementation of mitigation, compensation, monitoring, and institutional measures, and reporting on their implementation and results. Environmental management activities include:

» Monitoring and improvement of enhancement and mitigation methodology packages formulated by discipline specialists.
» Formulation of additional enhancement and mitigation methods, for resources/concerns not addressed by other disciplines.
» Monitoring of subproject planning and design stage activities related to mitigation and enhancement procedures and measures.
» Preparation of preliminary environmental management plans (EMPs) for individual subprojects, as part of EA. Detail implementation arrangements for EMPs shall be developed in consultation with WMCAs during subproject construction and operation.
» Follow-up on the implementation of proposed sustainability measures.
»

8. FINANCIAL AND ECONOMIC ANALYSIS

8.1 Preamble

114. Each subproject shall be subjected to both financial and economic analysis to:

» Determine the potential impact of the subproject on the local economy.
» Establish the potential impact of the subproject on the national economy.

115. The procedure and model used in analysis of subprojects of LGED's earlier SSWRDSPs are based on guidelines of the Asian Development Bank (Bank's Guidelines for Project Appraisal, ADB 1996) and the same model and procedure shall be followed for undertaking financial and economic analysis of subprojects under this project.

116. Financial and economic internal rates of return shall be calculated for each subproject. The sensitivity analysis considered the following combination of variables:

Scenario	Base Case	Cost Increase 10%	Cost Increase 20%	Benefits Decreased 20%
Base case				
Construction delayed two years				
Delay full benefits three years				

8.2 Investment Costs

117. Investment costs are broken down into the following categories:

» Engineering works
» Ancillary facilities
» Supporting works
» Physical contingency
» Price Contingency
» Administration and Engineering

118. Costs associated with the engineering works shall be estimated from the engineering analysis. These include items such as regulators, earthworks associated with constructing embankments or excavating drainage canals, etc. Current LGED Schedule of Rates shall be applied to the engineering components to derive the estimated costs.

119. Ancillary facilities include costs associated with subproject components such as buildings, equipment and machinery, and land acquisition. Actual costs shall be based on engineering estimates. The cost of land is estimated at Tk 400,000 per hectare.

120. The costs of supporting activities for agriculture, fisheries, livestock, socio-economic, and economic development and extension programs/services including demonstrations are estimated at 3% of the total costs of engineering works and ancillary facilities. Physical contingencies are estimated at 7% of the total base costs. Price contingencies are estimated at 5 % of the total base costs based on the current rate of inflation in Bangladesh. Administration & Engineering design costs are estimated at 5 % of the total base costs.

8.3 Operation and Maintenance

121. Costs estimates for operation and maintenance include provision for engineering works as well as ancillary facilities. Annual operation and maintenance costs shall be estimated at:

» 1.5% of structure cost,
» 3% of earthworks
» 5% of submersible embankments
» 10% of fish screen (made of bamboo) cost,

» 7% of equipment cost,
» 0.5% of total cost (to be used for miscellaneous expenditures).

122. Financial investment costs converted to economic costs on the basis of the conversion factors are shown in **Exhibit 10**, Tables 10.1 and 10.2.

8.4 Crop Budgets

123. Financial prices for agricultural inputs have been originally derived for the Project area by averaging district-level prices provided by Directorate of Agricultural Marketing (Ministry of Agriculture) and adjusted with field prices during the SAPROF.

124. Financial prices of agricultural outputs. These are presented in **Exhibit 10**, Table 10.4.

125. Economic prices for inputs and outputs should be based on a calculation of economic farm gate prices for internationally traded commodities (for both imported and exported commodities). These are shown in **Exhibit 10**, Tables 10.4 and 10.5.

126. For non-traded commodities, conversion factors based on the Flood Action Plans Guidelines for Project Assessment were used. These are shown in **Exhibit 10**, Tables 10.2 and 10.3. Based on the above, standard crop budgets (on a per hectare basis) for the Project area were prepared and are presented in **Exhibit 10**, Table 10.6.

8.5 Fisheries Budgets

127. Fisheries budgets have been prepared for capture fisheries in perennial water bodies and in floodplains. Pond aquaculture is judged not to be influenced by the investments under the Project and should not be in the analysis. Basis for fisheries analysis are given in **Chapter 5.3**. Details of economic analysis based on 1 ha fisheries are provided in **Exhibit 10**, Tables 10.7a and 10.7b. The pre-and post-subproject financial and economic unit values corresponding to the given yields are shown in table below.

Pre-Subproject							
				Unit Value		Production Value	
Habitat	Area (ha)	Yield (kg/ha)	Production (t)	Financial (Tk/ha)	Economic (Tk/ha)	Financial (Tk)	Economic (Tk)
Floodplain (F2+F3)	0	50	0	2,275	68	0	0
Perennial Water Bodies	0	220	0	2,250	3,601	0	0
Totals	0		0			0	0

Post-Subproject							
				Unit Value		Production Value	
Habitat	Area (ha)	Yield (kg/ha)	Production (t)	Financial (Tk/ha)	Economic (Tk/ha)	Financial (Tk)	Economic (Tk)
Floodplain (F2+F3)	0	25	0	1,138	-284	0	0
Perennial Water Bodies	0	110	0	-240	845	0	0
Totals	0		0			0	0

128. Financial prices for fish products, as well as operating costs and labor are based on field data collected for SSWRDSP-1 and SSWRDSP-2 by PRA and feasibility consultants, and averaged by the ADTA fisheries specialist of those projects. Since these are not internationally traded commodities, the conversion to economic prices was made using a standard conversion factor of 0.87 for fish products and operating costs, and 0.75 for labor.

8.6 Assumptions

129. The financial and economic analyses are based on a number of assumptions. The key assumptions are:

» Subprojects have a life of 30 years (including construction). The “present” and the “future without” condition of the subproject areas remain constant.

» Full post-project benefits are achieved within three years of completion of subproject infrastructure (phasing 50%, 75%, and 100%).

» Indirect benefits are not included in benefit stream.

» An exchange rate of Tk 68 = USD 1 (IP rate existing in the Banks auction market) should be applied throughout the study. This exchange rate is assumed to represent real opportunity costs of capital.

9. COMMON SUBPROJECT ELEMENTS

9.1 Preamble

130. The purpose of this section is to describe subproject elements that are fundamentally common in all subprojects. These are not repeated in the Feasibility Study and IEE/EIA Report of individual subprojects. These elements are:

- » Beneficiary Mobilization and Formation of WMCAs
- » Beneficiary Commitment to Operation and Maintenance
- » Gender Perspective

9.2 Beneficiary Mobilization and Formation of WMCAs

131. When the Union Parishad receives a request for a subproject from their respective constituencies, they discuss the request in a meeting of the Parishad and complete a subproject proposal proforma (form-1) and approach the LGED Upazila Engineer for assistance. The Upazila Engineer visits the area of the proposed subproject to assess the problems and proposed solutions. To do so, the Upazila Engineer meets with people of different classes, both inside and outside the area to obtain their views about the proposed subproject. They specifically should meet people who might be negatively affected.

132. When the LGED Upazila Engineer is reasonably satisfied that the subproject has both technical and social potential, he prepares technical documentation of the proposed subproject in a specified proforma (Form-2) and sent to the Upazila Parishad.

133. In a meeting of the Upazila Parishad, Chairpersons of the concerned Union and other adjacent Unions and the representatives of the various development related government departments and agencies discuss the proposed subproject. After necessary amendments, if any are made, the proposed subproject is accepted and forwarded to the district level LGED Executive Engineer.

134. The Executive Engineer reviews the proposal in the context of the district strategies and guidelines for SSWR interventions. If satisfied that the proposal contributes to the development objectives of the District, the Executive Engineer will forward it to the IWRM Unit of LGED in Dhaka.

135. The Project employs a Community Participation Officer (CPO), at district level, who assists the LGED staff in responding appropriately to the active involvement of all stakeholders. After confirming the subproject's technical viability from the IWRMU, the process of institutionalizing stakeholders' participation will be initiated by bringing various local stakeholders together into a Water Management Cooperative Association (WMCA) under the legal framework of the Co-operatives Act.

136. The Project will provide support of a Community Assistant (CA) to the WMCA of each subproject for the first 3 years. The CA will be appointed after clearance of the subproject by the DLIAPEC. The CA's initial assignment is to assist people living within the subproject to form WMCA. The first step is to form an "Organizing Committee" and through it, to organize an information campaign in which the subproject should be explained in detail to all stakeholders. Following that, the CA will make a total inventory of all households inside the subproject area and those affected by the subproject but living outside its boundary. Existing stakeholders’ groups and respected local leaders will be identified. Towards the end of the 3-month duration of the Organizing committee, a “First Managing Committee” will be elected in a general meeting of the stakeholders.

137. The First Managing Committee becomes the focal point for a number of key activities:

- » Commenting on proposed subproject concept and design
- » Drafting bye-laws for the operation of the co-operative association

» Formation of village or occupation based groups
» Membership enrolment
» Organizing a Water Management Co-operative Association (WMCA)
» Applying for registration of the WMCA
» Preparing for the WMCA's first election and General Meeting
» Collecting beneficiary contributions.

138. The process described above aims at creating a strong and broad-based water management organization. This organization is the platform for all decisions on the management of the water resources. This includes resolving the inevitable conflicts of interest between the various stakeholders. Activities of the First Management Committee conclude in obtaining formal registration of the WMCA. Registration of the WMCAs is the pre-condition to initiating construction activities.

9.3 Beneficiary Commitment to Operation and Maintenance

139. For each subproject, a number of steps shall be carried out to promote ownership and thus sustainability of the subproject infrastructure. These steps include:

» Ensuring that the WMCAs (and beneficiaries) understand early in the subproject processing cycle that the subproject infrastructure would be formally handed over to them and that routine operation and maintenance (including costs) will be their responsibility.
» Obtaining from subproject beneficiaries, formal commitment to contribute in cash and in kind to routine operation and maintenance costs. These commitments are submitted to the Executive Engineers in writing. In the absence of better data, costs are currently estimated at 3% for earthworks and 1.5% for structures.
» Involving the beneficiaries in the conceptual designs of the subprojects.
» Providing the WMCA with O&M Guidelines to facilitate preparing of an O&M plan. The provision of the guidelines shall include preliminary O&M Plan prepared by the feasibility Consultant, and training and assistance in preparing O&M plans to be imparted by IWRMU and the Project Consultants.
» Assisting the WMCA in the preparation of agriculture and fisheries (where relevant) development plans. The project provides, at each district, one Agricultural, Facilitator and one Fisheries Facilitator who provides necessary technical assistance.
» Planting trees on embankments, which provide some protection from erosion as well as providing resources for generating some income.

140. With the exception of planting trees, these steps shall generally be carried out prior to completion of the subproject feasibility studies.

9.4 Gender Perspective

141. At the time of formation of Water Management Co-operative Association (WMCA) bye-law drafting committee, the stakeholders of each subproject must be encouraged to ensure that at least 33% (one third of total) of the drafting committee members are women. The CPO and Upazila level LGED and project staff shall assist the stakeholders to select women members from the community with the emphasis on women headed households.

142. Equal participation of men and women must be encouraged during the formation of Water Management Co-operative Association, and CPO/CA shall assist the stakeholders to select women members from various categories of families, i.e. farmers, fishers, landless, etc. The CA shall continue motivational work to ensure a minimum of 33% women membership of each subproject's WMCA.

143. To ensure women's participation in the decision making process, the stakeholders must be encouraged to select at least 33% (one third) women members to the First Managing Committee. The CPO and CA shall assist the stakeholders to select women from all categories of households, including the women headed households.

144. To ensure equal wages for the same work, equal employment opportunity must be made available to males and females.

145. Special training program shall be arranged for women members of WMCAs to start income generating activities that will help rural women to raise family income. The women beneficiaries may get training on seed production and processing, poultry farming and processing, seasonal vegetable production, pond fish culture, etc. CPO and CA shall assist the stakeholders to select potential women for the specific training. WMCA must be encouraged to provide micro-credit to the trained women to start IGA and regular follow-up is a must by the CPO and CA in this regard.

146. To provide direct assistance to vulnerable sector of a subproject WMCA should see that during construction women's groups are employed as Labour Contracting Societies (LCS), and during the subproject operation and maintenance (O&M) embankment maintenance and tree plantation works are carried out by women.

10. DETAIL ENGINEERING DESIGNS

10.1 Introduction

147. The material presented in this chapter includes the standard requirement, design procedures and criteria to be used for completion of feasibility level analysis and designs. The hydrologic analysis and earthwork design criteria presented herewith should be considered as final since the same will be used in preparation of final designs and construction drawings.

148. Detail procedures and design criteria for structural and foundation designs are not included, as these should conform to the current LGED practice and standard technical specification (USBR, AASHTO).

149. Type designs of structures and gates compiled in the LGED Design Catalog (developed under SSWRDSP) should be used. The Catalog design drawings of structures and gates are available in ACAD soft format. These designs can be adjusted and modified as required to match the particular site conditions, usually height of operating deck and wing walls. The catalog structures' designs have standardized dimensions like vent size, stilling basin shape, length and width, cutoffs and deck dimensions; foundation design is not included in the catalog as this depends on site conditions.

150. The feasibility study Consultants will have a choice of using the available SSWRDSP or other software in conducting hydrological, hydraulic and structural design analysis. However, prior verification and approval by the IWRMU of other than SSWRDSP software will be required.

10.2 Climate

151. A general description of climate should be provided for each subproject, using climatic data abstracted from the nearest meteorological station(s). For irrigation subprojects more detailed data including evaporation and evapotranspiration should be assembled for calculation of crop water requirement.

10.3 Hydrology

152. The nearest rainfall and water level stations should be identified and the existing water level records checked for homogeneity and validity. Where required temporary water level gauging stations should be established and sufficient data collected before commencement of detail designs. High flood level marks surveyed in the field can also be used but these need to be taken from few locations within the subproject area to verify their validity.

153. A 5-day duration rainfall with a 10-year frequency has been adopted as the design storm. Rainfall data for the months of April through June are used for the design of subprojects for the pre-monsoon drainage and/or flood protection and rainfall data for the months of July through October are used for the monsoon drainage and flood protection subprojects. Usually the highest pre-monsoon rain occurs in June and the highest monsoon rain occurs in July or August.

154. Drainage Rate, also called Drainage Modulus, is the drainage rate expressed in millimeters per day at which the design rainfall runoff generated over the entire subproject basin (catchment area) has to be evacuated to limit inundation damage of crops grown in the net benefited area to an acceptable level (up to 5% of the net benefited area). The Drainage Modulus is determined from the basin water balance analysis as follows:

Basin Runoff = Rainfall - Infiltration - Surface Storage – Evapotranspiration

155. The following basin conditions have been assumed to exist at the onset of the design storm over subprojects with small size basin:

- » Low permeability of top layer of paddy soil or saturated state of the soil profile, either from irrigation or from preceding rain. The infiltration rate is insignificant, therefore, over a short time period it can be ignored.
- » Local depressions and paddy fields confined with earthen bundhs are filled up with irrigation or rainwater.
- » During rain air humidity is high and the evapotranspiration is insignificant.
- » Rain generated by the design storm (10-year frequency and 5-day duration) is considered to be uniform over the subproject basin.

156. Taking into account the above assumptions, for small basins the runoff can be considered as equal to rainfall:

Basin Runoff = Basin Rainfall

157. The Flood Management/Drainage criteria for agricultural projects are determined by (1) the ability of high yielding variety rice (HYV) to withstand inundation and (2) by the acceptable limit of crop damage. The HYV rice crop can tolerate without damage inundation up to 0.30 m, that is, inundation deeper than 0.30 m will damage the crop. Inundation deeper than 0.30 m and lasting longer than 3 days is considered to cause 100% crop damage. Since providing 100% protection against crop flood damage would be too expensive and render most of the proposed subprojects financially not feasible, the accepted level of crop damage has been adopted at 5% of the subproject cultivable area. This is in line with the BWDB criteria used for larger water development projects in Bangladesh.

158. The subproject area can be considered as a topographical basin, which drains through the low point(s). During rainfall water accumulates in the basin starting from the lowest point, and consequently submerges higher lands. The drainage system (channels and structures), should be designed to pass safely the incoming runoff water at such rate that (i) depth of the accumulated water is reduced to 0.30 m within 3 days, and (ii) the crop damage area does not exceed 5% of the subproject net benefited area, i.e., crop area flooded to above 0.30 m for 3 consecutive days should be less than 5%.

159. The design Drainage Rate is determined, for the above conditions, by applying the design 5-day storm onto the subproject catchment area (basin). The calculation is carried out with the aid of a computerized flood routing program using the design storm and the basin area-elevation-storage data (see **Exhibit 11**, **Appendix B, Section B2**) Analysis of Drainage Rate.

160. Records from the nearest, relevant, river gauging stations should be used for verification of external flood levels at the subproject site, and for derivation of design flood levels used for the design of flood embankments and drainage system (drainage channels and hydraulic structures). In case the existing records are not applicable, temporary gauging stations should be established.

161. Water levels at subproject should be determined from linear interpolation (or extrapolation) using the reference station water levels and the distance measured along the river channel. Records of a minimum 10-years period should be used. Shorter period can be accepted for stations where water levels have been altered by interventions such as construction of embankments or major channel re-excavation.

10.4 Earthworks

Drainage Channels (Khals)

162. Subproject channels are designed to safely pass design discharge. The design discharge is the average discharge required to drain basin runoff volume generated by a 5-day duration 10-year frequency storm. The average discharge calculation is based on the Drainage Rate and the Drainage Area at a given point of the channel:

Q (m^3/s) = [Drainage rate (mm/day) x Drainage Area (ha)]/8640

163. Discharge capacity of an individual channel is a function of the channel characteristics, like flow area, roughness and hydraulic gradient. In non-tidal channels the hydraulic gradient is assumed to be parallel to the channel bed.

164. In tidal channels hydraulic gradient is controlled by water level in the outfall channel, namely by tidal variation. When tide level in the outfall channel is higher than the subproject water level drainage remains blocked and there is no flow; it resumes when the tide falls below the basin level. Therefore, in tidal area the design discharge capacity has to be increased to take into account the flow blockage periods during high tides.

165. Based on tide records, a simplified method assuming triangular shape of tide curve has been adopted for calculation of drainage time per day, and the design discharge is increased proportionally to the drainage period per day. Accordingly, the equivalent **design discharge of tidal channel** is:

$$Q_{Equivalent} = Q_{Daily\ Average} \times 24/\text{drainage time in 24 hours}$$

166. Channels located in subprojects designed for pre-monsoon drainage are sized for passing safely the design discharge expected during the pre-monsoon season within channel banks. (Submergence of low banks in local depressions to a depth of about 0.30 m may be allowed). The design criteria used are:

- » Minimum flow velocity (to prevent sediment deposition) 0.3 m/s
- » Maximum flow velocity (to prevent erosion) 1.0 m/s.

167. Channels located in subprojects designed for monsoon drainage should be sized to safely pass monsoon season design discharge only in sections through higher land. In lower land areas and local depressions generally inundated by monsoon flood only part of the discharge passes through the channel section while the rest flow over floodplain.

168. Only sections of the channel passing through higher land, where the design basin water levels is below channel banks, should be designed for full design discharge. (Low channel sections submerged by floods do not pass the entire design discharge, as part of the flow passes overland outside the channel section).

169. Channel side slopes may vary from 1:1 to 1:2 depending on the soil type. The recommended channel side slopes are given in table below.

Excavated Channel with Unprotected Side Slopes	
Soil Material	**Side Slope (V:H)**
Clay	1:1
Mixed sandy clay to gravelly silt	1:1.5
Silt	1:2
Sandy silt	1:2

170. Channel alignment should follow smooth transitions with rounded (circular) curves at bends with greater angle equal or grater than 90^0.

171. The hydraulic design calculations for drainage channels shall be carried out with the aid of a computerized channel routing program based on the design drainage rate, the basin elevation-area-storage volume relation, and the channel parameters; bed width, longitudinal slope, side slopes and channel depth.

172. *In planning re-excavation and excavation of drainage channels*, and careful examination of the natural topography within as well as outside the subproject boundary must be made to determine the existing drainage pattern(s) and direction of flow in the channels during drainage period. It is very important that the existing natural drainage

patterns, which follow land slope(s), are not altered and the direction of flow in the channel(s) during the drainage period is not reversed.

Submersible Flood Embankments

173. Submersible flood embankments are designed mainly to protect boro rice from the pre-monsoon flash floods. During monsoon season these embankments remain submerged and cannot be used for communication. The recommended design section for submersible embankments is:

Design Water Level	-	1:10-year Pre-monsoon HFL
Freeboard	-	0.30 m
Crest Width	-	2.50 m
Side Slopes	-	1:2

174. To reduce potential of erosion and to facilitate maintenance, when constructed along channels, the embankment should be constructed at a safe set back distance from the channel. For practical purpose, the minimum embankment set back distance, or space between the bank of the channel and the riverside toe of the embankment should be not less than 6.0 m.

175. Approximate embankment set back distance can be determined from the following relation.

$$SB = Ze \times Dch$$

Where: SB = embankment set back distance (m)
Ze = side slope of embankment
Dch = depth of channel (m)

176. Thus obtained set back distance should be verified for slope undercutting by the adjacent channel (or borrow pit excavation). That is, the embankment side slope projected below ground level should not cut through the channel side slope, as shown in **Exhibit 12**, Figure 12.1.

177. In case the submersible embankment is or will be used as road, its crest width should conform to road embankment specifications as given herein below.

High Flood Embankments

178. High embankments are designed mainly to protect the subproject area from inundation by excluding both pre-monsoon and monsoon high floods. The recommended design section for high embankments is:

Design Water Level	-	1:20-year Annual HFL
Freeboard	-	0.60 m
Crest Width	-	Minimum 2.50 m
Side Slopes	-	Maximum 1V : 1.5H

179. The high embankment set back distance is determined by:

» Erosion rate of shifting channel (provide space for minimum 10-years projected erosion of river bank)
» Sufficient space for borrow pits on river side
» Maximum confinement effect 0.30 m.

180. In case the embankment will be used as road the design crest width is selected according to road specifications given in Table below.

Standard Crest Width of Road Embankments

Road Grade	Required crest width (m)
Rural Road (R3)	2.50
Rural Road (R2)	3.70
Rural Road (R1)	4.90
Feeder Road	7.30

181. The high embankment crest elevation should be designed for 1: 20-year flood, however, with added freeboard the embankment should not be overtopped by 1:50-year flood. When high embankments are provided on both sides of the channel (river) the embankment crest elevation should be designed for 1:20-year Future With Project HFL, i.e., for the design flood level increased by the calculated confinement effect.

182. Both, crest width and side slopes should be designed taking into account soil stability (seepage and slope sliding) and future use of the embankment. As a general guideline, for inland dikes under average embankment fill soil conditions (silty sand, mixture of silty clay and sand) the recommended side slopes are as given in Table below. In case the soil used for embankment fill comprise mainly sand, clay or organic material the side slopes should be flattened accordingly.

Recommended Embankment Side Slope	
Embankment Height (m)	**Side Slope (V:H)**
0 – 1.99	1:1.5
2.00 – 3.99	1 : 2
4.00 – 4.99	1 : 2.5
5 and above	Determine from detail slope stability analysis

183. Design of side slopes on sea dikes requires special consideration taking into account tidal range, wave action, wind and exposure (fetch distance). Generally sea dikes are designed with side slopes ranging from 1:3 to 1:7.

184. The minimum design <u>*set back distance*</u>, including re-sectioning of existing embankments, shall be 3.0 m. Approximate embankment set back distance can be determined from the following relation.

SB = Ze x Dch

Where: SB = embankment set back distance (m)
Ze = side slope of embankment
Dch = depth of channel (m)

185. Thus obtained set back distance should be verified for embankment undercutting by the adjacent channel (or borrow pit excavation). That is, the embankment side slope projected below ground level should not cut through the channel side slope (see **Exhibit 12, Figure 12.1**).

186. In no case embankment constructed along existing channel should have common slope with the re-excavated channel. In case the existing embankment is right along the channel slope, the appropriate reach of the embankment should be shifted inland to obtain a <u>minimum 3.0 m setback distance</u>. This criteria is derived from (i) soil properties, that withstand steeper slope in excavation (of channel) as it is in an original, consolidated soil, and flatter slope of embankment as it is built from disturbed not well compacted material, and (ii) requirement for a berm or access space during construction and maintenance, and space for possible plantation in the future.

187. <u>*Height of embankment*</u> is the difference between the embankment design crest elevation and the ground level on which the embankment is constructed. This height is the design embankment height required to maintain integrity of the embankment for protection against the design flood.

188. For construction and cost estimate the embankment height should be increased by 15 cm to account for base stripping. (The 15 cm base stripping is a separate item in the Schedule of Rates but the extra fill volume should be included in the total embankment fill volume)

Borrow Pits and Berms

189. Source areas from which fill material is taken for construction of embankments are called *borrow pits*. To preserve agricultural land, borrow pits should be located on the riverside.

190. Free spaces left on both sides of a borrow pit i.e., space between the toe of embankment and the edge of borrow pit on one side, and spaces left between the edge of borrow pit and the river bank are called *berms*. The depth of borrow should not exceed 1.5 m, and a minimum 6.0 m berm should be left between the edge of borrow pit and the riverbank.

191. The width of the embankment side berm, or distance between the river side toe of the embankment and the edge of borrow pit, should be from 3.0 m to 10.0 m depending on the depth of borrow pit and the side slope of embankment.

192. Borrow pits located on the riverside are expected to get silted, or filled up with soil and sediments carried by water during flood, and consequently reclaimed by agriculture. To prevent development of eroding flow concentration during high river stages, at least 6.0 m wide cross-bundhs perpendicular to alignment of embankment should be left between borrow pits every 30 m.

193. In case of insufficient space for borrow pits on riverside and not enough material can be excavated from the channel, embankment fill material can be borrowed from the countryside. As there will be no silting of borrow pits located behind high flood embankments, in order to maintain soil fertility, the excavation depth should not exceed 0.60 m.

Irrigation Canals

194. Alignment of irrigation canals should be selected to provide:

- » Minimum disruption of existing drainage pattern by following high ground elevations
- » Minimum requirement for cross drainage structures like aqueducts, siphons, culverts
- » Minimum interference with existing roads, navigation and property lines. The alignment may be shifted to boundary line to avoid fragmentation of land properties into cut-off un-accessible small plots
- » Maximum command area per unit length of canal to minimize land requirement, construction and maintenance cost.

195. To prevent sediment deposition, minimum flow velocity should be not less than 0.5 m/s, while the maximum velocity should be selected as non-erodible velocity for earthen canals.

196. The irrigation canal earthen section can be (i) in excavation (ii) in fill, and (iii) partly in excavation and partly in fill. General design criteria for drainage channels and embankments should be followed in designing cross-section of irrigation canal. However, to reduce land requirement and increase discharge capacity the inside side slopes should be constructed 1:1 and strengthened with concrete, brick lining, etc. if necessary.

197. Canals with trapezoidal section (earthen section with lined bed and internal slopes) should be provided with minimum of 0.3 m freeboard above full supply level (FSL). Square/rectangular section canals made from RCC, concrete or brick should be provided with a minimum of 0.15 m freeboard above FSL.

198. To facilitate inspection and communication/transportation, crest width of irrigation canal bank in fill should be provided as per local requirement but not less than the recommended minimum crest width of 0.6 m.

199. Construction of raised canals with square/rectangular section of RCC, concrete or brick constructed over earth-filled embankment should be scheduled for 2 years. Earthen portion of the canal should be completed in the first year of construction (with section increased for settlement and erosion) and allowed to settle during monsoon season, and the concrete section constructed in the second construction year, in dry season.

10.5 Structures

200. Depending on the objective, hydraulic structures can be designed to prevent entry of external water into the subproject, to retain water in the subproject, or to flush water into the subproject area. In addition, all hydraulic structures must be designed to pass safely the internal runoff water generated by the expected rainfall over the subproject catchment area. The hydraulic conditions used in the design of structures working under different conditions are described below.

201. All structures should be designed in conjunction with the design of channels (khals) and embankments, i.e., the same basin water level and the design channel bed elevation should be used in the design of structures in the adjacent channels, and these elevations should match. However, for safety, the structure design discharge should be increased by 20% over the channel discharge.

Sluices and Regulators in Non-Tidal Area[8]

(a) For Drainage

202. Non-tidal structures are designed to pass safely design discharge generated by a 5-day duration 1:10-year annual storm expected over the subproject catchment (basin) area. The required size of the structure (conduit dimensions and number of vents) is determined by matching the structure discharge capacity at 0.30 m hydraulic head with the required basin discharge, calculated from drainage rate and catchment area, increased by 20 percent. In this calculation, the countryside water level should be kept at the basin water level obtained from Drainage Rate analysis.

203. Hydraulic energy of flow through structure is dissipated through formation of a hydraulic jump within the stilling basin. To reduce cost of the structures, short stilling basins have been adopted, i.e., Indian Standard Stilling Basin Type-1 or USBR stilling Basin for Low Froude Numbers with the choice of basin governed by the value of Froude Number. For added safety of structures, *stilling basins and cutoff walls are designed for discharge at hydraulic head increased to 0.60 m* (twice the design head used for sizing of structures) to pass safely discharged flow at exit velocity of water (at the end sill) below 1.0 m/s.

204. Four Types of Flow occur through sluices depending on different conditions of WLs at the upstream and downstream. The four Flow Types are shown in Figure 11.1. Since hydraulic jump can occur only under conditions of flow Type 3 or Type 5, the designer should keep constant hydraulic head of 0.6 m and, starting from the design basin WL keep reducing both upstream and downstream WLs (but maintaining 0.6 m difference) until flow Type 3 or 5 is obtained. Thus obtained basin length is an indicative basin length; in detail design it has to be verified for creep path length and exit gradient.

205. A computer program using Koshla's theory of safe exit gradient is available with the project. The program also gives scour depth for the design of cutoff wall depth. – *The depth of cutoff, including concrete apron thickness, should not exceed 2.5 m. Higher than 2.5 m figure indicates error in entered hydraulic head (>0.6 m) or selected too small structure basin width*.

206. When the outfall channel is not far from gauged river, the downstream (riverside) water levels are related to the river water levels. For structures located on side channels

[8] The structures are defined as follows: Sluice – A hydraulic structure equipped with an automatic flap gate as the primary closing device. Regulator – A hydraulic structure equipped with a slide gate as the primary closing device.

whose water levels cannot be correlated to the gauged river levels, the design drainage channel water level and the subproject basin level are used as downstream and upstream water levels respectively.

(b) For Flushing

207. Countryside stilling basin is designed for an assumed countryside water level at one-half the depth of the conduit height and structure operating at a constant hydraulic head of 0.60 m (R/S WL = Invert El. + D barrel/2 + 0.6 m). Usually flow Type 5 occurs; if not, R/S and C/S WLs should be increased or decreased until Type 5 or Type 3 flow is obtained. The basin width should be checked for maximum exit velocity at the end of upstream concrete upstream apron as less than 1 m/s. If this velocity is above 1.0 m/s, the apron width should be increased.

Sluices and Regulators in Tidal Area

(c) For drainage

208. Tidal structures are designed to safely pass the design discharge generated by 5-day duration 1:10-year annual storm expected over the subproject catchment, taking into account variable downstream water levels and tidal lockage. The required size of the structure (conduit dimensions and number of vents) is determined by matching the calculated structure discharge capacity with the required basin discharge increased by 20 percent, taking into account tidal cycle. The structure discharge capacity is determined from the average flow during drainage (Q_{av}) with the tidal water level cycle on the riverside and the basin design water level held constant in the country side.

209. The structure design discharge (Q_{des}) is the actual discharge during the tidal cycle taking into account lockage and drainage periods, and is higher than the average discharge (Q_{av}) over 24 hour period. Q_{des} is determined by multiplying Q_{av} by the *ratio of 24 hours to hours of drainage* or from *ratio of tidal range to depth of LTL below design basin level* as follows:

$Q_{des} = Q_{av}$ x ((HTL – LTL)/ (Basin WL – LTL))
where:
LTL is low tide level
HTL is high tide level.

210. Hydraulic energy of flow through structure is dissipated through the formation of a hydraulic jump within the stilling basin at flow conditions Type 3 or Type 5. To reduce the cost of structures short stilling basins have been adopted, specifically, Indian Standard Stilling Basin Type-1 or USBR stilling Basin for Low Froude numbers, depending on the value of Froude Number. The riverside stilling basin is designed for the most adverse conditions under discharge varying accordingly to the riverside water levels, while the countryside water level remains constant at the calculated basin water level.

(d) For Flushing

211. Countryside stilling basin is designed for flushing in water into the subproject with an assumed countryside water level at one-half the depth of the conduit height and the riverside water elevation at average HTL. The maximum velocity at the end of apron should not exceed 1.0 m/s.

212. The countryside stilling basin design need to provide for safe passage of possible discharge during accidental flushing, for instance, when the gates remain fully open throughout the full tidal cycle and there is no rainfall in the basin.

Water Retention Structures (WRS)

213. Water retention structure is a term used for small size weirs. Depending on site conditions and operation the designer may select gated or un-gated (fixed sill weir) WRS. Water retention structures may be equipped with stop-logs also but those are not usually recommended. This is mainly due to difficulty in removing the stop-logs at high water level, and the associated high incidence of structure damages as is experienced on the

BWDB structures. Water retention structures are constructed in Water Conservation Subprojects located in non-tidal zone, in flooded as well as in flood free areas.

(e) Gated WRS

214. Gated WRS used are similar in shape to regulators but with open top conduit without breast wall. As water flows in one direction, during drainage, there is no need for stilling basin on the upstream (country) side.

215. The size of gated WRS is determined from passing the design monsoon flood discharge (increased by 20%) over broad-crested weir, under Type 4 flow condition, and hydraulic head of 0.3 m. The upstream water level is assumed to remain constant at the basin level (maximum allowable flood level) determined from routing of the design storm. The downstream stilling basin length and depth of cutoff wall are designed for 0.6 m hydraulic head following procedures outlined above for regulators.

216. For structures located in presently flood free area the size of the structure should be sufficient to pass the design flow within the banks of drainage channel, so that after the subproject implementation there is no crop flood damage. *The 0.30 m inundation of cultivated land for up to 3 days as in FM and FCD subprojects may not be acceptable to the beneficiaries, whose lands have not experienced any flood damage prior to the subproject implementation.*

(f) Un-gated WRS (Weirs)

217. The un-gated WRS are weirs with fixed-level raised sill designed for heading-up and retention of water during dry season and passing of floodwater over the sill during wet season. The size of the structure (length of weir and depth of floodwater flow over the sill) is determined from passing the design monsoon basin flood (increased by 20%). With upstream water level at the design basin level (maximum allow able flood level. If the weir is in a presently flood free area, it is to be noted that the (The 0.30 m inundation of cultivated land for up to 3 days as in FM and FCD subprojects may not be acceptable to the beneficiaries, whose lands have not experienced any flood damage prior to the subproject implementation) The raised sill is constructed as RCC or brick wall. *[The Design Catalog includes standard design of un-gated WRSs with weir height (P) ranging from 1.0 m to 1.8 m and overflow depth (He) ranging from 0.6 m to 1.0 m.]*

Regulators in Submersible Embankments Haor Areas (in Sylhet Basin)

218. Haors are typical to Sylhet Basin land depressions that remain deeply flooded from May through October. Inundation depth in excess of 1 m prevents growth of crops during monsoon season. These areas suffer from early flash floods that damage Boro rice at harvesting time, which basically is the only crop grown in this area. Constructing low, submersible embankments with flushing and drainage structures placed at strategic locations can provide limited protection from early pre-monsoon flooding and permit cultivation of HYV Boro rice that require longer growing season. Since submersible embankments permit flooding during monsoon, this type of development poses only limited restriction on fish habitat, and as such should be considered environment friendly.

219. The submersible embankments and regulators are designed to prevent entry of water into protected area in April through 15 May. After 15 May or when the crops are harvested the regulator gates are gradually opened and the haor filled with incoming flood water to within 0.30 m of the embankment crest elevation before the riverside water level reaches the embankment crest.

220. It should be noted that the level of annual flood peaks have no bearing on hydraulic design of a structure, except that operating deck should be located above annual flood level. This is (i) for easy identification of structures during flood season and (ii) to reduce earth washout around the concrete parts of the structure.

221. The discharge capacity or total number of vents of structures in a subproject with submersible embankments is determined from.

a) pre-monsoon flushing requirement, i.e., to flash-in water to within 0.30 m of embankment crest elevation before the start of overtopping, usually before 31st May; this criteria is to prevent excessive damage of embankment when flood water overtops it, and

b) post-monsoon drainage requirement, which is to maintain hydraulic head over regulator in draining mode within 0.30 m, i.e., the difference between water level inside the haor and in the river should be less than 0.30 m; this criteria is to effect drainage of the subproject area by providing adequate number of structure vents and to prevent damage of structure by excessive exit flow velocity at river side.

222. The design of haor (submersible embankment) structures involves water balance analysis and simulation of inflow (flushing mode) and outflow (drainage mode) through the structures. The analysis is carried out on daily basis for which daily water level records from May through November in the outfall river are required, for both the pre-monsoon flushing and the post-monsoon drainage. In Sylhet and Sunamganj area where rivers are very flashy, the structure requirement (total number of vents) is determined from the pre-monsoon flushing.

223. Generally, discharge capacity required for flushing is much higher than for drainage. In 9,840 ha Naluar Haor 16 vents of each 2 m width are required for flushing and only 6 vents are adequate for drainage).

224. Computerized flood routing program should be used for simulation of flushing and drainage of a haor subproject using actual river stage data and rainfall from at least the last 5 years of records.

225. The submersible embankment regulators should be equipped with gates that can be closed and opened under submerged condition. The use of fallboards (stop-log) closing devices previously used in other projects is not recommended, as they cannot be operated under hydraulic pressure.

226. Generally, haor area subprojects having less than 1,000 ha area requiring to be completely enclosed by submersible embankments may not be feasible for implementation under the LGED SSWRD Project, because of high cost of structures and maintenance of submersible embankments (annual O&M may reach up to 30% of capital cost). However, where the subproject area is already almost enclosed by high roads, or other kind of ridgs to about the May 15 WL, it may be feasible to close the remaining gap with either a submersible embankment or a high embankment as may be considered fit and provide drainage/flushing regulator(s). In such cases, even if high embankments are used, the subproject area should be filled up at the end of boro season using controlled flushing, so the structures are not damaged under high hydraulic head.

Selecting Structure Size –Dimensions and Number of Vents

227. The designer has a choice of 10 standard sizes of vent openings, ranging from 600 mm diameter pipe to 1500 mm x 1800 mm RCC box conduit, in the design of regulators and sluices. These are given, along with graphically presented design criteria in the Standard Design Catalogue, (Design Criteria for Selection of Vent Size and Invert Elevation in DWG. (File) No. GEN -1). Several criteria shown in the drawing relating to both vent size and invert elevation must be satisfied.

228. Selection of dimensions and number of vents of hydraulic structures are governed by

» design discharge Q_d, which is the required basin discharge increased by 20%
» shape of drainage channel mainly bed width, and
» depth of water near the structure site at the design Basin Water Level.

229. Based on the above information structure opening size and the number of vents can be selected using the Design Catalogue Tables for non-tidal and tidal regulators and sluices **(see Annex 11).** The governing criterion in selecting the opening vent height is the depth of water above invert elevation. That is, the depth of Basing Water Level above structure invert must be greater than the vent height. Otherwise the structure will flow only partly filled and its actual discharge will be lower than it is designed for.

230. The information given in the Design Catalogue Tables include: conduit dimensions, discharge capacity and basin dimensions for single vent structures. Conduit dimensions and length of basins are fixed while the width of basins (u/s and d/s) for multi vent structures can be obtained by adding incremental width of additional conduit(s) with pier(s).

231. The process of selecting the required structure size involves (1) matching the subproject structure design discharge with the discharge capacity shown in the Table and (2) matching the structure basin width with the width of the existing or design channel bed width.

232. The structure size so selected should be checked for capacity and conduit submergence by using computer program *"Sizing Of Regulator / Sluice"*. *A quick check of this criteria is verification of data during running computer program "Sizing of Regulator/Sluice", where Hw = Upstream Water Depth must be greater than Hv = Vent Height.*

Selecting Invert Elevation of Hydraulic Structures (Regulators and Sluices)

233. The invert elevation is set 0.30 m to 0.60 m (depending on the structure conduit size) above the bed elevation of a channel on the upstream side of the structure. The purpose of raising the invert is to:

- » Create a favorable fish habitat by preventing total drainage of the channel during falling water levels (tidal and non-tidal),
- » Increase the hydraulic discharge coefficient,
- » Improve structure operating conditions by reducing the possibility of sediment deposition in the structure conduit, and
- » Secure tail water depth during the initial stage of flushing, particularly for structures in tidal area.

Site Selection for Hydraulic Structures

234. From consideration of construction, quality of works and foundation it is better to locate structure in excavation, in loop-cut or in diversion channel, than in existing channel. This is because, generally, foundation under open channel is weaker as the soil is decompressed and loose or muddy. Also, as in most cases the structure construction is not completed in one year, there is a need for constructing temporary diversion channel or allowing flood water to pass over uncompleted works. However, from consideration of land use and land availability most of the SSWRDP structures are located in existing channels (khals).

235. As a general rule, *hydraulic structures should be located downstream from bridge or culvert if existing at the site.* This is to prevent damage of the bridge or culvert by concentrated and higher velocity discharge leaving the hydraulic structure for which bridges and culverts are not designed. However, the best would be to incorporate the hydraulic structure with the existing bridge/culvert by necessary modifications/adjustments so that land loss for construction of new structure is avoided and the cumbersome view of two or more structures at the some place is also avoided.

236. In case the hydraulic structure can not be combined with the existing bridge/culvert and also there is no suitable location on the downstream side, hydraulic structure can be constructed on the upstream side of the bridge. But in that case, the space between the hydraulic structure and bridge/culvert must be protected. The protection can be by CC blocks or brick blocks, or by concrete/RCC walls attached to the bridge abutments or wing walls.

237. When sluice or regulator is near the outfall river, the governing criterion is a safe set back distance from the outfall channel. Namely, the structure must be beyond the potential riverbank erosion expected within the lifetime of the structure near an active river. If there are no signs of riverbank erosion, a minimum 15 m (50 ft.) distance should be provided from the outfall riverbank to the downstream end of structure block-protective work.

238. If the above set back criteria locate the structures on the downstream side (river side) of flood embankment then the structures may be constructed in a position along the embankment. If however, the location is in the subproject side of the embankment, it should be constructed those and be connected to the embankment by approach dikes.

EXHIBITS

EXHIBIT 1

PROPOSED SUBPROJECT IDENTIFICATION FORM

EXHIBIT-1

স্থানীয় সরকার প্রকৌশল অধিদপ্তর

বৃহত্তর ময়মনসিংহ, সিলেট ও ফরিদপুর এলাকায় ক্ষুদ্রাকার পানি সম্পদ উন্নয়ন প্রকল্প

ইউনিয়ন পরিষদ কর্তৃক স্থানীয় পানি সংক্রান্ত সমস্যার বিবরণ ও সমাধানের খসড়া উপ-প্রকল্প প্রস্তাব

[নির্দেশনা ঃ ইউনিয়ন এলাকার পানি সংক্রান্ত সমস্যার বিবরণ ও তা সমাধানের উপ-প্রকল্প প্রস্তাব প্রস্তুত করার জন্য সংশ্লিষ্ট ইউপি চেয়ারম্যান সকল ইউপি সদস্যসহ ইউনিয়ন পরিষদের একটি পূর্ণ অধিবেশন আয়োজন করবেন। সভায় স্থানীয় পানি ব্যবস্থাপনা সংক্রান্ত সমস্যা ও তা সমাধানের জন্য কি কাজ বা কাঠামো নির্মাণ করা দরকার তা বিস্তারিত আলোচনা করে সর্বসম্মতভাবে এই ফরম পূরণ করে সভার কার্যবিবরণীসহ উপজেলা প্রকৌশলীর নিকট দাখিল করবেন]

১. (ক) ইউনিয়নের নামঃ...

(খ) উপজেলাঃ .... জেলাঃ ....

২. ইউনিয়নে কৃষি সংক্রান্ত প্রধান প্রধান সমস্যা ও তার প্রভাবঃ

সমস্যা [প্রযোজ্যগুলিতে (✓) টিক দিন]		* গুরুত্ব অনুসারে ক্রমিক	কৃষিসহ অন্যান্য খাতে সমস্যার কারণে কি ধরণের ক্ষতি হয়
আগাম বন্যা (চৈত্র-বৈশাখ-জ্যৈষ্ঠ মাসে)			
বর্ষাকালীন বন্যা (জ্যৈষ্ঠ থেকে আশ্বিন সময়ে)			
জলাবদ্ধতা	বর্ষা পূর্ববর্তী (বৈশাখ-জ্যৈষ্ঠ মাসে)		
	বর্ষা পরবর্তী (কার্তিক-অগ্রহায়ণ মাসে)		
খরা	বর্ষার প্রথম দিকে (আষাঢ়-শ্রাবণ-ভাদ্র মাসে)		
	বর্ষার শেষ দিকে (আশ্বিন-কার্তিক মাসে)		
সেচের অভাব	রবি/বোরো মৌসুমে		
	বর্ষাকালীন খরায়		

* প্রধান সমস্যা হলে ১, দ্বিতীয় সমস্যা হলে ২, এভাবে নম্বর দিন।

৩. সমস্যা সমাধানের প্রয়োজনীয় উপ-প্রকল্প প্রস্তাব/প্রস্তাবসমূহ

(১) প্রস্তাবিত উপ-প্রকল্পের নাম ঃ

(ক) সংশ্লিষ্ট নদী, খাল, বিল ও মৌজার নাম, উপকৃত জমির পরিমান ইত্যাদি সহ উপ-প্রকল্পের উদ্দেশ্য ও সংক্ষিপ্ত বর্ণনা

(খ) সমস্যা সমাধানে প্রয়োজনীয় কি কি ভৌত অবকাঠামো (যেমন রেগুলেটর/স্লুইস, বাঁধ নির্মাণ, খাল পুনঃখনন, ইত্যাদি) নির্মাণ করা দরকার এবং কোথায় নির্মাণ করতে হবে তার বর্ণনা দিন ঃ

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(২) প্রস্তাবিত উপ-প্রকল্পের নাম ঃ

(ক) সংশ্লিষ্ট নদী, খাল, বিল ও মৌজার নাম, উপকৃত জমির পরিমানসহ উপ-প্রকল্পের উদ্দেশ্য ও সংক্ষিপ্ত বর্ণনা

(খ) সমস্যা সমাধানে প্রয়োজনীয় কি কি ভৌত অবকাঠামো (যেমন রেগুলেটর/স্লুইস, বাঁধ নির্মাণ, খাল পুনঃখনন, ইত্যাদি) নির্মাণ করা দরকার এবং কোথায় নির্মাণ করতে হবে তার বর্ণনা দিন ঃ

(আরও প্রস্তাবিত উপ-প্রকল্প থাকলে (৩), (৪) এভাবে নং দিয়ে উপরের মত তথ্য দিন)

৪. **ইউনিয়ন পরিষদের সংশ্লিষ্ট সভার কার্যবিবরণী (উপস্থিত সদস্যগণের নাম ও স্বাক্ষরসহ) পূরণকৃত ফরমের সাথে সংযুক্ত করতে হবে।**

ইউপি সচিবের স্বাক্ষর ঃ	**ইউপি চেয়ারম্যানের স্বাক্ষর ঃ**
নাম ঃ	নাম ঃ
সীল ঃ	সীল ঃ
তারিখ ঃ	তারিখ ঃ
ফোন নং ঃ	ফোন নং ঃ

EXHIBIT 2

PROPOSED SUBPROJECT TECHNICAL PROPOSAL

EXHIBIT-2

স্থানীয় সরকার প্রকৌশল অধিদপ্তর

বৃহত্তর ময়মনসিংহ, সিলেট ও ফরিদপুর এলাকায় ক্ষুদ্রাকার পানি সম্পদ উন্নয়ন প্রকল্প

প্রস্তাবিত পানি সম্পদ উন্নয়ন উপ-প্রকল্পের কারিগরি প্রস্তাব

[নির্দেশনা ঃ ইউনিয়ন পরিষদ সভায় চিহ্নিত প্রতিটি উপ-প্রকল্প সরজমিনে পরিদর্শন করে এই ফর্ম পূরণ করতে হবে। প্রকল্পসমূহ পরিদর্শন কালে উপজেলা প্রকৌশল দপ্তরের সংশ্লিষ্ট উপ-সহকারী প্রকৌশলী/প্রকল্পের উপ-সহকারী প্রকৌশলী এবং প্রকল্পের জেলা পর্যায়ের জুনিয়র ওয়াটার রিসোর্স ইঞ্জিনিয়ার এবং কম্যুনিটি পার্টিসিপেশন অফিসার উপস্থিত থাকবেন। কৃষি বিষয়ে সহায়তা দেওয়ার জন্য স্থানীয় উপ-সহকারী কৃষি কর্মকর্তাকে পরিদর্শন দলে রাখা যেতে পারে]

১. প্রস্তাবিত উপ-প্রকল্পের নাম ঃ...

২. প্রস্তাবিত উপ-প্রকল্পের অবস্থান ঃ

জেলা ঃ.................................. উপজেলা ঃ.............................. ইউনিয়ন ঃ...............................

মৌজা ঃ...

সংলগ্ন প্রভাবিত ইউনিয়ন ঃ..

৩. উপ-প্রকল্পের জমির পরিমাণ

মোট ঃ.................................... হেক্টর (*)

সম্ভাব্য উপকৃত ঃ........................ হেক্টর (*)

৪. স্থানীয় কৃষক ও পেশাজীবিদের সমস্যাদি চিহ্নিতকরণ

দল	সমস্যাদি
উচু জমির কৃষক	
মাঝারী উচু/নিচু জমির কৃষক	
নিচু জমির কৃষক	
মৎস্যজীবি	
মাঝি	
ভূমিহীন	
মহিলা	

* ১ হেক্টর = ২.৪৭ একর

৫. প্রস্তাবিত উপ-প্রকল্পের ভৌত উদ্দেশ্য (**Physical Objective**) এবং সমাধান

ভৌত উদ্দেশ্য ¹		কিভাবে সমস্যার সমাধান হবে
বন্যা ব্যবস্থাপনা (**FM**)ঃ বন্যা ব্যবস্থাপনা বাঁধ নির্মাণ বা পুনঃনির্মাণ এবং রেগুলেটর/সুইস নির্মাণ করে উপ-প্রকল্পের এলাকার অধিক জমিতে উন্নত চাষাবাদের লক্ষ্যে বন্যার স্থায়ীত্ব ও গভীরতা কমানো/উপ-প্রকল্প এলাকায় লবণাক্ততা নিয়ন্ত্রণ করা।	বর্ষা পূর্বকাল বর্ষাকাল বর্ষা পরবর্তীকাল	
পানি নিষ্কাশন (**Drainage Improvement**)ঃ খাল পুনঃখনন করে নিষ্কাশন ত্বরান্বিত জলাবদ্ধতা দূর করা বা সেচের পানি সরবরাহ বৃদ্ধি করার মাধ্যমে কৃষি উৎপাদন বৃদ্ধি এবং সেই সঙ্গে মৎস্য চাষের ও নৌ-চলাচলের ব্যবস্থার উন্নয়ন।	বর্ষা পূর্বকাল বর্ষাকাল বর্ষা পরবর্তীকাল	
পানি সংরক্ষণ (**Water Conservation**)ঃ খাল খনন/পুনঃখনন সহ পানি সংরক্ষণ কাঠামো নির্মাণ করে বর্ষা মৌসুমে সম্পূরক সেচ, রবি ও শুষ্ক মৌসুম সেচ এবং গৃহস্থলী ও অন্যান্য কাজে পানির প্রাপ্তি বৃদ্ধি করার লক্ষ্যে পানি সংরক্ষণ করা।	বর্ষাকাল রবি ও শুষ্ক মৌসুম	
সেচ এলাকা উন্নয়ন (**Command Area Development**)ঃ বর্তমান সেচ এলাকার সেচ নালার উন্নয়নের মাধ্যমে বা ভূ-নিম্নে পাইপ স্থাপনের মাধ্যমে পানির অপচয় কমিয়ে বা অন্য কোন অবকাঠামো নির্মাণের মাধ্যমে অধিক এলাকা সেচের আওতাভূক্ত করা।	রবি/শুষ্ক মৌসুম	
অন্যান্য উদ্দেশ্যঃ (ক) (খ)		

৬. উপ-প্রকল্পের সম্ভাব্য নেতিবাচক প্রভাব

ক. উপ-প্রকল্পটি কোন্ প্রকার জনগণের উপর নেতিবাচক প্রভাব ফেলতে পারে (টিক ✓ দিন)

☐ কৃষক	উপ-প্রকল্পের এলাকার	☐ বাহিরে	☐ ভিতরে
☐ মৎস্যজীবি	উপ-প্রকল্পের এলাকার	☐ বাহিরে	☐ ভিতরে
☐ মাঝারী	উপ-প্রকল্পের এলাকার	☐ বাহিরে	☐ ভিতরে
☐ ভূমিহীন	উপ-প্রকল্পের এলাকার	☐ বাহিরে	☐ ভিতরে
☐ মহিলা	উপ-প্রকল্পের এলাকার	☐ বাহিরে	☐ ভিতরে
☐	উপ-প্রকল্পের এলাকার	☐ বাহিরে	☐ ভিতরে
☐	উপ-প্রকল্পের এলাকার	☐ বাহিরে	☐ ভিতরে

খ. টিক (✓) দেওয়া নেতিবাচক প্রভাবগুলি কথায় বর্ণনা করুন এবং কিভাবে কমানো যেতে পারে বলে মনে হয় উল্লেখ করুন।

১. --

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২. --

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৩. --

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৭. উপ-প্রকল্পটি কি বাংলাদেশ পানি উন্নয়ন বোর্ডের বিদ্যমান অথবা প্রস্তাবিত কোন প্রকল্প এলাকার মধ্যে বা সাথে সংশ্লিষ্ট?.. হ্যাঁ/না

¹ প্রযোজ্য উদ্দেশ্যের মধ্যে টিক (✓) দিন (একাধিক উদ্দেশ্য একসাথে প্রযোজ্য হতে পারে।

যদি হ্যাঁ হয়, তবে, প্রকল্পের নাম ও বর্তমান অবস্থা উল্লেখ করুন।

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৮. উপ-প্রকল্প এলাকার জনগণ কি অনুদান (পাকা কাজের জন্য ১.৫% এবং মাটির কাজের জন্য ৩%) দিতে এবং উপ-প্রকল্পের পরিচালনা ও রক্ষণাবেক্ষণের পূর্ণ দায়িত্ব নিতে রাজি আছে? .... হ্যাঁ/না

৯. উপ-প্রকল্প এলাকার জনগণ আগ্রহ নিয়ে এই উপ-প্রকল্পের যাবতীয় রক্ষণাবেক্ষণ কাজকর্ম সম্পাদন ও এলাকার আর্থ-সামাজিক উন্নয়নের লক্ষ্যে একটি পানি ব্যবস্থাপনা সমবায় সমিতি গঠনে সম্মত আছেন কিনা? .... হ্যাঁ/না

১০. উপ-প্রকল্প প্রস্তাব কি উপজেলা পরিষদের সভায় অনুমোদিত হয়েছে ? .... হ্যাঁ/না

যদি হ্যাঁ হয় অনুমোদনের তারিখ.. (সভার কার্যবিবরণী সংযুক্ত করতে হবে)

১১. প্রস্তাবিত উপ-প্রকল্পের সূচক মানচিত্র নিম্নোক্তভাবে তৈরী করে সংযুক্ত করুন

- উপ-প্রকল্পের এলাকা (গ্রস এলাকা, নীট উপকৃত এলাকা, নিষ্কাশন/ক্যাচমেন্ট এলাকা) উপজেলা বেস ম্যাপ বা টোপোগ্রাফিক ম্যাপ (স্কেল ১ঃ৫০০০০) এ দেখাতে হবে।
- সকল গ্রাম/বসতি, নদী, খাল ও বিল দেখাতে হবে।
- কাঠামো বা অন্যান্য কিছু দেখানোর ক্ষেত্রে এলজিইডি মানদন্ডে লিজেন্ড এবং চিহ্ন ব্যবহার করুন।
- বিদ্যমান কাঠামো দেখানোর জন্য কালো কালি (কলমের) ব্যবহার করুন।
- প্রস্তাবিত কাঠামো দেখানোর জন্য লাল কালি (কলমের) ব্যবহার করুন।
- প্রস্তাবিত খাল পুনঃখনন/বাঁধ পুনঃনির্মাণ/নির্মাণ দেখানোর জন্য লাল কালি ব্যবহার করুন।

১২. তারিখ সহ স্বাক্ষর এবং সীল

উপজেলা প্রকৌশলী উপজেলা ঃ	নির্বাহী প্রকৌশলী এলজিইডি জেলা ঃ

EXHIBIT 3

PRESCREENING AND RECONNAISSANCE FORMS

EXHIBIT-3

বৃহত্তর ময়মনসিংহ, সিলেট ও ফরিদপুর এলাকায় ক্ষুদ্রাকার পানি সম্পদ উন্নয়ন প্রকল্প

প্রস্তাবিত উপ-প্রকল্পের মাঠ পর্যায়ে প্রাথমিক পর্যবেক্ষণ (Reconnaissance)

প্রাথমিক পর্যবেক্ষণ প্রতিবেদন সার-সংক্ষেপ

(দলগত প্রতিবেদন)

১. প্রস্তাবিত উপ-প্রকল্পের নাম [পর্যবেক্ষণ দল কর্তৃক প্রস্তাবিত] :..

২. উপ-প্রকল্পের ধরণ: (এফএম / এফএমডি / এফএমডি ও ডবিণ্টউসি / ড্রেনেজ / পানি সরবরাহ ও ড্রেনেজ / ড্রেনেজ ও ডবিণ্টউসি/ ডবিণ্টউসি / ক্যাড / ক্যাড ও ড্রেনজ)

৩. উপ-প্রকল্পের অবস্থান ও বিস্তৃতি:

জেলা:................................ উপজেলা:................................ ইউনিয়ন:..

মৌজাসমূহের নাম:..

গ্রামসমূহের নাম:..

৪. উপ-প্রকল্পের আয়তন : মোট এলাকা .... হেক্টর

: নীট উপকৃত এলাকা .... হেক্টর

৫. ক্যাচমেন্ট এরিয়া (যদি উপ-প্রকল্পের এলাকা থেকে আলাদা হয়): .... হেক্টর

৬. প্রকল্পভুক্ত গ্রামসমূহের জনসংখ্যা:.......................... খানাসংখ্যা:..

৭. ভূমিহীন খানা সংখ্যা (<০.৫০ একর):.................... বড় কৃষকের খানা সংখ্যা (>৭ একর):..............

৮. সুপারিশকৃত ভৌত কাঠামো:

- রেগুলেটর : সংখ্যা...................... অবস্থান: ....
- স্লুইস : সংখ্যা...................... অবস্থান: ....
- ডব্লিউআরএস : সংখ্যা...................... অবস্থান: ....
- পাইপ স্লুইস : সংখ্যা...................... অবস্থান:..
- অন্যান্য কাঠামো : ....
- পাকা খাল : .... কি:মি:
- বারিড (ভূগর্ভস্থ) পাইপ লাইন : .... কি:মি:
- ওভারহেড ট্যাংক : সংখ্যা...................... অবস্থান:..
- বাঁধ : পুন:নির্মাণ.................. কি:মি:
  : নতুন নির্মাণ................ কি:মি:
- খাল পুন:খনন : .... কি:মি:
- অন্যান্য (যদি থাকে) : ....

৯. প্রকল্পের সামগ্রিক ব্যয় : ভৌত ব্যয় .... লক্ষ টাকা : মোট ব্যয় .... লক্ষ টাকা

: অন্যান্য আনুসাংগিক ব্যয় .... লক্ষ টাকা

১০. প্রতি হেক্টর উন্নয়ন খরচ : .... লক্ষ টাকা / হেক্টর

১১. জমি অধিগ্রহণ : প্রয়োজন আছে / নেই : যদি থাকে তবে আনুমানিক জমির পরিমান........... হেক্টর

১২. পুনর্বাসন এর প্রয়োজন আছে কি? : প্রয়োজন আছে / নেই : যদি থাকে তবে খানার সংখ্যা ....

: অন্যান্য স্থাপনার সংখ্যা ....

১৩. প্রস্তাবিত উপ-প্রকল্পটি কি বাংলাদেশ পানি উন্নয়ন বোর্ড (বাপাউবো) প্রকল্পের মধ্যে অবস্থিত? : হ্যাঁ / না

যদি হ্যাঁ হয় তবে বাপাউবো'র প্রকল্প সম্পর্কে যতটা সম্ভব তথ্য দিন এবং প্রস্তাবিত উপ-প্রকল্প ঐ প্রকল্পের সাথে কিভাবে সংযুক্ত বা সমন্বিত হবে বলুন। ....

....

১৪. উপকারভোগীরা কি পানি ব্যবস্থাপনা সমবায় সমিতি গঠনে আগ্রহী? : হ্যাঁ / না

১৫. উপকারভোগীরা কাজ আরম্ভের পূর্বে পরিচালনা ও রক্ষণাবেক্ষণ ব্যয়ের জন্য অনুদান দিতে আগ্রহী কি না? : হ্যাঁ / না
এই অনুদান কিভাবে প্রদান করবেন সে সমন্ধে ধারণা কি? ....

১৬. উপ-প্রকল্প এলাকার গ্রামের মধ্যে বর্তমানে কোন সামাজিক দ্বন্দ্ব আছে? : হ্যাঁ / না
যদি হ্যাঁ হয় তবে কি ধরণের বা কি বিষয়ে দ্বন্দ্ব তা উলে্লখ করতে হবে ....

....

১৭. কোন গ্রাম কি এই উপ-প্রকল্প বাস্তবায়নে বিরোধিতা করতে পারে? : হ্যাঁ / না
যদি হ্যাঁ হয় তবে গ্রামের নাম উলে্লখ করুন এবং এই বিরোধিতা করার কারণ/তথ্য দিন...

....

১৮. মহিলারা কি পাবসসের সদস্য হতে আগ্রহী? : হ্যাঁ / না

১৯. উপ-প্রকল্পে মাটির কাজ করার জন্য মহিলা শ্রমিক পাওয়া যাবে কি?: হ্যাঁ / না

২০. উপ-প্রকল্প বাস্তবায়নের ফলে কৃষি কাজ অথবা অন্যান্য খাতে নতুন কর্মসংস্থানের সুযোগ সৃষ্টি হবে কি? : হ্যাঁ / না
কিভাবে এবং কোন খাতে ....

২১. উপ-প্রকল্পটি বাস্তবায়নের ফলে কৃষি ও মৎস্য খাতে উপকার হবে কি ? : হ্যাঁ / না
হলে কৃষি ও মৎস্য খাতে কি পরিমান উৎপাদন বৃদ্ধি পাবে তার ধারণা দিন ....

....

২২. পর্যবেক্ষণ দল কর্তৃক সুনির্দিষ্ট মন্তব্য
কৃষিবিদ:...

....

মৎস্য / পরিবেশ বিশেষজ্ঞ ....

....

সমাজ বিজ্ঞানী / আর্থ সামাজিক বিশেষজ্ঞ ....

....

পানি সম্পদ প্রকৌশলী ....

....

২৩. প্রস্তাবের মূল্যায়ন

প্রকৌশল সম্ভাব্যতা	: অত্যন্ত ভাল / ভাল / সাধারণ মান / খারাপ
কৃষি সম্ভাব্যতা	: অত্যন্ত ভাল / ভাল / সাধারণ মান / খারাপ
মৎস্য সম্পদের উপর প্রভাব	: গ্রহণযোগ্য / প্রশমন প্রয়োজন / গ্রহণযোগ্য নয়
পরিবেশগত প্রভাব	: গ্রহণযোগ্য / প্রশমন প্রয়োজন / গ্রহণযোগ্য নয়
সামাজিক গ্রহণযোগ্যতা/নির্ভরযোগ্যতা	: অত্যন্ত ভাল / ভাল / সাধারণ মান / খারাপ

২৪. দলের সুপারিশ: পিআরএ করা যেতে পারে / প্রস্তাবটি পুন:বিবেচনা দরকার / প্রস্তাবটি বাদ দিতে হবে

কৃষিবিদ	মৎস্য বিশেষজ্ঞ/পরিবেশ বিশেষজ্ঞ	সমাজ বিজ্ঞানী	পানি সম্পদ প্রকৌশলী
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নাম ও পদবী	নাম ও পদবী	নাম ও পদবী	নাম ও পদবী

EXHIBIT-3

বৃহত্তর ময়মনসিংহ, সিলেট ও ফরিদপুর এলাকায় ক্ষুদ্রাকার পানি সম্পদ উন্নয়ন প্রকল্প

প্রস্তাবিত উপ-প্রকল্পের মাঠ পর্যায়ে প্রাথমিক পর্যবেক্ষণ (**Reconnaissance**)

পানি সম্পদ প্রকৌশলী

প্রতিবেদনকারী

উপ-প্রকল্পের নামঃ.. জেলাঃ .... উপজেলাঃ .... ইউনিয়নঃ..............................

[পানি সম্পদ প্রকৌশলী উপজেলা বেস ম্যাপ ব্যবহার করে উপ-প্রকল্পের সীমানা এবং ক্যাচমেন্ট এরিয়া (যদি উপ-প্রকল্পের সীমানা থেকে আলাদা হয়) এবং ম্যাপটিতে বর্তমানে রাস্তার অবস্থান, ব্রীজ, কালভার্ট, বাজার, খালের নাম ও এলাইনমেন্ট, বিল, বাওড় ও অন্যান্য জলাধার, বিদ্যমান রেগুলেটর/স্লুইস/ডব্লিউআরএস (যদি থাকে) চিহ্নিত করবেন। যে সমস্ত স্থানে পানি সম্পর্কিত সমস্যা বিরাজমান সেগুলো বিশেষভাবে চিহ্নিত করতে হবে যেমন (বন্যা প্লাবিত, পানি প্রবাহে বিঘ্নতা/জলাবদ্ধতা), নদী ভাঙ্গন স্থানের অবস্থান এবং টিম কর্তৃক ভৌত কাজের প্রস্তাবসহ ম্যাপে উপরোক্ত সব উপাত্ত সংযোজন করতে হবে]

ক্রমিক নং	কার্যক্রম/সমস্যা	তথ্য-উপাত্ত, কারণ, সমাধান প্রস্তাব ইত্যাদির বিবরণ
১।	প্রস্তাবিত উপ-প্রকল্পের অবস্থান মৌজা ও ইউনিয়নের ভিত্তিতে যাচাই করা এবং উপজেলা হেডকোয়ার্টার থেকে উপ-প্রকল্প স্থানের যাতায়াত ও পরিবহণ ব্যবস্থার বিবরণ।	
২।	জনগণের সাথে আলোচনা করে প্রস্তাবিত উপ-প্রকল্পের সীমানা (হাইড্রোলজিক্যাল) নির্ধারণ করা। যেমন নদী, খাল, রাস্তা, রেলপথ, উঁচু জমি যা উত্তর, দক্ষিন, পূর্ব ও পশ্চিম সীমানায় অবস্থিত সেগুলো চিহ্নিত করতে হবে।	
৩	প্রকল্পের জমির প্রকৃতি যথা উঁচু, মধ্যম ও নীচু জমি সহ বিল, হাওড় ও অন্যান্য পানি এলাকা ম্যাপে দেখাতে হবে। পানি সারা বৎসর নাকি শুধু বর্ষা মৌসুমে থাকে উল্লেখ করুন।	
৪।	আউটফল নদী ও সীমানায় অবস্থিত নদী/খালের বিবরণ। নদী থেকে বাঁধ অথবা প্রস্তাবিত রেগুলেটরের দুরত্ব কত? পানি সমতল গেজ অথবা পানি পরিমাপ স্টেশন উপ-প্রকল্পের নিকটে থাকলে তার নাম ও দুরত্ব দিন। উপ-প্রকল্পের নিকটে অবস্থিত নদীর পাড় ভাঙ্গন সম্পর্কে তথ্য সংগ্রহ করে প্রতি বৎসর নদী ভাঙ্গনের হার কত (যথা মিটার প্রতি বৎসর) উল্লেখ করুন। যদি নদীতে পলি পড়ে তলদেশের উচ্চতা বৃদ্ধি পায় এবং নদীতে চর পড়া অব্যাহত থাকে তার বিবরণ দিতে হবে।	

ক্রমিক নং	কার্যক্রম/সমস্যা	তথ্য-উপাত্ত, কারণ, সমাধান প্রস্তাব ইত্যাদির বিবরণ
৫।	উপ-প্রকল্পের মধ্যে এবং সীমানার নিকটবর্তী এলাকায় বিদ্যমান অবকাঠামো যথা রাস্ড়া, ব্রীজ এবং কালভার্ট, খাল, রেগুলেটর, স্লুইস ইত্যাদির তালিকা ও অবস্থান লিখুন এবং ম্যাপে দেখান।	
৬।	উপ-প্রকল্প এলাকার কৃষিজীবি, মৎস্যজীবি এবং স্থানীয় জনগণের সাথে কথা বলে কি কি অবকাঠামো (যথা রেগুলেটর, স্লুইস, বাঁধ, খাল পুনঃখনন ইত্যাদি) প্রয়োজন স্থির করুন এবং সে সব অবকাঠামোর স্থান ম্যাপে দেখান।	
৭।	উপ-প্রকল্প বাস্ড়বায়নের সময় কোন পুনর্বাসন প্রয়োজন হবে কি? সংক্ষেপে কি ধরনের এবং কত খানা পুনর্বাসন লাগবে।	
৮।	বর্তমানে উপ-প্রকল্প এলাকার পানি সম্পদজনিত সমস্যা যথা বন্যা, অপর্যাপ্ত নিষ্কাশন, পানি বদ্ধতা, সেচের জন্য পানি সল্পতাসহ বন্যার উৎস/কারণ ও প্রাকৃতিক নিষ্কাশন পদ্ধতি বর্ণনা করুন। মানচিত্রে ভূ-পরিস্থ পানির উৎস (যদি থাকে) দেখাতে হবে।	
৯।	বর্তমানে উপ-প্রকল্প এলাকায় মৎস সম্পদের অবস্থা (মুক্ত জলাশয়/পুকুরে চাষকৃত), পূর্ণকালীন মৎসজীবি খানার সংখ্যা, কোন গ্রামে তাদের বসবাস, কোথায় তারা মাছ ধরে, কোন সময়ে মাছ ধরে এবং গড়ে প্রতি খানা প্রতিদিন কি পরিমাণ মাছ ধরতে পারে (কেজি/খানা/দিন) এসবের তথ্য সংগ্রহ করে লিখুন। উপ-প্রকল্পের ফলে মৎস সম্পদের উপর সম্ভাব্য প্রভাব কি? যদি বিরূপ প্রভাব থাকে তবে কিভাবে তা উপশম করা যাবে?	
১০।	উপজেলা বেস ম্যাপ বর্ধিত করে প্রস্তাবিত উপ-প্রকল্পের একটি ইনডেক্স ম্যাপ প্রস্তুত করে উপরে বর্ণিত সমস্ত ভৌত বৈশিষ্ট সংযোজন করতে হবে। প্রয়োজন হলে অন্যান্য বিশেষজ্ঞ কর্তৃক সংগৃহীত তথ্যাদি সন্নিবেশিত করতে হবে।	[ম্যাপ সংযুক্ত করুন]

স্বাক্ষর :

তারিখ :

নাম :

পদবী :

EXHIBIT-3

বৃহত্তর ময়মনসিংহ, সিলেট ও ফরিদপুর এলাকায় ক্ষুদ্রাকার পানি সম্পদ উন্নয়ন প্রকল্প

প্রস্ড়াবিত উপ-প্রকল্পের মাঠ পর্যায়ে প্রাথমিক পর্যবেক্ষণ (Reconnaissance)

কৃষিবিদ

প্রতিবেদনকারী

উপ-প্রকল্পের নাম:................................ জেলা:........................ উপজেলা:........................ ইউনিয়ন:....................

১. চাষাবাদ এলাকার ধরন ও ব্যবহার (নিচের ছকে প্রতি ঘরকে □ ১০% হিসেবে সংশ্লিষ্ট মৌসুমে প্রস্তাবিত উপ-প্রকল্প এলাকাধীন মোট আবাদি জমির শতকরা কত ভাগ কি ধরনের পূরণ করুন)

জমির ধরন	খরিফ ১										খরিফ ২										রবি									
জলাবদ্ধতা মুক্ত																														
বন্যা পণ্ঢাবন মুক্ত																														
খরামুক্ত																														
সেচাধীন																														
জলাবদ্ধ																														
বন্যা পণ্ঢাবিত																														
খরা																														
সেচবিহীন																														

২. ফসল উৎপাদনে সমস্যা

মৌসুম	ফসলের নাম	আবাদি এলাকা (মোট আবাদি এলাকার % পরিমাণ)	গড় ফলন (কেজি/একর)	সমস্যা
খরিফ ১				
খরিফ ২				
রবি				

৩. স্থানীয় কৃষকদের মতামতঃ

ক. উপ-প্রকল্পের প্রয়োজনীয়তা (✓ চিহ্ন)

জলাবদ্ধতা দূরীকরণ	সময়মত পানি নিষ্কাশন	বন্যা প্রতিরোধ	বন্যার গভীরতা হ্রাস	পানি সংরক্ষণ	সেচপানি সরবরাহ	সম্পূরক সেচ সুবিধা	সেচ এলাকা বৃদ্ধি	অন্যান্য (উলেণ্টখসহ)

খ. উপ-প্রকল্পের কার্যকারিতা (✓ চিহ্ন)

শস্যহানি হ্রাস	শস্য আবাদি এলাকা বৃদ্ধি	নতুন শস্য আবাদ	উন্নত জাতের আবাদ বৃদ্ধি	শস্য নিবিড়তা বৃদ্ধি	শস্য বিন্যাসে পরিবর্তন	ফলন বৃদ্ধি	ক্ষতি হবে, কারণ	অন্যান্য (উলেণ্টখসহ)

স্বাক্ষর :

তারিখ :

নাম :

পদবী :

৪. প্রস্তাবিত উপ-প্রকল্প এলাকার ম্যাপে শস্য বিন্যাস এবং ফসল উৎপাদনে সমস্যার ধরন ও সমস্যা কবলিত এলাকা চিহ্নিতকরণ

উত্তর

EXHIBIT-3

বৃহত্তর ময়মনসিংহ, সিলেট ও ফরিদপুর এলাকায় ক্ষুদ্রাকার পানি সম্পদ উন্নয়ন প্রকল্প

প্রস্তাবিত উপ-প্রকল্পের মাঠ পর্যায়ে প্রাথমিক পর্যবেক্ষণ

সমাজবিজ্ঞানী

প্রতিবেদনকারী

উপ-প্রকল্পের নাম:.. জেলা: .... উপজেলা: .... ইউনিয়ন:................................

ক্রমিক নং	কার্যক্রম/সমস্যা	তথ্য-উপাত্ত, কারণ, সমাধান প্রস্তাব ইত্যাদির বিবরণ
১।	সংশ্লিষ্ট ইউপি চেয়ারম্যান এবং সদস্য (মহিলা সদস্যসহ) গণের প্রস্তাবিত উপ-প্রকল্প সম্পর্কে মতামত/মন্তব্য কি?	
২।	বিভিন্ন স্থান থেকে স্থানীয় জনগণের প্রকল্প সম্পর্কে মতামত জেনে লিখুন। (প্রকল্পের পক্ষে ও বিপক্ষে উভয় ধরণের মতামত হতে পারে)।	
৩।	কার উদ্যোগে এই উপ-প্রকল্পের প্রস্তাব পাঠানো হয়েছে? এই অঞ্চলের ইউপি চেয়ারম্যান, ইউপি সদস্য, এমপি, সরকারী/ব্যাংক/স্বায়ত্বশাসিত সংস্থার কর্মকর্তা অথবা অন্য কেহ।	
৪।	এলাকায় কো-অপারেটিভ সোসাইটি, ইনফরমাল কমিউনিটি প্রতিষ্ঠান, সোসাল ওয়েলফেয়ার ক্লাব/ট্রাস্ট ইত্যাদি থাকলে নাম লিখুন এবং তাদের মূল কাজ কি উল্লেখ করুন।	
৫।	প্রস্তাবিত উপ-প্রকল্পে কোন কোন এনজিও কাজ করছে, তাদের কাজের ক্ষেত্র সম্পর্কে বলুন।	
৬।	এলাকায় মাটির কাজ এবং অন্যান্য কাঠামো বাস্তবায়ন কাজে স্থানীয় শ্রমিক পাওয়া যাবে কি? মহিলা শ্রমিকরা কি এলসিএস ব্যবস্থাপনায় কাজ করবে?	

ক্রমিক নং	কার্যক্রম/সমস্যা	তথ্য-উপাত্ত, কারণ, সমাধান প্রস্তাব ইত্যাদির বিবরণ
৭।	প্রস্তাবিত উপ-প্রকল্পাধীন এলাকায় সংশ্লিষ্ট গ্রামসমূহের জমির পরিমান (শতকরা হারে) কত। মোট খানাসংখ্যা, জনসংখ্যা এবং ভূমিহীন খানার অংশ (শতকরা হারে) কত। উপকারভোগী জমির কত অংশ (ক) ভূমিহীন/বর্গাচাষী (<০.৫ একর) এবং (খ) প্রান্তিক ও (গ) ক্ষুদ্রচাষী (>১.০ একর) চাষে নিয়োজিত।	
৮।	উপ-প্রকল্পের কারণে যে সকল এলাকা (মৌজা, গ্রাম) এবং গোষ্ঠী প্রতিকূলতার (বিরূপ প্রভাব) সম্মুখীন হবে তা চিহ্নিত করুন। প্রতিকূলতার জন্য ঐ সকল জনগোষ্ঠীর সাধারণ মতামত উল্লেখ করুন। কিভাবে ঐ সকল প্রতিকূলতা উপশম করা সম্ভব হতে পারে।	
৯।	ভৌত অবকাঠামো সম্পর্কে বিস্তারিত তথ্য এবং উপ-প্রকল্প বাস্তবায়নে কতটুকু পরিমাণ (একর) জমি অধিগ্রহণ (যদি প্রয়োজন হয়) করতে হবে। ম্যাপে প্রস্তাবিত অধিগ্রহণ জমির অবস্থান দেখাতে হবে। প্রয়োজনে পানি সম্পদ প্রকৌশলীর সহায়তা নিতে হবে।	
১০।	উপ-প্রকল্প নিয়ে কোন সামাজিক দ্বন্দ্ব আছে কি? যদি থাকে তবে কোন ইস্যুতে দ্বন্দ্ব হচ্ছে তা চিহ্নিত করতে হবে এবং এই ইস্যু উপ-প্রকল্প বাস্তবায়নে কোন বিরূপ ভূমিকা রাখবে কি?	
১১।	এই উপ-প্রকল্পের কারণে গ্রামে গ্রামে/গোষ্ঠীতে কোন প্রকার দ্বন্দ্ব সংঘাতের সৃষ্টি হবে কি না তাহা যাচাই করতে হবে। যদি হয় তবে কিভাবে এ দ্বন্দ্ব প্রশমন করা যাবে।	
১২।	যদি উপ-প্রকল্প এলাকায় কোন আদিবাসী/উপজাতী গোষ্ঠী থাকে তবে তাদের পেশা, সংস্কৃতি এবং স্থানীয় সমাজের সাথে যোগাযোগ বিষয়ে বিবরণ দিন। এই উপ-প্রকল্প বাস্তবায়ন তাদের কিভাবে প্রভাবিত করতে পারে এবং যদি সমস্যা হয় তবে তা কি উপায়ে প্রশমিত করা যেতে পারে।	

স্বাক্ষর :

তারিখ :

নাম :

পদবী :

EXHIBIT-3

বৃহত্তর ময়মনসিংহ, সিলেট ও ফরিদপুর এলাকায় ক্ষুদ্রাকার পানি সম্পদ উন্নয়ন প্রকল্প

প্রস্তাবিত উপ-প্রকল্পের মাঠ পর্যায়ে প্রাথমিক পর্যবেক্ষণ

পরিবেশবিদ

প্রতিবেদনকারী

উপ-প্রকল্পের নামঃ.. জেলাঃ .... উপজেলাঃ .... ইউনিয়নঃ................................

ক্রমিক নং	কার্যক্রম/সমস্যা	তথ্য-উপাত্ত, কারণ, সমাধান প্রস্তাব ইত্যাদির বিবরণ
১।	প্রস্তাবিত উপ-প্রকল্পের মধ্যে কোন সংরক্ষিত জলাভূমি (যেমন সুনামগঞ্জ জেলার টাঙ্গুয়ার হাওড়) অথবা পরিবেশের কারণে প্রসিদ্ধ হাওড় অথবা স্থায়ী জলাশয় বিদ্যমান থাকলে তার বিবরণ দিন। প্রস্তাবিত উপ-প্রকল্প এসব জলাভূমির উপর কি ধরণের অনুকূল অথবা বিরূপ প্রভাব ফেলতে পারে। বিরূপ প্রভাব নিরসনের জন্য কি ধরণের ব্যবস্থা গ্রহণ করা প্রয়োজন।	
২।	প্রস্তাবিত উপ-প্রকল্পের ভেতরে কোন বনভূমি থাকলে তার আয়তন কত এবং সংরক্ষিত বনভূমি কি না? ম্যাপের মধ্যে বনভূমিটি পানি সম্পদ প্রকৌশলীর সহায়তায় চিহ্নিত করুন। প্রস্তাবিত উপ-প্রকল্পটি বাস্তবায়নের কারণে বনভূমির উপর অনুকুল অথবা প্রতিকুল প্রভাব পড়বে কি? যদি কোন প্রতিকুল প্রভাব পড়ে তবে তা নিরসন কল্পে উপ-প্রকল্প বাস্তবায়নে কিরূপ পদক্ষেপ নিতে হবে।	
৩।	কোন প্রত্নতাত্ত্বিক অথবা ঐতিহাসিক স্থান যদি প্রস্তাবিত উপ-প্রকল্পের মধ্যে বা সন্নিকটে থাকে তার বিবরণ। উপ-প্রকল্প বাস্তবায়নের ফলে এই সকল স্থানে কোন বিরূপ প্রভাব ফেলবে কি? কিভাবে তা নিরসন করা যেতে পারে। (ম্যাপের মধ্যে ঐ সকল স্থান চিহ্নিত করুন)।	

ক্রমিক নং	কার্যক্রম/সমস্যা	তথ্য-উপাত্ত, কারণ, সমাধান প্রস্তাব ইত্যাদির বিবরণ
৪।	উপ-প্রকল্পটি বাস্তবায়ন পর্যায়ে কোন ধরনের বিরূপ পরিবেশের সৃষ্টি করতে পারে কি (যেমন ক্রস ড্যামের কারণে নিষ্কাশন ব্যাহত, পানি প্রাপ্যতা হ্রাস, জমি ক্ষয় ইত্যাদি)? এই সমস্ত ত্রুটি সমাধানের জন্য কি করণীয় তা উল্লেখ করতে হবে।	
৫।	উপ-প্রকল্পটি বাস্তবায়নের ফলে/পরিচালনার সময় কোন প্রতিকূল পরিবেশ সৃষ্টি করবে কি (যেমন পানি সংরক্ষণ কাঠামোর জন্য উজানের নীচু জমি নিমজ্জিত হতে পারে এবং ভাটিতে পানি প্রাপ্যতা হ্রাস করবে, বাঁধের কারণে পানি নিষ্কাশন ব্যহত করবে, খান পুনঃখনন করার কারণে পানি অতিরিক্ত নিষ্কাশন হবে ইত্যাদি)? এই প্রতিকূল পরিবেশ নিরসন করার জন্য মাঠ পর্যায়ে আলোচনা করে ধারণা দিন।	

স্বাক্ষর :

তারিখ :

নাম :

পদবী :

EXHIBIT-3

বৃহত্তর ময়মনসিংহ, সিলেট ও ফরিদপুর এলাকায় ক্ষুদ্রাকার পানি সম্পদ উন্নয়ন প্রকল্প
প্রস্তাবিত উপ-প্রকল্পের মাঠ পর্যায়ে প্রাথমিক পর্যবেক্ষণ (Reconnaissance)

মৎস্যবিদ

প্রতিবেদনকারী

ক্রমিক নং	কার্যক্রম/সমস্যা	তথ্য-উপাত্ত, কারণ, সমাধান প্রস্তাব ইত্যাদির বিবরণ
১.	প্রস্তাবিত উপ-প্রকল্প এলাকায় বর্তমান মৎস্য জলাশয় এবং উৎপাদনের পরিমান।	(ক) মৎস্য জলাশয় : মুক্ত জলাশয় (খাল, বিল ও হাওড়) = ... হেক্টর বদ্ধ জলাশয় (পুকুর ....) = ... হেক্টর মোট = ... হেক্টর (খ) উৎপাদন : মুক্ত জলাশয় = ... টন। মৎস্য চাষ = ... টন। মোট = ... টন।
২.	প্রস্তাবিত উপ-প্রকল্প এলাকায় মৎস্য পেশায় নিয়োজিত জনগণের সংখ্যা এবং শ্রেণী বিভাগ।	(ক) মৎস্য পেশায় নিয়োজিত মোট জনগণ = (খ) মৎস্যজীবি পূর্ণ সময়কালীন = মৎস্যজীবি খন্ডকালীন = মৎস্যচাষী পূর্ণ সময়কালীন = মৎস্যচাষী খন্ডকালীন =
৩.	প্রস্তাবিত উপ-প্রকল্প এলাকায় (ক) মৎস্যজীবির সংখ্যা এবং (খ) মোট জনসংখ্যার শতকরা কতজন।	(ক) মৎস্যজীবির (জেলে) সংখ্যা = (খ) মৎস্যজীবিগণের সংখ্যা মোট জনসংখ্যার শতকরা .... ভাগ
৪.	প্রস্তাবিত উপ-প্রকল্প এলাকায় কোন সংরক্ষিত মৎস্য জলাশয়া যা মৎস্য অভয়াশ্রম আছে কিনা। থাকলে তার বিবরণ।	☐ সংরক্ষিত মৎস্য জলাশয় ☐ মৎস্য অভয়াশ্রম ☐ আছে ☐ নাই বিবরণ:
৫.	প্রস্তাবিত উপ-প্রকল্প বাস্তবায়িত হলে মৎস্য সেক্টরে কি কি প্রভাব পড়বে।	☐ মৎস্য প্রগমন (Fish Migration) ব্যহত হবে ☐ মৎস্য জলার পরিমান কমে যাবে ☐ মৎস্য উৎপাদন কমে যাবে ☐ মৎস্যজীবিগণের মাছ ধরার সুযোগ কমে যাবে ☐ মৎস্যচাষীগণের চাষ কাজে বিঘ্ন সৃষ্টি হবে / সুবিধা বাড়বে ☐ অন্যান্য
৬.	প্রস্তাবিত উপ-প্রকল্প বাস্তবায়নের ফলে মৎস্য সেক্টরে কোন বিরূপ প্রভাব পড়লে তা প্রশমনের জন্য কি কি ব্যবস্থা নেয়া যেতে পারে।	☐ রেগুলেটরের Invert যথাযথ লেভেলে স্থাপন করে স্থায়ী জলাশয়ের সম্পূর্ণ নিষ্কাশন রোধ করতে হবে ☐ রেগুলেটরের সাথে জাল লাগিয়ে মাছ পলানো রোধ করতে হবে ☐ ক্ষতিগ্রস্ত মৎস্যজীবিগণের পুর্নবাসনের ব্যবস্থা করতে হবে ☐ উপ-প্রকল্প বাস্তবায়নের ফলে সৃষ্ট জলাশয় বিশেষভাবে মৎস্য চাষের ব্যবস্থা করতে হবে

স্বাক্ষর ঃ ____________ তারিখ ঃ ____________ নাম ঃ ____________ পদবী ঃ ____________

EXHIBIT 4

AGRICULTURE SURVEY FORMS

EXHIBIT-4

Subproject Feasibility Study: Agricultural Data and Information from Field Survey

Subproject Name:

Upazila:

District: Date of Survey: Name and Designation of Surveyor(s):

Table 4.1: Crop Patterns

No.	Name of Crop Cultivated in Three Seasons			Percent of Total Cultivated Area in Each Land Type			
	Kharif 1	Kharif 2	Rabi/Boro	High Land	Medium High Land	Medium Low Land	Low Land
Total				100	100	100	100

Crop Pattern: The name of crops grown on the same piece of land one after another covering three crops seasons in a year. For example, B. aus-LT Aman-Wheat crop pattern indicates land is cultivated in kharif I, kharif II and rabi seasons.

Crop seasons: Kharif I: March/April to June; Kharif II: July-October; Rabi: November to March

Land type: Highland (F0): The cultivated land where flooding depth is 0 to 30 cm; Medium highland (F1): The cultivated land where flooding depth is 30 to 90 cm; Medium lowland (F2): The cultivated land where flooding depth is 90 to 180 cm; Lowland (F3): The cultivated land where flooding depth is more than 180 cm

Percent of Total Cultivated Area in Each Land Type: For example, B. Aus-LT Aman-Wheat crop pattern occupies 60% of the total highland, 50% of the total medium highland, 20% of the medium lowland and 5% of the lowland in the proposed subproject area. Accordingly, other crop patterns occupy remaining 40% of the highland, 50% of the medium highland, 80% of the medium lowland and 95% of the lowland.

Table 4.2: Crop Cultivation Practices and Input Use

Subproject Name: Date:

Name of Crop	Operation Time (Week/Month)			Irrigated Area (percent of cropped area)					Fertilizer Use (kg/hectare)					Pesticide (kg/ha)	Labor Use (person-day / ha)	Draught Animal Use (pair/ha)
	Sowing	Trans-plantation	Harvest	LLP	STW	DTW	HTW	Traditional	Urea	TSP	MP	Organic	Other			

Operation Time (Week/Month): For example, 3w 4m would mean 3rd week of April

Irrigated area: For example, 20% of the total HYV boro area is irrigated by LLP, 30% by STW and 50% by DTW.

LLP: low lift pump; STW: shallow tubewell; DTW: deep tubewell; HTW: hand tubewell; Traditional: don, sewti

Fertilizer use: TSP: triple super phosphate; MP: murate of potash; organic: compost; green manure; Other: zinc sulphate, gypsum, borax or DAP.

Labor use: labor employed for crop production from sowing to storing.

Person day: eight hours.

Draught Animal: pairs of bullock used for plough, laddering, weeding, threshing, carrying.

Table 4.3: Crop Damage (percent of total area under the crop)

Subproject Name: Date:

Name of Crop	Damage free				Damaged by pre-monsoon flooding				Damaged by monsoon flooding			
	High Land	Medium High Land	Medium Low L	Low Land	High Land	Medium High Land	Medium Low Land	Low Land	High Land	Medium High Land	Medium Low Land	Low Land

Table 4.3 (contd): Crop Damage (percent of area under the crop)

Subproject Name: Date:

Name of Crop	Poor drainage				Drought				Pest infestation			
	High Land	Medium High Land	Medium Low Land	Low Land	High Land	Medium High Land	Medium Low Land	Low Land	High Land	Medium High Land	Medium Low Land	Low Land

Table 4.4: Crop Yield (ton/hectare)

Subproject Name: Date:

Name of Crop	Damage free cropped area				Pre-monsoon flood damaged cropped area				Monsoon flood damaged cropped area			
	High Land	Medium High Land	Medium Low Land	Low Land	High Land	Medium High Land	Medium Low Land	Low Land	High Land	Medium High Land	Medium Low Land	Low Land

Table 4.4 (contd): Crop Yield (ton/hectare)

Subproject Name: Date:

Name of Crop	Poor drainage cropped area				Drought damaged cropped area				Pest infested cropped area			
	High Land	Medium High Land	Medium Low Land	Low Land	High Land	Medium High Land	Medium Low Land	Low Land	High Land	Medium High Land	Medium Low Land	Low Land

Table 4.5: Farmers' Needs

Subproject Name: Date:

Name of Crop	Flood Reduction (✓mark)	Flood Protection (✓mark)	Flood control (✓mark)	Crop Protection from Submergence (✓mark)	Drainage Improvement (✓mark)	Increase in Soil Moisture (✓mark)	Irrigation Water Supply (✓mark)	Other (mention)

Table 4.6: Farmers Views on Impact of The Proposed Subproject

Subproject Name: Date:

Name of Crop	Protect crop form flooding (✓ mark)	Improve drainage (V mark)	Protect crop from drought (✓mark)	Land can be cultivated (✓mark)	Increase in cultivated area (%)	Increase in yield level (%)	No impact, because	Subproject will create problem, because	Other (specify)

EXHIBIT 5

PRA FORMAT AND REPORT OUTLINE

EXHIBIT-5

Annex 1: Report Format for PRA Engineering Findings

Proposed Subproject: ____________________ Union (s): ___________________ Upazila: ________ District: ___________

1. Describe the project area and people and proposed sub project concept plan.

2. Describe the history of water related interventions (hydraulic structures, khal re-excavations, embankment, roads, etc.) Particularly mention details of BWDB interventions inside and outside (vicinity) of subproject area.

3. Indicate on the map (subproject/physical map) using arrows the directions of flood flows and drainage flows.

4. Indicate on the map (subproject/physical map) by shading, flood inundated areas and waterlogged areas, and in the report itself give dates and depth of inundation.

5. How often is the area flooded (once every 1,2,3,4,5 or more years), what is the source of the flooding, depth of flooding and what is the highest flood level (local mark)?

6. In case of a proposed water conservation project, what is the soil condition (clayey/sandy/etc.) of the khals and/or beels, which might be used to store water? Check if there is a potential water sharing issue.

7. If the proposed subproject is implemented, what will be the impacts on the water environment?

(Please use back of format, if space provided is not sufficient)

Stakeholders Involved in PRA Activities (Engineering)

Name of Union and Villages (study areas): ______________________________

____

Sl. No.	Name	Village	Gender	Occupation	Signature	Date

EXHIBIT-5

Annex 2: PRA Report Format for Agriculture Findings

Proposed Subproject: ____________________ Union(s): _________________ Upazila: ____________ District: _________

1. **Land Types:**

Land Types	Area (hectare)	Major Crops			Major Limitations to Crop Production (Late planting, crop damage, use of local variety, low yield, low productivity, etc.)	Average Cost of Land (Tk/ha)
		Kharif 1	Kharif 2	Rabi		
Drainage free						
Flood free						
Irrigated: Full Supplement						
Flooded: Shallow Moderate Deep Very Deep						
Poor drainage						
Drought						
Un-irrigated						

2. **Flood Related** Crop Production Limitations

Flood Characteristics (circle types)	Flash flood/ Seasonal flood/ Local rainfall Shallow/ Moderately deep/ Deep/Very deep
Average number of floods per year	
Period of floods; from-to (month)	
Yield loss per crop	Name of Crop ___________________ loss: _________ kg/ha or % Name of Crop ___________________ loss: _________ kg/ha or %
Farmers' suggestions on how to protect crop from flood damage	

3. **Water Logging** Related Crop Production Limitation

Drainage pattern (circle applicable one)	Slow / Delayed / Late Pre-monsoon / Monsoon / Post-monsoon
Type of land where water logging occurs (circle applicable one)	High / Medium High / Medium Low / Low / Very Low
Period of water logging; from-to (month)	
Yield loss per crop	Name of Crop _________________ loss: ___________ kg/ha or % Name of Crop _________________ loss: ___________ kg/ha or %
Farmers' suggestions for improvement *(Categorise suggestions coming from highland, medium land, low land and farmers)*	

4. Drought Related Crop Production Limitations

Characteristics of drought	Extensive / Short / Before rainy season / After rainy season / Before dry season / After dry season
Period of drought (months/season)	
Type of land affected by drought	High / Medium High / Medium Low / Low / Very Low
Area of land affected by drought (ha)	
Yield loss per crop	Name of Crop ______________ loss: ___________ kg/ha or % Name of Crop ______________ loss: ___________ kg/ha or %
Farmers' suggestions on how to protect crop from drought	

5. Expected Impact of Subproject on Crop Production

Reduce crop damage (name of crop and area)	
Increase in area under modern variety (name of crop and area)	
Increase in crop area (name of crop and area)	
Change in cropping patterns (specify cropping patterns)	
Increase in crop yield (name of crop and yield increase in percent)	
Others	
No impact	

Stakeholders Involved in PRA Activities (Agriculture)

Name of union and villages (study areas):____

____

Sl. No.	Name	Village	Gender	Occupation	Signature	Date

EXHIBIT-5

Annex 3: PRA Report Format for Fisheries Findings

Proposed Subproject: ____________________ Union(s): __________________ Upazila: ___________ District: _________

1. Fisheries Resource Base and Production

Type of Water Body	Total Area (Hectare)	Khas Area (Hectare)	Tidal Effect (Yes/No)	Annual Production (Kg)			
				Fish	Galda	Bagda	Total
A. <u>Seasonal Water Body</u> (at least 0.5 m water standing for almost 4 months)							
☐ Floodplain Ricefields							
☐ Pond, Dighi, Ditch							
☐ Khal							
☐ Beel							
☐ Borrow pit							
Sub-Total							
B. <u>Perennial Water Body</u> (at least 0.8 m water retained throughout the year)							
☐ Pond, Dighi, Ditch							
☐ Khal							
☐ Beel							
☐ Baor							
☐ River, Haor							
Sub-Total							
Total (Sub-total A + B)							

2. Fish Migration Routes (for in and out migration of fish to and from the subproject area. indicate on the map)

Name of the Channel/Khal	Period of Major Migration					
	Early Monsoon		Middle Monsoon		Late Monsoon	
	In	Out	In	Out	In	Out
a.						
b.						
c.						
d.						

3. Fishing Communities

Type of Household (HH)	Total HHs	Female Headed HHs
a. Genuine/Ethnic Fisher		
b. Subsistence Fisher/ Part time Fisher		
c. Genuine Fish Farmer		
d. Subsistence Fish Farmer/ Part time Fish Farmer		

4. Involvement of women in fisheries activities

Fisheries Activities	Number
Feeding fish	
Pond culture	
Fish nursery	
Others:	
•	
•	
•	

5. **Expected Impact of Proposed Subproject Interventions on Fisheries (*Male and female responses to be segregated if significantly different*)**

Expected Impact	Suggested Mitigating Measures
Reduction of fish habitat (area, depth of water, period of inundation)	
Reduction in the entry of brood fish and fish seeds	
Reduction in fish production	
Reduction in the inflow of water	
Reduction in community consumption of fish	
Deterioration of livelihood condition of fisher folks	
Others:	
•	
•	
•	

Stakeholders Involved in PRA Activities (Fisheries)

Name of union and villages (study areas):____

____

Sl. No.	Name	Village	Gender	Occupation	Signature	Date

EXHIBIT-5

Annex 4: PRA Report Format for Environmental Findings

Proposed Subproject: ________________________ Union(s): __________________ Upazila: __________ District:_________

Villages/Moujas (Study Areas): ____

1. Is there any conserved wetland like Tanguar Haor or conserved forest like Sundarban in the proposed subproject area? If so, give details and show location on the map.

2. Is there any historical/archaeological site, which may be threatened or may have to be demolished for subproject construction? If so, indicate in the map and give details.

3. Indicate on the map and give names of the water bodies which may be drained partially or completely if the proposed subproject is implemented

Water bodies not affected by proposed subproject	
Water bodies partially drained by proposed subproject	
Water bodies completely drained by proposed subproject	

4. Land Acquisition Issue and/or Agricultural Land Loss. Mention here the type and approximate area of land to be acquired/lost as well as the number of households likely to be affected, if any. Also mention mitigation demand by affected households.

Type and Approximate Area of Land (in hectare)	Number of Affected Households	Mitigation Demands from Affected Households

5. Indicate on the map and give names and the number of boats passing through khals/rivers/channels, which may be closed with a structure if the subproject is implemented.

Average number and types of boats passing proposed structure site per day

Site/Khal Name	Pre-monsoon	Monsoon	Post-monsoon

6. Indicate on the map and provide names of villages/areas outside the subproject boundary, which may experience higher risk of flooding if the subproject is implemented.

7. Types and amount of chemical fertilizer and pesticides presently used by farmers

Crop	Name of Fertilizer and Pesticide	Amount Used per Acre

8. Will the subproject construction require destruction of natural or planted vegetation? If so, give detail.

9. Give the approximate percentage of people in favor and/or against the proposed subproject

10. Expected environmental impacts and possible mitigation measures if proposed subproject is implemented

Type of Intervention	**Expected Impacts and Affected People**		**Possible Mitigation Measures**
	Positive	**Negative**	
Khal re-excavation			
Construction of sluices, regulators, WRS			
Embankments			
Other interventions			

11. Summary Table of Project Affected People (PAP)

Sl. No.	Type of Stakeholder Group Affected	Number of Affected People	Negative Impacts	Mitigation Measures
1.				
2.				
3.				
4.				

Note 1: If new impact issues other than those described above are identified during field visits and discussions with sub-project beneficiaries, affected groups and other stakeholders, these issues are to be recorded in separate sheets along with mitigation options suggested by them.

Note 2: If any environmental impact has serious adverse effects as per assessment of the beneficiaries, affected groups and other stakeholders, the PRA Team should recommend a detailed field investigation and should indicate this in its overall conclusions.

Stakeholders Involved in PRA Activities (Environment)

Name of union and villages (study areas):____

Sl. No.	Name	Village	Gender	Occupation	Signature	Date

EXHIBIT-5

Annex 5.1: PRA Report Format for Social Aspects

Proposed Subproject: ____________________ Union(s): __________________ Upazila: ___________ District: ________________

Type, number and percentage of stakeholder groups :

1.a Problems and Solutions Identified by Male Stakeholders

Stakeholder Group	**No. of Individuals Consulted**	**Stakeholders' Response/Comments**	
		Present Problems (highest and second highest priority)	**Proposed Solutions (for each problem mentioned)**
Landless (operating less than 0.5 acres). Livelihood mainly depends on manual labor.			
Small and Marginal Farmers (operating <2.5 acres)			
Medium-Large Farmers (operating 2.5 or more acres)			
Fishers and Boatmen			
Service holders and others			

1.b Problems and Solutions Identified by Female Stakeholders

Stakeholder Group	No. of Individuals Consulted	Stakeholders' Response/Comments	
		Present Problems (highest and second highest priority)	Proposed Solutions (for each problem mentioned)
Landless (operating less than 0.5 acres) Livelihood mainly depends on manual labor.			
Small and Marginal Farmers (operating <2.5 acres)			
Medium-Large Farmers (operating 2.5 or more acres)			
Fishers and boatmen			
Service Holders & Others			

2. Expected impact and reaction to the proposed subproject by stakeholders

Stakeholder Group	No. of Individuals Consulted	Male Response	Female Response
Landless (operating less than 0.5 acres) Livelihood mainly depends on manual labor.			
Small and Marginal Farmers (operating <2.5 acres)			
Medium-Large Farmers (operating 2.5 or more acres)			
Fishers and Boatmen			
Service holders and Others			

3.a Problems and Solutions Identified by Indigenous People

Indigenous Groups	**No. of Individuals Consulted**	**Stakeholders' Response/Comments**	
		Present Problems (highest and second highest priority)	**Proposed Solutions (for each problem mentioned)**

3.b Expected impact and reaction to the proposed subproject by Indigenous People

Indigenous Groups	**No. of Individuals Consulted**	**Male Response**	**Female Response**

4. History of cooperation among the people in the subproject area. Whether or not they have implemented any project/program (e.g. water resource, health and sanitation, etc.) using mainly their own resources. Or if they have contributed their resources (money, labor) to any government/private projects or programs. Give details

5. Major social conflicts in the area (within last 3 years)

Nature of Conflict (describe)	People/Groups Involved	Describe how it was resolved	Not yet resolved
a.			
b.			
c.			

6. Existing Groups or Organizations (government sponsored/voluntary/self help groups, women groups, youth groups, etc.) in Subproject Area. If any, mention name of group/organization, its objectives and activities

7. Inventory of Adult Landless and Destitute Men and Women in Subproject Area who are ready for earth work

Sl. No.	Name	M	F	Father's Name/ Husband's Name	Age	Village	Occupation			Land Ownership (acre)			Physical Strength		Earthwork Experience (Yes/No)	Marital Status* (M/S/A/ D/W/U)	HH Head?		No. of HH Members	No. of Earning Members	Remarks (Name of NGO, if any)
							HH Work	Day Lab.	Skill Lab.	Cultiv able	Others	Total	Weak	Strong			Yes	No			
	Total																				

* M=Married; S/A= Separated/Abandoned; D= Divorced; W=Widow (er); U=Unmarried

EXHIBIT-5

Annex 5.2: PRA Report Format for Women Aspect

Proposed Subproject: ____________________ Union(s): ___________________ Upazila: ___________ District: ________________
No. of Villages: __________

5.2.1 Non-Water Related Problems and Solutions Identified by Women

Women (Based on land ownership)	**Population**		**No. of Individuals Consulted**	**Stakeholders' Response/Comments**	
	No.	%		**Present Problems**	**Proposed Solutions (for each problem mentioned)**
Poor and landless and destitute					
Marginal and small					
Middle					
Big/Large					
TOTAL					

Number and Percentage of Women Headed Households: _______________________

5.2.2 Activities and Workload and Source of Livelihood

5.2.3 Mobility Status

Stakeholders Involved in PRA Activities (Social/Women)

Name of union and villages (study areas): ____

____

Sl. No.	Name	Village	Gender	Occupation	Signature	Date

EXHIBIT-5

Annex 6: Overall Conclusions of the PRA Team

Proposed Subproject: ________________________ Union(s): _________________ Upazila: ___________ District: ___________

1. Is there broad, popular support for the proposed subproject? (Quantify in percentage)

2. Is there any opposition to the proposed subproject, and if so, by whom, why and how many (number and %) people are against it?

3. Is the proposed subproject technically feasible?

4. What are the likely environmental impacts and what possible measures can be taken to mitigate negative impacts?

5. Are the beneficiaries willing to pay the first year's operation and maintenance cost (3% of earthwork, 1.5% of structures) before start of construction, form a Water Management Association, assist in land acquisition activity, and take full responsibility for operation and maintenance?

Date: ____________________ Names and Signature of PRA Team Members

____________________ ____________________ ____________________ ____________________ ____________________
(PRA Team Leader) (…………………………..) (…………………………….) (…………………………..) (…………………………)

EXHIBIT-5

Annex 7: Table of Contents of PRA Report

* One page for Executive Summary with one paragraph summarizing each of the 6 chapters. One page for Introduction to include when work order was issued, when team actually started PRA work, when debriefing session with stakeholders, XEN and UE was conducted and the PRA methods and tools used for the study.

EXHIBIT 6

FISHERIES SURVEY FORMS

EXHIBIT-6

Subproject Feasibility Study: Fisheries Field Survey and Data Collection

Subproject Name:

Upazila:

District:

Date of Survey:

Name and Designation of Surveyor(s):

PART-I: SUMMARY

A. Fisheries Resource Base and Production

A-1. Estimation on the basis of secondary data

Type of Water Body*	Area (ha)	Yield (kg/ha)	Production (ton)
F2 + F3			
Perennial Water Body			

* Water Bodies inundated by monsoon flood and likely to be affected by the project intervention (Part-IIA)
F2 +F3 = Seasonal Water body with at least 0.9 m of water depth standing for at least 4 months
Perennial Water Body = Lowland and permanent water body like Khal, Beel, Baor, Haor, River segment etc. holding water through the year.

A-2. Estimation on the basis of the field survey

Type of Water Body	Area (ha)	Yield (kg/ha)	Production (ton)
a. Seasonal Flood land**			
b. Beel, Baor, Haor			
c. Khal, River segment			
Total			

** Seasonal Flood Land = Seasonally flooded area of the flood plain with 0.5 m water standing at least for 4 months.

A-3. Particulars of public water bodies

Sl. No.	Type of Water Body	Name of the water body	Area (ha)	Lessee	Lease Value (Taka)	Lease Period From -To (year)

B. Fisheries Community

B-1: Fishers and Fish Farmers(operating within the sub-project area)

Category		Number of Household		Average Annual HH Income	Other Profession	No. of persons involved (# F)	Annual catch per person (Kg)
		Total	Female Farmer HH				
Genuine* Fisher	Ethnic(Hindu)						
	Neo-Fisher						
Subsistence Fisher							
Genuine Fish Farmer							
Subsistence Fish Farmer							

* **Genuine Fisher/ Fish Farmer**: Fulltime fisher/fish farmer spending most of his time in fishing/fish farming and earning livelihood mostly from fishing / fish farming.
Ethnic Fisher:Traditional Hindu fisherman or woman
Neo-Fisher: Fulltime fisher, mostly Muslims, who have adopted the profession in recent years
Subsistence Fisher/ Fish Farmer: Part time Fisher/Fish Farmer

C. Fisheries

C-1 Fish Species

i. Culture Species: (1) .... (2) .... (3) ....
(Name the species cultivated in the sub-project area, if any)

ii. Wild Species (Enclose the list as per proforma below)

Sl. No.	Local Name (with alternative local names)	English Name	Occurrence :1 =Very Common (50%) 2 =Common (25%) 3 =Rare (10%) 4 =Very rare (5%)

PART II: Particulars of Water Bodies

Type of Water Body a. Seasonal Floodland b. Beel, Baor, Haor c. Khal, River Segment d. Pond, Dighi, Ditch, Borrow Pit								
1. Name, if any								
2. Location (village)								
3. Recorded area (ha)								
4. Total Water Area (ha)								
a. Rainy Season (June-Sept)								
b. Dry Season (Jan-April)								
5. Depth (m)								
a. Rainy Season (June-Sept)								
b. Dry Season (Jan- April)								
6. Fisheries Production (ton/year)								
a. Fish								
b. Prawn (G-Galda,B-Bagda)								
c. Crab								
7. Lease Status								
a. Lessee								
b. Lease Period								
c. Lease value								
8. Seasonality I-Seasonal P-perennial								
9. Tidal Influence (Y/N)								
10. Flooding Source Khal-1, River-2, Other-3								
11. Mode of Fishing Single, Group, CBF								
12. Fishing period								
a. Seasonal (month)								
b. Round the year								
13. Fisheries Type a.Capture Fisheries, b. Culture-based Fisheries c. Culture								

14. Stocking Information								
a. Species stocked*								
b. Number per decimal								
c. Size (cm)								
15. Water Control Structure R-Regulator, S-Sluice, WRS								
16. Fish Passage Control Structure a. Fish- Screen b-Other								
17. Culture Status a-Cultivated b-Cultivable c-Derelict								
18. Type & Mode of Culture a-Monoculture b-Polyculture c-Traditional d-Managed e- Fish and Poultry f- Nursery g-Grow out								
19. Flooding Status a-Flood free b-Flood prone								
20. Mode and Method of Fishing a-Partial b-Total c-Netting d -Dewatering e-Self-fishing f-Contract fishing								
21. Source of Fingerlings a-Natural b-Hatchery raised c-Self collected of raised d-purchased e-Local f-Out sourced								
22. Ownership i-Public ii-Private iii-Institutional								
23. Effect of Project Intervention (Yes / No)								

Note: *Species 1.................. 2.............. 3.............. 4 ....5..........

EXHIBIT 7

SOCIO-ECONOMIC SURVEY FORM

EXHIBIT-7

Subproject Feasibility Study: Guidelines for Socio-Economic Field Survey

Important: These Guidelines should be read along with Chapter 6 - Social Analysis

In order to facilitate and ensure proper data collection, the Sociologist and his survey team, if applicable, should follow the step-by-step procedure presented below:

1.0 **Preparation of Index Map:** The Sociologist will prepare the Index Map (4″ to 1 mile topographic map) of the proposed subproject area using the topographic maps supplied from IWRMU, LGED.

In the preparation of the Index Map, the Sociologist will

a) Identify all villages inside the subproject boundary

b) List the names of all villages surrounding the subproject boundary whose land might be affected negatively by the water management structures of the subproject.

c) Identify on the map the major educational, religious, social, health care, cooperative, NGO, etc. organizations inside the subproject boundary.

2.0 **Collection of Preliminary Census Data:** The survey team will obtain preliminary census data on the subproject area by following this procedure:

a) Following the index map, the team will list all mouza and village geo-codes of villages included inside the subproject boundary.

b) The team will contact the Upazila Statistical Officer and request population counts and number of households by mouza and/or village geo-code.

c) The team will cross-check this information in the Union Parishad office and in the villages themselves. If the Upazila Statistical Officer cannot provide the information in the requested form, similar information should be requested from Union Parishad office.

3.0 **Collection of Information from Union Parishad:** The survey team will collect the following information from the Union Parishad:

a) Household counts, as a cross-check to previously obtained census data. For every village covered by the proposed subproject, obtain the following information from Union Parishad HH list maintained in the Tax Register:
- number of household
- number of people
- occupations of heads of household

c) Names of all governmental, NGO/institution doing group formation or micro-credit in the area, with specific villages where they work (data to be cross-checked in the villages)

d) Other institutions or organizations in the subproject area: schools, mosques, temples, clubs, VDP, cooperatives etc.

e) Are there any other rural development or special projects currently (or recently) operating in the subproject area or operated in recent years? Have there been any water management project/activities in recent years? Who planned and organized them? This information should be reported along with Table 4.

4.0 **Visits/Interviews:** The survey team shall visit every village inside the subproject boundary, collect field data from sample villages[1] and fill in the formats in the following manner:

a. Collect data from local people as indicated in the attached Tables.

b. Arrange two separate group discussions with villagers in every selected sample village at convenient times, and in village locations (not in market places). One group will consist of farmers with land more than 0.2 ha, and the other group will consist of landless people (owning less than 0.2 ha of land) and fishers, boatman (if present in the subproject area). At least 1/3 of the participants in one group should be women.

c. The required questions are indicated on the attached Tables 2 to 7. Each sheet has space for information on three villages. Additional sheets should be used as needed. After village-by-village information is collected, a summary report on all findings should be prepared. This summary report and all back-up field notes (filled-in tables) will become part of the permanent subproject file.

d. If the persons met inside or outside the subproject boundary make positive or negative remarks about the proposed structure or other subproject plans, these remarks should be documented village-by-village and this information should be included in the notes. (See Table 5 for people inside subproject boundary, and Table 6 for people outside)

e. After making a list of villages outside the proposed subproject boundary, visit all villages that appear to have land, water bodies, or houses affected negatively by the water management structure. In particular, the following villages outside the subproject boundary should be visited:

   - a village/villages downstream of the subproject area. On the map these will be located at the outlet of a khal or otherwise having water draining out into their areas.
   - any village with land between the proposed embankment and a river or other large water body.

f. The purpose of the visits to the villages outside of the proposed subproject boundary is to determine whether or not there are people in the vicinity who might be negatively affected by the proposed subproject. The remarks should be documented village by village (Table 6). For example, are there houses near a proposed embankment that might be flooded in the rainy season? Are there lands that would be water-logged or deprived of needed water? If Table 6 shows negative impacts on the people living outside the subproject, then Table 7 should be filled to collect additional information about the negative impact outside of subproject boundary, and occupational profile of negatively impacted people.

[1] Selection of sample villages presented in Section 6.2

Socio-economic Field Survey Forms

Subproject Name :

Upazila :

District : Date of Survey:

Name and Designation of Surveyor(s):

Table 7.1: Inventory of Villages

No.	Village Name	Union	No. Households	Total Population	Date(s) Visited
Villages inside the subproject area					
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					
11.					
12.					
13.					
14.					
15.					
Villages outside the subproject area					
1.					
2.					
3.					
4.					
5.					
6.					
7.					

Explain rationale for selection of sample villages

-- attach necessary pages ---

Any additional comments

-- attach necessary pages ---

Table 7.2: Farm Size Distribution and Household Occupation of Sample Villages
Person interviewed: Group of Farmers with land > 0.2 ha <u>inside</u> SP boundary

Village Names		1.	2.	3.	Totals
7.2.1	People interviewed (groups)	Number of Males:__ Number Females:__ Total:_____	Number of Males:__ Number Females:__ Total:_____	Number of Males:__ Number Females:__ Total:_____	Number of Males:__ Number Females:__ Total:______
7.2.2	Total number of HH in village				
7.2.3	In this village, number of a) Households entirely depending on agricultural production for income (Farm) b) Households with farm and other occupations (mixed Farm/non-Farm) c) Households entirely dependent on non-farm occupations (Non-Farm)				
7.2.4 7.2.4 7.2.4	a) Is most of the land owned by a few households? b) Are most of the farmland operated by landless, sharecropper, marginal and small land owners? Or c) What (estimated) percentage of land is operated by landless, sharecropper, marginal and small land owners?				
7.2.5	What (estimated) percentage of land is owned by people living elsewhere but not within the subproject? (Name other villages where land owners live)				
7.2.6	What (estimated) number/percentage of farmers in this village sharecrop or lease-in some/all of their farm land?				
7.2.7	Who owns / lease water bodies in side subproject, if there is/are any?				

Village Names		1.		2.		3.		Totals	
	Farm Landholdings	No.	%	No.	%	No.	%	No.	%
7.2.8	Landless/functionally landless: < 0.2 ha (< 50 decimal)								
7.2.9	Marginal farmer: 0.2 – 0.5 ha (50 to 125 decimal)								
7.2.10	Small-holder: 0.5 – 1 ha (126 to 250 decimal)								
7.2.11	Medium-size holder: 1 - 2 ha (251 to 500 decimal)								
7.2.12	Large-size holder: > 2 ha (more than 501 decimal)								
7.2.13	**Farmers: Total**								
	Primary Occupation / Income Source of Households	No.	%	No.	%	No.	%	No.	%
7.2.14	Daily-paid Agricultural Labor								
7.2.15	Other daily-paid work: Laborers, Household Maids, Earth Workers								
7.2.16	Traditional Fisher (fishing in rivers or beels etc. only)								
7.2.17	Agricultural Farming								
7.2.18	Poultry, fisheries, dairy								
7.2.19	Medium-Large Business, Trade, Transport, Boat owners								
7.2.20	Small-scale Business, Trade								
7.2.21	Transport (Rickshaw/Van puller), Boatmen								
7.2.22	Others (In Service, Retired, Foreign Remittances)								
7.2.23	Unemployed								

Village Names		1.		2.		3.		Totals	
7.2.24	**Primary Occupations: Total**								
7.2.25	How many people earn money from fishing only part-time, or only in certain seasons?								
7.2.26 a	What is the average agricultural day labour wage in peak period ?	Male…….. Fem………		Male….. Fem……..		Male……..Fem…….			
7.2.26 b	What is the average agricultural day labour wage in lean period?	Male…….. Fem………		Male….. Fem……..		Male……..Fem…….			

Comments on willingness to form a multi-purpose cooperative society

-- attach necessary pages ---

Comments on willingness to pay the cost of annual O&M

-- attach necessary pages ---

Table 7.3: Household Occupation, Employment, Poverty Level, etc. Inside Sample Villages
People interviewed: Group of Landless People (land < 0.2 ha), Fishers, Boatmen living inside the proposed subproject boundary

	Village Name	1.		2.		3.		**Total**	
7.3.1	People interviewed (groups)	Male number= Female number= Total=		Male number= Female number= Total=		Male number= Female number= Total=		Male number= Female number= Total=	
7.3.2	**Total number of HH in village**								
7.3.3	Is the majority of land here: a) Owned by a few households, or b) Are most farms managed by small/medium owners?								
	In/Out Migration	No.	% of total	No.	%	No.	%	No.	%
7.3.4	How many men migrate-**out** for work during some part of the year?								
7.3.5	How many men migrate-**in** for work during some part of the year?								
7.3.6	Do any women migrate-out for work?								

	Primary Occupations of Household Heads	Number	%	Number	%	Number	%	Number	%
7.3.7	Daily-paid Agricultural Labor								
7.3.8	Other daily-paid work: Laborers, Household Maids, Earth Workers								
7.3.9	Traditional Fisher (fishing in rivers or beels etc. only)								
7.3.10	Agricultural Farming								
7.3.11	Poultry, fisheries, dairy								

7.3.12	Medium-Large Business, Trade, Transport, Boat owners								
7.3.13	Small-scale Business, Trade								
7.3.14	Transport (Rickshaw/Van puller), Boatmen								
7.3.15	Others (In Service, Retired, Foreign Remittances)								
7.3.16	Unemployed								
7.3.17	**Occupations: Total**								

7.3.18a	What is the average agricultural day labour wage in peak period ?	Male…….. Fem………	Male….. Fem……..	Male……..Fem…….	
7.3.18b	What is the average agricultural day labour wage in lean period?	Male…….. Fem………	Male….. Fem……..	Male……..Fem…….	
	Household Economic Status Information				
7.3.19	How many households depend entirely on agricultural/day labor for their income?				
7.3.20	How many poor women in this village are earning income or seeking work?				
7.3.21	How many poor female-headed households are there in the village?				
7.3.22	What is the normal payment for a woman doing household labor?	Amount: Per (day/week/month):	Amount: Per (day/week/month):	Amount: Per (day/week/month):	Amount: Per (day/week/month):
7.3.23	What is the normal payment for a woman doing earth works?	Amount: Per (day/week/month):	Amount: Per (day/week/month):	Amount: Per (day/week/month):	Amount: Per (day/week/month):

Village Name		1.		2.		3.		Total	
		Number	%	**Number**	**%**	**Number**	**%**	**Number**	**%**
7.3.24	How many households under poverty line income are there in this village? [Poverty line income = Tk........../.......	Number:		Number:		Number:		Number:	
7.3.25	How many of these poor households send their children to elementary school?								

Comments on willingness to form a multi-purpose cooperative society

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-- attach necessary pages ---

Comments on willingness to pay the cost of annual O&M

-- attach necessary pages ---

Table 7.4: Present Levels of Involvement and Cooperation of Local People in Local Organizational / Institutional Activities

Ask various groups and individuals the following question (add extra pages as necessary): What *samitis* exist in the village? Governmental/NGOs, for example: BRDB, BSS, BRAC Agricultural or other cooperatives, etc.

	Village Name	1.	2.	3.
	Organization Names	Organization Activities (involvement of local people in organization activities)	Organization Activities (involvement of local people in organization activities)	Organization Activities (involvement of local people in organization activities)
7.4.1				
7.4.2				
7.4.3				
7.4.4				
	Comments: Respondent's comment on the prospect of forming an organization.			

Additional information : Rural development or special projects currently (or recently) operating inside subproject area, Water management project/activities in recent years, who planned and organized them, etc.

-- attach necessary pages ---

Comments on willingness to form a multi-purpose cooperative society

-- attach necessary pages ---

Comments on willingness to pay the cost of annual O&M

-- attach necessary pages ---

Table 7.5: Opinion of People Living <u>Inside</u> SP Boundary: In Favor or Against the Proposed Subproject

<u>Instructions</u>: Record any comments, opinions or conflict within the community group and leadership. Any notes will help to supplement the findings of the PRA team. Write what people express spontaneously. Use extra pages if necessary.

Comment/Opinion	**Expressed by Person(s) of Which Village(s)?**	**Category of Person(s) with this opinion (Farmers, Landless, etc.)**
7.5.1		
7.5.2		
7.5.3		

Comments on willingness to form a multi-purpose cooperative society

-- attach necessary pages ---

Comments on willingness to pay the cost of annual O&M

-- attach necessary pages ---

Table 7.6: Opinion of People Living <u>Outside</u> SP Boundary: In Favor or Against the Proposed Subproject

<u>Instructions</u>: Record any comments, opinions or conflict within the community group and leadership. Any notes will help to supplement the findings of the PRA team. Write what people express spontaneously. Use extra pages if necessary.

Comment/Opinion or negative impact	**Expressed by Person(s) of Which Village(s)?**	**Category of Person(s) with this opinion (Farmers, Landless, etc.)**
7.6.1		
7.6.2		
7.6.3		

Table 7.7: Negative Impact Outside of Subproject Boundary and Occupational Profile of Impacted People

Remark: Table 7 is only required if Table 6 shows negative impact.

Instructions: Meet with one or two groups in each selected village. The purposes of these meetings are: (a) to obtain an occupational profile of each selected village, and (b) to learn of the existence of lands, water bodies, or residential areas that might be affected by the proposed project. Document comments, and who said them, in the following columns village-by-village. Use extra pages if needed.

	Name of Village	**1.**		**2.**		**3.**	
7.7.1	Number of Persons Interviewed	Number of men: Number of women: Total:		Number of men: Number of women: Total:		Number of men: Number of women: Total:	
7.7.2	Total number of households						
7.7.3	Estimated population						
	Local Households	No.	%	No.	%	No.	%
7.7.4	Farm Households: Depend entirely on agricultural production for income						
	Mixed Farm/Non-Farm Households: Do farming together with other occupations						
	Non-Farm Households						
	Total		100%		100%		100%
7.7.5	Traditional Fishermen (fishing in rivers, beels, haor)						
7.7.6	How many earn income from fishing part-time or seasonally?						

Name of Village (Continued)		1.	2.	3.
7.7.7	Ask the following general questions: a) Are you aware of the plan that [*name of subproject area*] is to improve their local water management? b) Show a map and explain: This is the boundary of the area they plan to establish.			
7.7.8	c) Ask: Who owns or lease lands and water bodies downstream of subproject?			
7.7.9	d) Ask: Who owns lands/water bodies along side subproject?			
7.7.10	e) Do you expect that their plan will affect your village lands, water bodies, or houses in any way?			
7.7.11	f) Ask: What is your opinion of this proposed plan?			

EXHIBIT 8

INVENTORY OF SUBPROJECT BENEFICIARIES

EXHIBIT-8

উপ-প্রকল্পের আওতাধীন উপকারভোগীদের তালিকা (List of Beneficiaries under Subproject)

উপ-প্রকল্পের নাম্বার (Subproject No.) ঃ	ইউনিয়ন সংখ্যা (Number of Union) ঃ
উপ-প্রকল্পের নাম (Subproject Name) ঃ	গ্রাম সংখ্যা (Number of Village) ঃ
উপজেলা (Upazila) ঃ	এলাকা (Total Area) ঃ
জেলা (District) ঃ	উপকৃত এলাকা (Benefited Area) ঃ

ক্রমিক নং Sl.No.	নাম Name	পিতার নাম Father's Name	গ্রাম Village	পেশা Occupation	আয়ের অন্যান্য উৎস Other Source of income	জমির পরিমান (শতাংশ/একর) Amount of Land (Decimal/Acre)	মৌজা Mouza
১.	২.	৩.	৪.	৫.	৬.	৭.	৮.

কমুনিটি এসিসটেন্ট
Community Assistant

কমুনিটি পার্টিসিপেশন অফিসার
Community Participation Officer

সহকারী প্রকৌশলী, এলজিইডি
Assistant Engineer, LGED

অতিরিক্ত শীট ব্যবহার করা যাবে।

EXHIBIT 9

GUIDELINES FOR ENVIRONMENTAL ASSESSMENT

EXHIBIT-9

GUIDELINES FOR ENVIRONMENTAL ASSESSMENT OF SSWRD SUBPROJECTS

Background

The JICA supported Small Scale Water Resources Development Project (SSWRDP) in Greater Mymensingh, Sylhet and Faridpur areas consists of 15 districts. The main objective of the project is to achieve sustainable agricultural development through institutionalization of stakeholders for integrated management of water resources. The project includes implementation of 200 subprojects of different categories having benefited areas of 50-1000 ha each by rehabilitation and/or upgrading of existing water management systems. The identified subproject types are water conservation (WC), drainage improvement (Dr), flood management (FM), and command area development (CAD). The major physical interventions in respect of these four types of subprojects will be re-excavation of khals, rehabilitation/construction of embankments, and construction of water management structures like sluices, regulators, water retention structures, weirs, etc. The SSWRDP is funded by JICA and the Government of Bangladesh (GoB). The Local Government Engineering Department (LGED) of the GoB is the implementing agency of the project. The estimated total project cost is JY 7,538 million (Tk. 4,541 million). The time frame for the project is 2008-2013.

The policy of JICA is to promote environmentally sustainable economic development in developing countries using Japanese assistance. In order to implement this policy, JICA has formulated some guidelines for environmental assessment of its' projects. The document is intended to protect environment in its projects. The environment policy of the GoB governed by the Department of Environment (DoE) requires Initial Environmental Examination (IEE) for all projects and Environmental Impact Assessment (EIA) for only red listed projects that include projects involving construction of road, embankment, etc.

All projects are classified from environmental point of view into three different categories as following.

Category A: Projects expected to have significant adverse environmental impacts. An EIA is required to address the significant impacts in such projects.

Category B: Projects judged to have some adverse environmental impacts, but of lesser degree and/or significance than those for Category A projects. An IEE is required to determine whether or not significant environmental impacts warranting an EIA are likely. If an EIA is not needed, the IEE is regarded as the final environmental assessment report.

Category C: Projects unlikely to have adverse environmental impacts. No EIA or IEE is required, although environmental implications are still reviewed.

Most of the subproject types of SSWRDP namely Dr, WC, and CAD are likely to fall under category-B and therefore environmental assessment will require conduction of an IEE to determine any significant environmental impact for warranting another step for an EIA. In absence of any significant environmental impact the IEE will be regarded as the final environmental assessment report. A few of the subprojects of SSWRDP, namely those that involve rehabilitation/construction of embankment will fall under category-A. Therefore these types of subprojects will require a full scale EIA to fulfill the conditions set by GoB as well as JICA.

A monitoring program for two important environmental indicators namely water quality and bio-diversity for a group of representative sample subprojects (approximately 10-15) based on each agro-ecological zone and subproject type will have to be carried out for a minimum period of 5 years. A set of baseline data will have to be collected before starting operations of the subprojects and the same are to be followed and compared with those collected during operation stage. The results of monitoring will then be analyzed and evaluated for designing the required appropriate protective measures against any adverse impacts.

In addition, implementation of a common program for the protection and enhancement of natural resources and its habitat will be necessary for all proposed subprojects. This will facilitate environmental sustainability of the project development initiatives and at the same time it will enhance natural resource base in the concern subproject locality. This common program will include the following.

- Integrated pest management (IPM) training for the farmers
- Use of LGED environmental laboratory and training of WMCA for water quality impact monitoring of subprojects.
- Agricultural land soil analysis and soil fertility dose fixation for the farmers
- Environmental awareness raising through education and training for the stakeholders and
- Fishery production training for the professional fishermen and fish farmers.

Details about the common program are described in Appendix A.

These environmental guidelines for the subprojects of SSWRDP are subject to modification using new experiences from the field, if any, during implementation and post implementation period of individual subprojects.

ASSESSMENT OF ENVIRONMENTAL FEASIBILITY

The entire process of environmental feasibility assessment in respect of individual subprojects of SSWRDP will have to be completed following the three steps described below.

Step-1: Reconnaissance Visit and Scoping of Important Environmental Components (IECs)

Reconnaissance visit is to be undertaken by a multidisciplinary team comprising water resources engineer, agriculturist, fishery specialist, environmentalist and sociologist of the contracted consulting company. The IWRMU Environmentalist is to accompany the team, whenever possible, following screening and identification of the proposed subprojects. The concerned Executive Engineer and Upazila Engineer of LGED are to coordinate the field program and assist in arranging reconnaissance trip to the subproject sites.

Before starting for field visits the reconnaissance team is to receive two days orientation training on environmental field survey methodology through beneficiary participation process. The training also will cover environmental impact data collection and analysis, IEE/EIA report preparation, and benchmark data collection for environmental impact monitoring program. The reconnaissance team must carry the proposed subproject index map prepared on the basis of available Upazila Base Map, Topo Map, Mouja Map and Water Resources Planning Map (4″to 1 mile scale) from LGED, Survey of Bangladesh and/or Bangladesh Water Development Board. In order to gain a quick impression about the subproject environmental conditions, the sub-project index map must indicate exact locations of river, khal, beel, baor, haor, water flow directions, natural forests, plantations, etc., along with the settlements, roads, bridges, culverts, and community places in and around the subproject area. Following reconnaissance, the same team is to start a scoping process from field observations and local people's opinion, and finally select the important environmental components (IECs) of the concerned sub-project and simultaneously prepare a note sheet of the same to take into account for impact survey in the next step.

Step-2: Collection of Field Information for IEE/EIA and Data for Impact Monitoring

The field information and benchmark data for impact monitoring are to be collected by the multidisciplinary reconnaissance team following separate questionnaires in respect of water resources, agriculture, fishery, socio-economics, and environmental issues. A set of structured questionnaires will be developed in Bangla and these should cover all aspects of environmental issues as outlined in the recommended IEE and EIA report formats. A sample questionnaire for field information collection for IEE of the subprojects of SSWRDP is presented in Appendix B. Same questionnaire is subject to adjustment in line with subproject area, type and other local conditions.

The answers to the questions relevant to the selected IECs, as noted down in Step-1 above, are to be checked-in first with ticks in respect of Yes/No/Unknown from pre-arranged group discussions with beneficiaries and affected groups at environmentally sensitive/important sites of the village. Following this exercise, more questions are to be put to collect detailed information and record those in appropriate boxes provided in the questionnaire sheets. Information sheet for the sub-project area and adjacent area are to be filled-in separately, with one sheet provided for each village. For example, if the subproject area consists of four villages then four separate sheets (Sheet No. 1,2,3,4) are to be filled-in. However, in case of subprojects with more than 4 villages the representative villages are to be chosen before starting the data collection process. Selection of representative villages will depend on field observation, discussion with the local people and secondary source information about environmentally sensitive / important sites. The collected information and data are to be cross checked with the survey results from another independent specialist team, the PRA team, consisting of professionals deployed by contracted PRA Firms/NGOs. The PRA findings should come from at least two consultation meetings with both beneficiaries and affected groups in each environmentally sensitive site of the proposed subproject.

Step-3: Analysis of Impacts and Preparation of IEE/EIA Report

The multidisciplinary team of the consulting company will then combine the individually completed questionnaires into separate sheets for the subproject area and adjacent area. An objective assessment of impacts for the sub-project area is to be made upon completion of a qualitative evaluation of the potential impact of the IECs based on their field observations, PRA findings, and available secondary source information. If the assessment results indicate no potential adverse impact, no mitigation plan will be required. But, in case of any negative impact, an environmental management plan (EMP) will have to be developed taking into consideration the magnitude of adverse impacts and their possible mitigation measures. The Mitigation Measures Table shown in Appendix E should be consulted while formulating the EMP. This step will reduce the degree of adverse impact and in such case the remaining impact will be taken as residual impact. Finally, based on the overall results of impact assessment and mitigation measures, if any, the IEE/EIA report is to be concluded as a draft report for environmental feasibility of the proposed subproject. The draft report is to be reviewed by the Project Consultant Environmentalist for any correction or modification and will be finalized from environmental point of view upon consultation with the reconnaissance team and the IWRMU, LGED.

For adjacent area, following an objective assessment of the negative impacts based on the collected field information and PRA report, mitigation measures are also to be formulated consulting the Mitigation Measure Table (Appendix E) and the same are to be included in the IEE/EIA Report.

The structure of the IEE Report and EIA Report as recommended is shown in Appendix C and Appendix D, respectively. The same structure will have to be followed in IEE/EIA report preparation for environmental feasibility study of proposed subprojects under the SSWRDP.

IMPACTS MONITORING AND EVALUATION

Water Quality Impact Monitoring

The activities of SSWRDP can have either positive or negative water quality impact. For example, in drainage type subprojects, quick disposal of stagnant and polluted water is likely to improve water quality. On the other hand, early drainage will create scope for one more crop production leading to increased use of fertilizer and pesticides thereby deteriorating water quality condition. So, monitoring of water quality impact and adoption of necessary protective measures against any adverse situation will be necessary for the sustainability of the subproject activities.

Two monitoring sites in each subproject, one for surface water quality and the other for ground water quality will have to be selected. A representative number of sample subprojects are to be included under water quality changes monitoring program on the basis of hydrological zones, agro-ecological zones, districts/greater district as well as subproject types. The water quality parameters to be monitored are: pH, dissolved oxygen, salinity, electrical conductivity, nitrate, phosphate, arsenic, faecal coliform bacteria and total hardness. The program will be implemented in-house by using the resources and facilities of the LGED environmental laboratories within or nereby the project area districts.

The scopes of this impact monitoring will be as follows.

* Formulation of appropriate mitigation measures in respect of harmful water quality impact
* Protection of the water resources and aquatic habitat including fish from pollution effects
* Sustenance of the development activities in agriculture sector
* Contribution to the national water quality database

Bio-diversity Impact Monitoring

The haor basins of Sylhet and Mymensingh districts are very rich in biodiversity and therefore carry great ecological and commercial values, both nationally and internationally. But the resources of these wetlands are now under serious degradation due to over exploitation of natural aquatic resources. Implementation of SSWRDP in these areas may accelerate this degradation process if not mitigated properly. So, a biodiversity monitoring program especially fish bio-diversity, needs to be carried out to correlate any impact with the SSWRDP physical interventions and to formulate the protective-cum-mitigation measures.

Four EFM/FCD subproject sites in the haor basins, two in greater Sylhet area and two in greater Mymensingh area will have to be selected. The monitoring program needs to be contracted out to an NGO experienced in wetland surveys and studies.

The scopes of bio-diversity impact monitoring will be as follows.

* Identification of key indicator species for the local ecosystem at the selected sites
* Establishment of EFM/FCD subproject impacts on wetland characteristics, specially, fish bio-diversity
* Selection of suitable sites for establishing fish sanctuary / conservation areas
* Inventory list of common, rare, endangered and threatened flora and fauna species in the survey sites.

Appendix A

Issues of Environmental Sustainability

Integrated Pest Management (IPM) Training

Rationale / Objective

Use of pesticides is very common in Bangladesh. Carcinonogenic, bioaccumulative, and stable type of organochlorine pesticides such as, aldrin, endrin, heptachlor, DDT, etc. are frequently used in HYV rice, potato, and sugar cane cultivation. These pesticide chemicals easily destroy the natural habitats and create imbalance in the ecological system. The SSWRDP is expected to intensify agricultural production through introduction of pest sensitive high yielding variety crops. So, it is likely that the project will have an adverse impact on the environment through increased application of pesticides. So, mitigation measures are to be taken to minimize these negative impacts. The local farmers can best achieve this mitigation through integrated pest management (IPM) training and practice. The IPM training program is already well established in the ongoing SSWRDSP.

Scope

* Application of biological pest control method
* Conservation of beneficial predators and their habitats
* Protection of natural resources and their habitats from environmental degradation
* Cost effective agricultural production

Cooperation

Department of Agricultural Extension (DAE)

Environmental Laboratory

Rationale and Objective

LGED is implementing SSWR subprojects since 1995 and by now has implemented some 600 subprojects throughout the country. This JICA assisted SSWRDP in greater Mymensingh, Sylhet and Faridpur areas will implement about 200 new SSWR subprojects. Similar projects will come for implementation in future also. Water management interventions may impact water environment, particularly the water quality aspect, negatively. For example: keeping water conserved / confined in a closed stagnant condition for long time as in FMD and WC subprojects may alter the quality of water, increased crop production through improved water management involves increased use of chemical fertilizer and pesticide that deteriorate water quality, etc. Increased crop production and use of chemical fertilizers impact soil quality also. Thus, it is important that environmental laboratories are established in areas where water resources development and management projects are implemented, particularly, to monitor water and soil quality changes as an impact of the project.

Locations

LGED has established 5 Regional Environmental Laboratories at Barisal, Khulna. Rangpur, Mymensingh and Comilla. These Regional Laboratories provide facilities for a wide range of water and soil quality tests. The JICA assisted SSWRDP will be supported by the Mymensingh (within project area) and Comilla (near greater Sylhet area) and Barisal/Khulna (for greater Faridpur area) Regional Laboratories. Besides, 21 District LGED Laboratories including 5 Project districts (Sylhet, Mymenisngh, Tangail, Jamalpur and Faridpur) have mobile Kits for performing selected water (Dissolved Oxygen, pH, Arsenic, etc) and soil (N-P-K) quality tests.

Scope

* Enhancement of departmental capability in analytical laboratory works
* Water and soil test performance required by the different project activities
* Skill development of engineers and material testing laboratory staff in analytical methods
* Income generation through customer service facilities in analyzing water and soil samples

Co-operation

Department of Environment (DOE); Department of Soil Science, University of Dhaka; ICDDR'B Laboratory, Dhaka

Soil Analysis and Soil Fertility Level

Rationale / Objective

Best management practices in agriculture depends on sustainable soil productivity, which can be achieved through extension services to the farmers for regular analysis of soil samples for nutrient levels, organic carbon, moisture, etc., and fixation of required fertilizer doses and pesticides.

Area
Twenty sample sites in each subproject

Scope
* Fertilizer dose recommendation for the farmers
* Balanced fertilizer use in agricultural lands
* Regular checking of soil nutrient level changes

Cooperation
Soil Resources Development Institute (SRDI) for soil sample analysis and Department of Soil, Water and Environment, University of Dhaka for training Agriculture Facilitators (Project staff) and Laboratory Technician (LGED Staff).

Environmental Education and Training

Rationale / Objective
Active participation of the stakeholders during all stages of planning, construction, operation, and maintenance is the key for sustaining any development project. Subprojects of the SSWRDP will be handed over to the stakeholders upon successful completion and one-year trial operation and maintenance. So, it is important that the stakeholders are not only trained in structure operation and maintenance but their knowledge is also enhanced in respect of wise use of sensitive ecosystems.

Area
WMCA members and general beneficiaries in all subprojects.

Scope
* Environmentally sustainable use of all natural resources
* Care taking of natural resources by resource users
* Protection of conserved forests, wetlands, rare/endangered species, etc.
* Enhancement of bio-diversity and maintenance of ecological balance
* Implementation of country's environmental safeguard policies and compliance with the environment conservation rules.

Co-operation
Department of Environment (DoE) ; IUCN – The World Conservation Union.

Tree Plantation Program

Rationale / Objective
A countrywide tree plantation program is ongoing in Bangladesh for the last few years. The SSWRDP will create scope for plantation beside embankments, khals, and at water control

structure sites. So, all the subprojects of the SSWRDP should include compulsory tree plantation program with the objective of economic benefit for the WMCA members local landless people in particular the poor women as well as contribution to the national economy. The proposed tree plantation program is already well established in SSWR development subprojects through earlier SSWRD Sector Projects.

Location

Berms of embankments, banks of khals, and water regulatory structure sites in all subprojects of the SSWRDP.

Scope

* Supply of food, medicine, fuel, and materials for house construction for the rural community
* Providing effective protection to the embankment, khal, and structure sites from air/wave erosion
* Enhancement of plant bio-diversity thereby providing shelter for birds as well as preservation of ecological balance
* Economic benefit to the poor and destitute women and WMCA members.

<u>Fish Production Training</u>

Rationale / Objective
In FMD and Dr subprojects there is a possibility of partial loss in fish production within floodplain areas. So, the people engaged in monsoon fishing are likely to be affected in these two types of subprojects. Some sort of training such as, rice-fish culture in floodplains, fish culture in ponds, fingerling production in borrow pits, establishment of fish hatchery, etc. will compensate this partial loss and at the same time will improve overall livelihood of both professional and subsistence fisher people.

Area
All subprojects of the SSWRDP with potentiality for fish culture.

Scope
* Compensation for partial loss of fish catches from floodplain areas
* Development of skill among fisher/fish farmer people in fish production technology
* Availability of fingerlings for fish culture from local hatchery/nursery ponds
* Development of community based fishery extension agent.

Co-operation
Department of Fisheries (DOF) and Fisheries Research Institute (FRI) Mymensingh will conduct the training.

Appendix B
Sample Questionnaire for Field Data Collection

Name of the Sub-project:	Sub-Project ID Number :
Location (UP/Upazilla/Dist):	Name of Villages :
Area of the Sub-project :	Population (2001census) :
Main River/Khal :	Catchment Area of River/Khal :
Length of Navigable Route:	Irrigated Land Area :
Land Elevation/Topography:	Soil Type/Texture :

A.1 Sub-Project Area Information (Sheet No…..)

A.1.1 Physical Environment

A1.1.1	Flood Regime	
Q.1	May the sub-project implementation bring any change in the high flow regime of any river/khal in and around the area?	Yes/No/Unk
	If yes, name the river/khal and give peoples comment about the present situation and expected changes.	
A1.1.2.	Ground Water Table	
Q.2	May the sub-project cause a fall or rise of ground water table inside and/or outside the area?	Yes/No/Unk
	If yes, give your comments about the impact on drinking water well, STW, DTW, wetland, etc., and on water logging in low lying agricultural lands.	
A1.1.3	Water Quality	
Q.3	May the sub-project activity influence present water quality status either obstructing or creating flushing provision?	Yes/No/Unk
	Give comments about present status and possible impact on water quality.	
A1.1.4	Water logging and Siltation	
Q.4	May there be any water logging or siltation problem due to sub-project activities?	Yes/No/Unk
	If yes, describe the present situation and give ideas about possible water logged area in km^2 and length of silted water way/canal in km.	
A1.1.5	Soil Characteristics / Fertility	
Q.5	May the sub-project implementation obstruct natural replenishment of flood plain agricultural soil or require topsoil cut from fertile land?	Yes/No/Unk
	If yes, give the present status of soil fertility and put local people's comments about the impact and mitigation suggestion, if any.	

A1.2 Biological Environment

A1.2.1	Aquatic Habitat	
Q.6	May the subproject bring any change to the wetlands (beel/haor/depression/lake/ river/khal) in the area?	Yes/No/Unk
	If yes, name the wetland and it's present condition. Describe how it can be changed, and mitigation suggestion, if any, in case of adverse impact.	
Q.7	Is there any habitat for aquatic lives, which can be affected by the subproject?	Yes/No/Unk
	If yes, describe how it can be affected and give comments on possible impact on habitat species.	
A1.2.2	Terrestrial Habitat	
Q.8	May the subproject change ecosystem of any natural forest or significant terrestrial habitat for bird, animal etc.?	Yes/No/Unk
	If yes, name the terrestrial habitat. Describe how it can be affected and mitigation suggestion, if any, in case of adverse impact.	
A1.2.3	Fisheries	
Q9	May the subproject activities reduce natural fisheries production by preventing fish migration and/or disconnecting breeding ground for them?	Yes/No/Unk
	If yes, give an estimate of the loss of production compared to the present situation and include mitigation suggestion, if any, from the beneficiaries.	
Q10	May the subproject activities directly or indirectly change artificial fisheries situation and its associated activities?	Yes/No/Unk
	If yes, describe present situation of aquaculture. Give an estimate of the loss of production and mitigation measure, if any, from the beneficiaries.	
A1.2.4	Biological Diversity	
Q11	May the subproject activities affect any rare, endangered, or threatened plant or wildlife species in and around the area?	Yes/No/Unk
	If yes, name the species, describe present status and make suggestion how it can be preserved.	
A1.2.5	Eutrophication	
Q12	May the subproject implementation create anaerobic condition or eutrophication, in any of the water pools, ditches, borrow pits, etc.?	Yes/No/Unk
	If yes, state local people's comment and suggestion about how it can be managed.	

A1.3 Social Environment

A1.3.1	Land Acquisition	
Q13	May the subproject implementation require land acquisition?	Yes/No/Unk
	If yes, give the type and approximate area of land to be acquired as well as the number of landowners affected.	
A1.3.2	Agricultural Development	
Q14	May the subproject implementation lead to more crop production with increased land for boro and rabi cultivation, crop diversification, etc.?	Yes/No/Unk
	If yes, describe the present situation and estimated production, area of land increase, and name of the crops.	
A1.3.3	Accessibility and Employment	
Q15	May navigation /boat communication system be interrupted by the subproject activities?	Yes/No/Unk
	If yes, give approximate length of present navigation route, expected changes and period of interruption.	
Q.16	May the subproject activity promote accessibility resulting in growth center development and employment opportunity in the area?	Yes/No/Unk
	If yes, describe the present situation and expected changes from the comments of beneficiaries.	
A1.3.4	Health and Nutrition	
Q.17	May there be any change in disease incidences in the area as a result of subproject implementation?	Yes/No/Unk
	If yes, describe the prevalent diseases, especially water related, in the area and mention the type and degree of change anticipated.	
Q.18	May the subproject implementation directly or indirectly affect nutrition in the area?	Yes/No/Unk
	If yes, give your comments about how it can be affected and to what extent.	
A1.3.5	Community Impact	
Q.19	May the subproject cause increase in unemployment in any professional community?	Yes/No/Unk
	If yes, name the community and their suggestion for mitigating the problem.	
A1.3.6	Cultural Values	
Q.20	Is there any historical / archaeological site, or recreation / tourism spot which may be affected due to subproject implementation?	Yes/No/Unk
	If yes, name the site and provide suggestion for mitigation.	

A.2 Adjacent Area Information (Sheet No…..)

Name of the Village: Area of the Village:
Location (UP/Thana/Dist) : Population (2001… census):

Q.1	Is the village a flood prone area? If yes, mention the period of last flood, its source, and consequences.
Q.2	Is there any disaster shelter center in the area? If yes, how many, where it is located, and did people take shelter during the last flood? Did they receive any flood disaster management training?
Q.3	Give local people's comment in respect of any risk, like flood, water scarcity, obstacle to boat movement, epidemics, etc., or any other type which can appear as a result of sub-project implementation and their suggestions to mitigate any such problems.
Q.4	Give local people's comments in respect of any positive impact like, more agricultural and fisheries production, better accessibility, employment opportunity, agro-industrial development, etc., that can be developed as the result of subproject implementation.

Appendix C

IEE Report Format[1]

A. Introduction

1. This section usually will include the following:
   - (i) Purpose of the report, including (a) identification of the project and Project Proponent; (b) brief description of the nature, size, and location of the project and of its importance to the country; and (c) any other pertinent background information.
   - (ii) Extent of the IEE study: scope of study, magnitude of effort, person or agency performing the study, and acknowledgement.

B. Description of the Project[2]

2. Furnish sufficient details to give a brief but clear picture of the following (include only applicable items):
   - (i) Type of project
   - (ii) Category of project
   - (iii) Need for project
   - (iv) Location (use maps showing general location, specific location, and project site layout)
   - (v) Size or magnitude of operation
   - (vi) Proposed schedule for implementation
   - (vii) Description of the project including drawings showing project layout, components of project, etc. *This information should be of the same type and extent as is included in feasibility reports for proposed projects,* in order to give a clear picture of the project and its operations.

C. Description of the Environment (in area affected by the project)

3. Furnish sufficient information to give a brief but clear picture of the existing environmental resources including the following (to the extent applicable):
   - (i) *Physical resources* (topography, soils, climate, surface water, ground water, geology/seismology).
   - (ii) E*cological resources* (fisheries, aquatic biology, wildlife, forests, rare or endangered species).
   - (iii) *Human and economic development* (including, but not limited to) (where applicable): population and communities (numbers, locations, composition, employment, etc.; industries; infra-structural facilities (including water supply, sewerage, flood control / drainage, etc.) institutions; transportation (roads, harbors, airports, navigation); land use planning (including dedicated area uses); power sources and transmission; agricultural development; and mineral development.
   - (iv) *Quality of life values* (including but not limited to): socioeconomic values; public health; recreational resources and development; aesthetic values; archaeological or historical treasures; and cultural values.

[1] This typical report format is recommended by ADB and may be adjusted as necessary to suit this SSWRDP supported by JICA.
[2] IEE shall be conducted for each individual subproject and therefore the word "Project" herein should be taken us "Subproject".

D. Screening of Potential Environmental Impacts and Mitigation Measures

4. Using the checklist of environmental parameters for different sector projects (see Bank's Environmental Guidelines), this section will screen out "no significant impacts" from those with significant adverse impact by reviewing each relevant parameter according to the following factors or operational stages. Mitigation measures, where appropriate, will also be recommended.
   i) Environmental problems due to project location
   ii) Environmental problems related to design
   iii) Environmental problems associated with construction stage
   iv) Environmental problems resulting in project operations
   v) Potential environmental enhancement measures
   vi) Additional considerations.

E. Institutional Requirement and Environmental Monitoring Program

5. This section will describe the required institutional capability (both hardware and software needs) and the monitoring or surveillance program and submission of progress reports.

F. Findings and Recommendations

6. This section will include an evaluation of the screening process and recommendation will be provided whether significant environmental impacts exist needing further detailed study or EIA. If there is no need for further study, the IEE itself, which at times may need to be supplemented by a special study in view of limited but significant impacts, becomes the completed EIA for the project and no follow-up EIA will be required.

G. Conclusions

7. This section will discuss the result of the IEE and justification if any of the need for additional study or EIA. If an IEE or an IEE supplemented by a special study is sufficient for the project, then the IEE with the recommended environmental management plan, institutional and monitoring program becomes the completed EIA.

Appendix D

EIA Report Format[3]

A. Introduction

1. This section usually will include the following:
   (i) Purpose of the report (prepare an EIA), including (a) identification of the Project and Project Proponent; (b) brief description of the nature, size, and location of the project and of its importance to the country, (c) any other pertinent background information.
   (ii) Stage of project preparation.
   (iii) Extent of the EIA study: scope of study, magnitude of effort, person or agency performing the study, and acknowledgement.
   (iv) Brief outline of the contents of the report including mention of any special techniques or methods used.

B. Description of the Project

2. Furnish sufficient details to give a brief but clear picture of the following (include only applicable items):
   (i) Type of project.
   (ii) Need for project.
   (iii) Location (use maps showing general location, specific location, project boundary and project site layout).
   (iv) Size or magnitude of operation including any associated activities required by or for the project.
   (v) Proposed schedule for approval and implementation.
   (vi) Description of the project including drawings showing project layout, components of project, etc. *This information should be of the same type and extent as is included in feasibility reports for proposed projects,* in order to give a clear picture of the project and its operations.

C. Description of the Environment (in area affected by project)

3. Furnish sufficient information to give a brief but clear picture of the existing environmental resources and values including the following (to the extent applicable):
   (i) *Physical resources* (topography, soils, climate, surface water, ground water, geology / seismology).
   (ii) *Ecological resources* (fisheries, aquatic biology, wildlife, forests, rare or endangered species, wilderness or protected areas).
   (iii) *Human and economic development* (including, but not necessarily limited to): population and communities (numbers, locations, composition, employment, etc.; industries; infra-structural facilities (including water supply, sewerage, flood control / drainage, etc.); institutions; transportation (roads, harbors, air ports, navigation); land use planning (including dedicated area uses); power sources and transmission; agricultural development; mineral development; and tourism resources.
   (iv) *Quality of life values* (including but not limited to): socioeconomic values; public health; recreational resources and development; aesthetic values; archaeological or historical treasures; and cultural values.

[3] This typical report format is recommended by ADB and may be adjusted as necessary to suit this SSWRDP supported by JICA.

D. Alternatives

4. In the event serious losses of natural environmental resources and/or serious health effects are expected to result from the proposed project, the EIA report will justify the need for the project considering other alternative projects. In addition, various other relevant options such as site, design and technology will be included in the investigation. This section will also cite the advantages / disadvantages of these alternatives from the point of view of environmental protection. The discussion will justify the need for the project and indicate that all feasible alternative options have been considered. Other than advantages and disadvantages, justification of the project will go beyond the least-cost option and touch upon a need to diversify by implementing different project subtypes to address national security risk (eg. preference for a mix of project subtypes such as geothermal, coal or natural gas over a single source of fuel for the entire country or region).

5. In most cases, environmental impacts "with" and "without" project alternatives will be examined and in some cases, this could be the best and the only presentation in this section.

6. For each alternative considered, the environment specialist (ES) will: (i) summarize the probable adverse impacts, and (ii) relate the impacts to the proposed project and other alternatives. The best alternative will be selected from an environmental perspective and will be examined in the overall context of the project feasibility.

E. Anticipated Environmental Impacts and Mitigation Measures

(i) *Item by Item Review:* This section of the report will evaluate the expected impact (in as quantified terms as possible) of the project on each resource or value and in the applicable sectoral environmental guidelines wherever any significant impact is expected[4]. Environmental impacts to be investigated will include those due to project location, those caused by possible accidents, those related to design, during construction, during regular operations and final decommissioning or rehabilitation of a completed project. Where adverse effects are indicated, discuss measures for minimizing and/or offsetting these, and opportunities for enhancing natural environmental values will be explored. Both direct and indirect effects will be considered, and the region of influence indicated. This analysis is the key presentation in the report and if not sufficiently completed it may be necessary to delay the project until the analysis can be completed. It is necessary to present a reasonably complete picture of both the human use and quality of life gains to result from the project due to the utilization, alteration, and impairment of the natural resources affected by the project, so that fair evaluation of the net worth of the project could be made.

(ii) *Offsetting and Mitigating Adverse Effects:* For each significant adverse environmental impact, the report will carefully explain how the project plan/design minimizes the adverse effects and in addition how the project plan/design, to the extent feasible, includes provision for offsetting oe compensating of adverse effects and for positive enhancement of benefits or environmental quality. Where substantial cost of mitigation measures is involved, alternative measures and costs will be explored.

(iii) *Irreversible and Irretrievable Commitments of Resources:* The EIA report will identify the extent to which the proposed project would irreversibly curtail the potential use of environment. For example, highways that cut through stream corridors, wetlands, or a natural estuary can result in irretrievable damage to those sensitive ecosystems. Other impacts that may be irreversible include alteration of historic sites, and expenditure of construction materials and fuels. Also, projects through estuaries, marshes, etc., may permanently impair the natural ecology of the area; or elimination of recreation areas

[4] This could include environmental risk assessment, where appropriate.

and parklands can precipitate drastic changes in the social and economic character of the project area.

(iv) *Temporary Effects During Project Construction:* In the event the construction phase of the project involves special environmental impacts (to be terminated on completion of construction), these will be separately discussed including proposed remedial measures.

F. Economic Assessment[5]

9. This section will include: (a) costs and benefits of environmental impacts; (b) costs, benefits and cost effectiveness of mitigation measures; and (c) for environmental impacts that have not been expressed in monetary values, a discussion of such impacts, if possible in quantitative terms (e.g. weight or volume estimates of pollutants). This information should be integrated into the overall economic analysis of the project.[6]

G. Institutional Requirements and Environmental Monitoring Program

8. This section of the report will describe the required institutional capability including staff skills, tools and equipment, and monitoring or surveillance program, including periodic progress reports to be established and continued by the Project proponent following granting of approval for the project to proceed. The objective of these reports is to assure the concerned government environment agency that all necessary environmental protection measures are being carried out on a continuing basis as envisioned in the approved project plan, and that proper special measures will be taken for containing any adverse impacts not envisioned in the project plan.

H. Public Involvement

9. This section will describe the process undertaken to involve the public in project design and recommended measures for continuing public participation; summarize major comments received from beneficiaries, local officials, community leaders, NGOs, and others, and describe how these comments were addressed; list milestones in public involvement such as dates, attendance, and topics of public meetings; list recipients of this document and other project related documents; describe compliance with relevant regulatory requirements for public participation; and summarize other related materials or activities, such as press releases and notifications.

I. Conclusions

10. The EIA report will present the conclusions of the study including: (a) gains which justify implementation of the project; (b) explanation of how adverse effects could be minimized or offset and compensated for to make these impacts acceptable; (c) explanation of use of any irreplaceable resources; and (d) provisions for follow-up surveillance and monitoring. Simple visual presentations of the type and magnitude of the impacts may aid the decision-maker.

[5] This section may be drawn from the economic analysis conducted for the feasibility study; the economic assessment, as applicable, should be used in the economic analysis of the projects.

[6] It is recognized that not all environmental benefits and costs could be quantified and presented in monetary terms.

Appendix E

Table for Mitigation Measures

Sl. No.	Potential Negative Impact	Possible Mitigation Measure
1.	Changes in river / khal water flow and flooding pattern	• Incorporation of adequate flow (2/3 of natural flow) provision in the design criteria of water regulatory structures • Avoidance of beel bypass during construction of embankment • Provision for adequate bridges / culverts for free overland flow
2.	Fall of ground water table	• More recharge by increasing inundation area and period • Reduction of ground water abstraction volume • Increase of surface water irrigation facilities
3.	Deterioration of water quality	• Protection of water bodies from domestic and sanitary waste disposal, and agricultural field run-off • Reduction of agro-chemical use by introducing IPM practice
4.	Water logging in low lying areas and silting of canals	• Installation and maintenance of adequate drainage system • Prevention of seepage from irrigation canal • Regular maintenance of re-excavated canals for removing deposited layers • Measures to minimize soil erosion from road / embankment
5.	Loss of soil fertility	• Avoidance of top soil cut from fertile agricultural land • Provision for natural replenishment of flood plain soil by flood water inundation • Agricultural extension services for manure preparation training and motivational program for using organic fertilizer
6.	Change of eco-system of aquatic or terrestrial habitat	• Siting of the sub-project to minimize loss or avoid encroachment on sensitive areas • Conservation of valuable wetland sites and training of local beneficiaries on community based wetland management • Plantation on available lands with local suitable species
7.	Decline in fisheries production	• Construction of fish passage ways structure and it's timely operation to facilitate hatchling migration • Conservation of reproduction sites like, beels, haors, etc. • Incorporation of culture fishery management including hatchery and restocking program in the sub-project Environmental Management Plan • Fishery extension services for training pond owners and interested farmers on aquaculture • Introduction of IPM for crop pest control and rice-fish farming in the paddy field

Sl. No.	Potential Negative Impact	Possible Mitigation Measure
8.	Effect on rare, endangered, or threatened biological species	• Restoration of suitable alternative habitat for rare, endangered, or threatened plant or wildlife species
9.	Eutrophication and spreading of nuisance plant	• Incorporation of nuisance plant destruction program in the sub-project mitigation plan • Agriculture extension services for training farmers on water hyacinth based compost preparation and motivational program for using compost fertilizer
10.	Dislocation of habitat due to siting (alignment) of infrastructure	• Relocation of affected people in suitable areas with proper compensation for resources lost, and scopes for employment opportunities
11.	Increase of water related diseases	• Measures for controlling disease vectors by destroying their habitats • Disease prophylaxis and treatment • Training for domestic water management and low cost water sanitation technology
12.	Unemployment of professional community	• Identification of affected professional group and incorporation of in-kind compensation for losses in the sub-project planning
13.	Enhanced flood risk in adjacent areas	• Construction of refuse shelter for flood affected people • Training on flood disaster management, specially for women
14.	Water and air pollution from construction activities	• Pollution control by careful location of waste disposal sites and construction camps
15.	Soil erosion in road, embankment, bank of river / khal	• Compliance with construction standards like, blanket cover, proper slope ratio, compaction, turfing, etc • Regular maintenance work to minimize erosion

Appendix F

Guidelines for Preparing Environmental Mitigation Plan

All subprojects of the JICA supported SSWRDP will undergo environmental assessment study in the form of IEE and/or EIA followed by preparation of an environmental management plan (EMP). The environmental mitigation plan is aimed at mitigating the adverse environmental impacts and it forms a part of the EMP. The contracted consulting firms of SSWRDP will carry out the IEEs/EIAs leading to preparation of the mitigation plan of the EMPs. The mitigation plan will be prepared in such a way that all adverse impacts found in the IEE/EIA reports are mitigated to the highest possible extent and the project-affected peoples (PAPs) are consulted and their opinions are incorporated in the plan as effective mitigation measures.

The following are the procedural steps to be followed in preparing the Mitigation Plan, which will be signed by LGED Executive Engineer, project affected peoples (PAPs), and representatives from Water Management Co-operative Associations (WMCAs) (see attached sample sheet for Environmental Mitigation Plan).

Steps for Preparing Environmental Mitigation Plan

Step 1: Finding of potential impacts and identification of adverse impact issues from environmental assessment study report (IEE/EIA).

Step 2: Cross checking of identified adverse impact issues with PRA findings.

Step 3: Identification of PAPs from both IEE/EIA and PRA reports.

Step 4: Primary formulation of mitigation measures in line with mitigation measures table (**Appendix E).**

Step 5: Presentation of identified impacts and their best possible mitigation options in meeting with PAPs and collection of their opinion in implementing the program (see item 4 and 5 in the attached sample Environmental Mitigation Plan).

Step 6: Finalization of mitigation plan after detail discussion with PAPs (see item 6 in the attached sample Environmental Mitigation Plan) and incorporation of recommended options in subproject engineering design.

Step 7: Fixing of implementation schedule for finally accepted Mitigation Plan (see item 7 in the attached sample environmental mitigation plan) and endorsement of the document by the concern LGED Executive Engineer, PAPs, and representatives from WMCAs.

Note: All works as in the signed mitigation plan should be clearly mentioned in the Implementation Agreement of the concern subproject.

ENVIRONMENTAL SUBPROJECT MITIGATION PLAN (Sample Format)

Environmental Mitigation Plan for .... Subproject (SP)
(to be completed by the contracted consulting firm and preserved in the SP back-up file)

1. Subproject information	Name : Type : Upazilla: District:		
2. Proposed interventions	Khal excavation/re-excavation		... km
	Construction/re-sectioning of embankment		... km
	Construction of water control structure(s)		... no.
3. Potential impact as per IEE/EIA/PRA reports	1. 2. 3. 4.		
4. Adverse environmental impacts & mitigation options	<u>Impacts</u>	<u>Options</u>	
	1.	1. 2.	
	2.	1. 2.	
5. Consultation Meeting for mitigation measures	<u>Names of the PAPs</u>	<u>Address of the PAPs</u>	<u>Signature of PAPs</u>
	1.		
Place :...............................	2.		
Date :..............................	3.		
	4.		
6. Options selected by PAPs	<u>Impact</u>	<u>Measures</u>	<u>Name of the PAPs</u>
	1.		1. 2. 3.
7. Implementation Schedule	<u>Name of the work</u>	<u>Date start</u>	<u>Date end</u>
	1.		
	2.		
	3.		

Executive Engineer, LGED	WMA Representative	Date of signing .... Place of signing ....
(..)	(...............................)	

EXHIBIT 10

FINANCIAL AND ECONOMIC DATA

EXHIBIT-10
FINANCIAL AND ECONOMIC DATA

Table 10.1: Input Use and Yield Levels per Hectare

Crop	Seeds	Manure/ Compost	Fertilizers				Pesticides	Irrigation	Draft Animal	Labour	Yield
			Urea	TSP	MP	Other					
	(kg/ha)	(kg/ha)	(kg/ha)	(kg/ha)	(kg/ha)	(kg/ha)	(kg/ha)	(Tk/ha)	(Pair-days)	(Man-days)	(ton/ha)
Mix Aus	50.5	0.0	38.0	18.5	7.5	0.0	1.9	0.0	15.5	42.5	1.3
Local B. Aus	103.1	375.0	68.9	52.0	32.5	0.0	2.0	0.0	27.8	61.0	1.9
HYV T Aus (Flooded)	49.6	2500	115.0	70.0	43.0	0.0	3.5	1900.0	30.0	140.0	2.9
B. DW Aman	98.2	0.0	87.0	49.2	19.5	0.0	1.2	0.0	28.0	74.0	2.1
Mix DWR	50.0	0.0	38.0	18.0	7.5	0.0	1.9	0.0	15.0	42.5	1.4
T. DW	58.6	0.0	71.0	37.0	24.0	0.0	1.5	0.0	26.0	102.0	2.1
HYV T Aus	49.6	2949.8	125.2	73.0	48.3	0.0	4.4	3080.0	33.0	149.6	4.1
HYV Boro	50.9	3400.0	197.1	112.4	58.7	29.6	6.1	4252	36.0	165.0	5.5
HYV Boro (Flooded)	55.0	1500.0	180.0	102.0	52.0	18.0	4.0	2750.0	30.0	146.0	2.9
HYV T Aman (Droughty)	50.5	2300.0	123.0	71.0	37.0	0.0	2.8	0.0	30.0	140.0	3.1
HYV T Aman (Flooded)	48.5	1700.0	119.0	67.0	36.0	0.0	2.4	1963.0	30.0	142.0	2.8
HYV T Aman (Normal)	47.5	2600.0	131.3	76.1	40.8	0.0	2.9	1963.0	32.0	149.0	4.2
Jute	9.9	1700.0	74.0	49.0	29.0	0.0	2.0	440.0	29.0	136.0	2.4
Local Boro	57.6	0.0	122.3	73.6	33.8	32.1	4.0	2021.0	30.6	133.8	3.3
LT Aman (Droughty)	51.0	1700.0	92.0	58.0	31.0	19.0	2.3	0.0	31.0	125.0	2.3
LT Aman (Flooded)	49.0	1400.0	87.0	56.0	31.0	17.0	2.4	0.0	31.0	125.0	2.2
Lt Aman (Normal)	47.0	2100.0	101.0	59.0	34.0	24.7	2.5	880.0	33.0	131.0	2.9
LT Aus	57.9	1400.0	81.0	51.0	40.1	0.0	2.8	1210.0	29.0	114.0	2.6
LT Aus (Flooded)	57.9	1200.0	75.0	50.0	36.0	0.0	2.0	400.0	28.0	109.0	1.4
Oilseeds	9.9	4255.6	88.5	80.0	40.0	0.0	1.5	1210.0	27.3	66.5	1.2
Onions (Spices)											
HYV Potato	1140.0	4257.9	164.1	131.4	123.3	0.0	5.2	2000.0	50.1	222.7	15.7
Pulse	33.0	3598.4	71.1	84.0	44.0	0.0	1.7	495.0	24.1	68.1	1.4
Spices	5.0	3410.2	107.2	91.9	47.0	0.0	1.1	1227.0	41.0	185.0	4.8
Sugarcane	3469.0	1035.0	183.0	118.0	71.0	26.0	6.7	1540.0	42.0	220.0	52.4
Sweet Potato	2.0	1100.0	114.0	64.0	101.0	0.0	3.0	0.0	36.0	118.0	11.0
Tobacco	0.3	700.0	185.0	148.0	198.0	37.0	3.0	1150.0	59.0	173.0	2.4
Vegetables	2.0	4857.5	131.7	72.9	45.2	64.2	4.4	4180.0	52.0	230.0	9.2
Wheat (Droughty)	145.5	3900.0	153.0	120.2	55.6	5.0	1.1	0.0	24.0	110.0	1.9
Wheat (normal)	145.5	4500.0	153.0	120.2	55.6	5.0	1.1	2698.0	28.0	120.0	2.7

Source: SAPROF for Small Scale Water Resources Development Project in 2006.

Table 10.2: Conversion Factors For Economic Prices

Item of Cost	Conversion Factor[a]	Item of Cost	Conversion Factor[b]	Item of Cost	Conversion Factor[c]
Capital Cost Components		**Agricultural Inputs**		**Agricultural Outputs**	
Engineering Works		**Labour**	0.70	**Products**	
Earthworks**	0.67	**Draft Power**	0.87	Tobacco	0.87
Structures**	0.77	**Seeds**		Potato	0.88
Roads-Bank Protection**	0.85	Paddy	1.00	Sweet potato	0.88
Forestation/Demolition**	0.74	Wheat	1.00	Vegetables	0.87
Labour		Jute	1.00	Spices	0.87
Skilled Labour	0.87	Tobacco	0.87	Others	0.87
Unskilled Labour	0.65	Sugarcane	1.06		
Machinery/Equipment/Transport		Pulses 3/	0.90	**By-products**	0.87
Transport vehicles	0.68	Oilseeds 3/	0.90		
Machinery/Equipment	0.62	Potato	0.87		
Materials		Sweet potato	0.88		
Cement	0.79	Vegetables	0.87		
Steel (Basic metal)	0.75	Spices	0.87		
Bricks and Others	0.87	Others	0.87		
Engineering and Administration	0.87	**Manure**	0.87		
Physical Contingencies	0.87	**Fertilizers**	0.98		
O&M* **	0.87	**Pesticides**	0.90		
		Irrigation	1.00		
		Miscellaneous	0.87		

Notes

[a] Conversion factors based on SAPROF Small Scale Water Resources Development Project in 2006.

[b] Conversion factors derived from components; basis for conversion of market prices into economic prices of project costs.

[c] Conversion factors of O&M estimated at 0.87 as weighted average of miscellaneous items.

Table 10.3: Basis for Conversion of Market Prices into Economic Prices of Project Costs

Item of Cost	Conversion Factor*	Contents of Construction Cost in % of Base Cost				Average Conversion Factor			
		Earthworks	Structures	Roads-Emb. Protection	Forestation/ Demolition	Earthworks	Structures	Roads-Emb. Protection	Forestation/ Demolition
1. Skilled Labour	0.87	10	3	3	5	0.09	0.03	0.03	0.04
2. Unskilled Labour	0.65	85	11	8	55	0.55	0.07	0.05	0.36
3. Transport Equipment	0.68	5	3	3	5	0.03	0.02	0.02	0.03
4. Cement	0.79	0	25	0	0	0.00	0.20	0.00	0.00
5. Steel (Basic Material)	0.75	0	35	0	0	0.00	0.26	0.00	0.00
6. Machinery/ Equipment	0.62	0	3	0	0	0.00	0.02	0.00	0.00
7. Bricks and Other Materials	0.87	0	20	86	35	0.00	0.17	0.75	0.30
Total		100	100	100	100	0.67	0.77	0.85	0.74

Note

* Conversion factors based on Flood Plan Coordination Organization's Guidelines for Project Assessment (FPCO's GPA), 1992 used to estimate economic prices of internationally non-traded goods.

Table 10.4: Financial and Economic Prices of Inputs of Agricultural Products

Item	Unit	Financial Price (2006)	Conversion Factor	Economic Price	Economic Price Selection Basis
Labour and Draft Power					
Labour	Tk/pd	91	0.70	63.7	Conversion factor
Draft (Average of Bullock + Power Tiller)	Tk/pair/d	210	0.90	189.0	Conversion factor
Seeds					
Mix Aus	Tk/kg	14.5	1.00	14.5	Conversion factor
Local B. Aus	Tk/kg	14.5	1.00	14.5	Conversion factor
B. DW Aman	Tk/kg	20.0	1.00	20.0	Conversion factor
Mix DWR	Tk/kg	20.0	1.00	20.0	Conversion factor
T. DW	Tk/kg	20.0	1.00	20.0	Conversion factor
HYV T Aus	Tk/kg	14.5	1.00	14.5	Conversion factor
HYV Boro	Tk/kg	20.0	1.00	20.0	Conversion factor
HYV T Aman	Tk/kg	20.0	1.00	20.0	Conversion factor
Jute	Tk/kg	28.0	1.06	29.7	Conversion factor
Local Boro	Tk/kg	20.0	1.00	20.0	Conversion factor
Lt Aman	Tk/kg	20.0	1.00	20.0	Conversion factor
LT Aus	Tk/kg	14.5	1.00	14.5	Conversion factor
Oilseeds	Tk/kg	90.0	0.90	81.0	Conversion factor
HYV Potato	Tk/kg	18.0	0.90	16.2	Conversion factor
Pulse	Tk/kg	34.0	0.90	30.6	Conversion factor
Spices (Average of Chillies+Onions)	Tk/kg	56.0	0.90	50.4	Conversion factor
Sugarcane	Tk/kg	1.2	1.06	1.3	Conversion factor
Sweet Potato	Tk/kg	7.0	0.90	6.3	Conversion factor
Tobacco	Tk/kg	440.0	0.87	396.0	Conversion factor
Vegetables	Tk/kg	425.0	0.90	382.5	Conversion factor
Wheat	Tk/kg	14.0	1.00	14.0	Conversion factor
Fertilizers and Pesticides					
Urea	Tk/kg	7.5	0.98	7.4	Export parity
TSP	Tk/kg	16.3	0.98	16.0	Import parity
MP	Tk/kg	15.5	0.98	15.2	Import parity
Other	Tk/kg	10.0	0.98	9.8	Conversion factor
Manure	Tk/kg	0.5	0.87	0.4	Conversion factor
Pesticides	Tk/kg	135.0	0.90	121.5	Conversion factor
Irrigation	Tk/ha	Variable; depends on crop type	0.87		Conversion factor

Note

Source: SAPROF Small Scale Water Resources Development Project in 2006.

Table 10.5: Financial and Economic Prices of Agricultural Outputs

Item	Unit	Financial Price (2006)	Conversion Factor	Economic Price	Economic Price Selection Basis
Products					
Mixed Aus	Tk/ton	8,370	1.00	8,370	Import parity
Local B Aus	Tk/ton	8,370	1.00	8,370	Import parity
B DW Aman	Tk/ton	10,290	1.00	10,290	Import parity
Mix DWR	Tk/ton	10,080	1.00	10,080	Import parity
T DWR	Tk/ton	10,080	1.00	10,080	Import parity
HYV T Aus	Tk/ton	9,370	1.00	9,370	Import parity
HYV Boro	Tk/ton	10,270	1.00	10,270	Import parity
HYV T Aman	Tk/ton	11,600	1.00	11,600	Import parity
Jute	Tk/ton	25,000	1.00	25,000	Export parity
Local Boro	Tk/ton	10,200	1.00	10,200	Import parity
LT Aman	Tk/ton	11,600	1.00	11,600	Import parity
LT Aus	Tk/ton	9,370	1.00	9,370	Import parity
Oilseeds	Tk/ton	30,000	0.88	26,400	Import parity
HYV Potato	Tk/ton	11,060	0.87	9,622	Conversion factor
Pulse	Tk/ton	34,000	1.00	34,000	Import parity
Spices	Tk/ton	45,580	0.87	39,655	Conversion factor
Sugarcane	Tk/ton	1,200	1.06	1,272	Import parity
Sweet Potato	Tk/ton	7,000	0.88	6,160	Conversion factor
Tobacco	Tk/ton	20,000	0.87	17,400	Conversion factor
Vegetables	Tk/ton	11,281	0.87	9,814	Conversion factor
Wheat	Tk/ton	14,320	1.00	14,320	Import parity
By-Products					
Local rice straw	Tk/ton	550	0.87	478	Conversion factor
HYV rice straw	Tk/ton	490	0.87	425	Conversion factor
Wheat	Tk/ton	440	0.87	385	Conversion factor
Jute sticks	Tk/ton	1,100	0.87	960	Conversion factor
Sugarcane	Tk/ton	375	0.87	326	Conversion factor
Pulses	Tk/ton	550	0.87	478	Conversion factor
Oilseeds	Tk/ton	660	0.87	575	Conversion factor
Vegetables	Tk/ton	330	0.87	287	Conversion factor
Other	Tk/ton	110	0.87	96	Conversion factor

Note

Source: SAPROF Small Scale Water Resources Development Project in 2006.

Table 10.6: Financial and Economic 1-Hectare Crop Budgets

Sl. No.	Crop	Yield (ton/hectare)	Net Return (Tk/ha)	
			Economic	Financial
1	Mix Aus	1.3	3,599	2,237
2	Local B Aus	1.9	3,032	1,146
3	HYV T Aus (Flooded)	2.9	7,738	3,660
4	B DW Aman	2.1	7,773	5,522
5	Mix DWR	1.4	6,665	5,311
6	T DW Rice	2.1	6,926	3,903
7	HYV T Aus	4.1	17,301	12,904
8	HYV Boro	5.5	31,508	26,850
9	HYV Boro (Flooded)	2.9	6,889	2,941
10	HYV T Aman (Droughty)	3.1	11,710	7,645
11	HYV T Aman (Flooded)	2.8	9,605	5,505
12	HYV T Aman (Normal)	4.2	27,948	23,619
13	Jute	2.4	42,813	38,766
14	Local Boro	3.3	14,814	11,027
15	LT Aman (Droughty)	2.3	5,065	1,316
16	LT Aman (Flooded)	2.2	4,766	1,022
17	Lt Aman (Normal)	2.9	14,425	10,468
18	LT Aus	2.6	7,813	4,421
19	LT Aus (Flooded)	1.4	-2,679	-5,901
20	Oilseeds	1.2	21,775	19,632
21	HYV Boro (Droughty)	5.0	28,643	24,409
22	Potato (HYV)	15.7	39,174	42,387
23	Pulse	1.4	33,394	31,239
24	Spices *	4.8	188,617	182,466
25	Sugarcane	52.4	30,690	24,853
26	Sweet Potato	11.0	58,431	55,144
27	Tobacco	2.4	17,954	13,487
28	Vegetables	9.2	72,448	65,230
29	Wheat (Droughty)	1.9	6,488	3,579
30	Wheat (Normal)	2.7	17,670	13,783

Note: * Figures for spices represent average of chilies and onions.

Table 10.7a: Fisheries Budget - Perennial Water Bodies

(Per 1 ha Basis)

Items of Benefits/Costs	Physical Unit	Without Subproject					With Subproject				
		Physical	Financial		Economic		Physical	Financial		Economic	
		Quantity/ha	Price/Unit	Value/ha	Price/Unit	Value/ha	Quantity/ha	Price/Unit	Value/ha	Price/Unit	Value/ha
Revenue											
Main product	kg	220	55	12100	47.85	10527	110	55	6050	47.85	5263.5
Sub-total Revenue				12100		10527			6050		5263.5
Operating Costs (excluding labor)											
Gear	ha	1.00	2200	2200	1914	1914	1.00	1100	1100	957	957.0
Craft	ha	1.00	1100	1100	957	957	1.00	550	550	478.5	478.5
Lease Fee	ha	1.00	1000	1000	0	0	1.00	500	500	0	0
Guarding	ha	1.00	700	700	609	609	1.00	350	350	304.5	304.5
Other Costs	ha	1.00	300	300	261	261	1.00	150	150	130.5	130.5
Sub-total Operating Costs				5300		3741			2650		1870.5
Income (without labor costs)				6800		6786			3400		3393
Labor Costs (hired labor)											
March	person-day	5.5	91.00	500.5	63.7	350.4	4.4	91.00	400.4	63.7	280.3
April	person-day	4.0	91.00	364.0	63.7	254.8	3.2	91.00	291.2	63.7	203.8
May	person-day	1.0	91.00	91.0	63.7	63.7	0.8	91.00	72.8	63.7	51.0
June	person-day	1.5	91.00	136.5	63.7	95.6	1.2	91.00	109.2	63.7	76.4
July	person-day	2.0	91.00	182.0	63.7	127.4	1.6	91.00	145.6	63.7	101.9
August	person-day	2.0	91.00	182.0	63.7	127.4	1.6	91.00	145.6	63.7	101.9
September	person-day	3.0	91.00	273.0	63.7	191.1	2.4	91.00	218.4	63.7	152.9
October	person-day	4.5	91.00	409.5	63.7	286.7	3.6	91.00	327.6	63.7	229.3
November	person-day	6.0	91.00	546.0	63.7	382.2	4.8	91.00	436.8	63.7	305.8
December	person-day	7.0	91.00	637.0	63.7	445.9	5.6	91.00	509.6	63.7	356.7
January	person-day	8.0	91.00	728.0	63.7	509.6	6.4	91.00	582.4	63.7	407.7
February	person-day	5.5	91.00	500.5	63.7	350.4	4.4	91.00	400.4	63.7	280.3
Sub-total Labor costs		50.0		4550		3185	40		3640		2548
Income (with labor costs)				**2250**		**3601**			**-240**		**845**

Table 10.7b: Fisheries Budget – Floodplain

(Per ha Basis)

Items of Benefits/Costs	Physical Unit	Without Subproject					With Subproject				
		Physical	Financial		Economic		Physical	Financial		Economic	
		Quantity/ha	Price/Unit	Value/ha	Price/Unit	Value/ha	Quantity/ha	Price/Unit	Value/ha	Price/Unit	Value/ha
Revenue											
Main product	kg	50	55	2750	47.85	2392.5	25	55	1375	47.85	1196.3
Sub-total Revenue				2750		2392.5			1375		1196.3
Operating Costs (excluding labor)											
Gear	ha	1.00	250	250	217.5	217.5	1.00	125	125	108.8	108.8
Craft	ha	1.00	125	125	108.8	108.8	1.00	62.5	62.5	54.4	54.4
Lease Fee	ha	1.00	0	0	0	0	1.00	0	0	0	0
Guarding	ha	1.00	0	0	0	0	1.00	0	0	0	0
Other Costs	ha	1.00	100	100	87	87	1.00	50	50	43.5	43.5
Sub-total Operating Costs				475		413.2			237.5		206.6
Income (without labor costs)				2275		1979.3			1137.5		989.6
Labor Costs (hired labor)											
March	person-day		91.00	0	63.7			91.00	0	63.7	
April	person-day		91.00	0	63.7			91.00	0	63.7	
May	person-day		91.00	0	63.7			91.00	0	63.7	
June	person-day		91.00	0	63.7			91.00	0	63.7	
July	person-day	3		0	63.7	191.1	2		0	63.7	127.4
August	person-day	6		0	63.7	382.2	4		0	63.7	254.8
September	person-day	9		0	63.7	573.3	6		0	63.7	382.2
October	person-day	12		0	63.7	764.4	8		0	63.7	509.6
November	person-day		91.00	0	63.7			91.00	0	63.7	
December	person-day		91.00	0	63.7			91.00	0	63.7	
January	person-day		91.00	0	63.7			91.00	0	63.7	
February	person-day		91.00	0	63.7			91.00	0	63.7	
Sub-total Labor costs		30		0	63.7	1911	20		0		1274
Income (with labor costs)				**2275**		**68**			**1138**		**-284**

Source: Subproject feasibilities and PRA field surveys for SSWRDSP-2.

EXHIBIT 11

ENGINEERING ANNEX

EXHIBIT-11

Appendix-A
SALIENT DATA, DESIGN AND IMPACT OF SUBPROJECT

A1 General Subproject Information

Subproject Name				**Type**
Location		**Subproject Area:**		
Zone		Gross		ha
District		Net		ha
Upazila				
Union:				
Subproject Processing Dates			**Comments**	
Proposal received in IWRMU				
Pre-screening				
Field reconnaissance				
PRA				
Name of PRA Firm/NGO	Date of Assigning Work: Field Work: Date Start: End: PRA Report Completed (date):			
Feasibility Study				
Name of FSDD Firm			Assign Date:	
Data Collection				
Multidisciplinary Field Visit Period	Start Date:		End Date:	
Concept Report	Submitted:		Finalized:	
Detail Data Collection				
- *Socio-Economic*	Date From:		Date To:	
- *Agricultural*	Date From:		Date To:	
- *Fisheries*	Date From:		Date To:	
- *Environmental*	Date From:		Date To:	
- *Engineering Survey*	Date From:		Date To:	
Feasibility Analysis				
Feasibility Report - Draft	Submitted		Reviewed	
Feasibility Report – Final Draft	Submitted		Reviewed	
Planning Discussion Meeting	Date Held		Place	
Feasibility Report	Submitted		Approved	
Clearances				
DLIAPEC Clearance	Date Obtained			
Environmental Clearance	Date Submitted			
Detail Engineering Design				
Detail Design of Works - Draft	Submitted		Reviewed	
Design Discussion Meeting	Date Held		Place	
Detail Design of Works - Final	Submitted		Approved	
LA Plan and BOQ				
Preparation of LA Plan	Date Form		Date To	
Preparation of Detail BOQ	Date Form		Date To	
Preparation of Bid Documents	Date Form		Date To	
Comments:				

A2 Climatic Design Data of Subproject

Parameters	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Year
Temperature (^{0} C)				**Station Number & Name:**						**Period of Data:**			
Max													
Mean													
Min													
Evaporation, E (mm/day)				**Station Number & Name:**						**Period of Data:**			
Average													
Evapotranspiration, ETo (mm/day)				**Station Number & Name:**						**Period of Data:**			
Average													
Rainfall, R (mm/month)				**Station Number & Name:**						**Period of Data:**			
Average													
Water Balance (mm/month)													
Water Body													
Crop Land													

A3 Hydrological Design Data of Subproject

A 3.1 Rainfall Data

A. Mean Monthly Rainfall (mm)

Station Number and Name:... Period of Data:.....................

Parameters	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Year
Max													
Mean													
Min													

B. Design Storm Rainfall (Synthesized 5-day 10-year Storm)

Station Number and Name:... Period of Data:.....................

Pre-monsoon (Jan-Jun)							**Monsoon** (Annual)					
Duration (Days)	**1**	**2**	**3**	**4**	**5**		**Duration** (Days)	**1**	**2**	**3**	**4**	**5**
Cumulative Depth (mm)							**Cumulative Depth** (mm)					

A 3.2 River (Outside) Water Level Data

A. Mean Monthly Water Levels (Tidal Zone)

Subproject WL	**Apr**		**May**		**Jun**		**Jul**		**Aug**		**Sep**	
	HTL	**LTL**	**HTL**	**LTL**	**HTL**	**LTL**	**HTL**	**LTL**	**HTL**	**LTL**	**HTL**	**LTL**
Max												
Mean												
Min												
	Oct		**Nov**		**Dec**		**Jan**		**Feb**		**Mar**	
	HTL	**LTL**	**HTL**	**LTL**	**HTL**	**LTL**	**HTL**	**LTL**	**HTL**	**LTL**	**HTL**	**LTL**
Max												
Mean												
Min												

Computational Basis and Procedures

U/S Stn. Number & Name: **Period of Data:**	**U/S Stn. Number & Name:** **Period of Data:**
Subproject Data Derived by: Interpolation Extrapolation Correlation	Sketch representation of reference stations and the subproject with distances and other comments, assumptions if any:

B. Mean Monthly Water Levels (Non-Tidal Zone)

Subproject WL	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Max												
Mean												
Min												

Computational Basis and Procedures	
U/S Stn. Number & Name: **Period of Data:**	**U/S Stn. Number & Name:** **Period of Data:**
Subproject Data Derived by: Interpolation Extrapolation Correlation	Sketch representation of reference stations and the subproject with distances and other comments, assumptions if any:

C. High Flood Level (HFL)

Return Period (year)	**Pre-monsoon**	**Monsoon**
2.33		
5		
10		
20		
50		

Computational Basis and Procedures	
U/S Stn. Number & Name: **Period of Data:**	**U/S Stn. Number & Name:** **Period of Data:**
Subproject Data Derived by: Interpolation Extrapolation Correlation	Sketch representation of reference stations and the subproject with distances and other comments, assumptions if any:

A4 Area – Elevation - Storage Relationship of Subproject

Land Elevation[1] (m PWD)	**Cumulative Area** (ha)	**Cum Storage Volume** (ha-m)	**Land Use**
			Permanent Water Body
			Highland and Homesteads

[1] Usually areas and storage volumes are incremented for incremental land elevations at 0.30 m internals.

A5 Drainage Modulus and Basin WL (From Routing of Design Storm Rainfall)

Season	**Area (ha)**			**LGL** (mPWD)	**Dr Level** (mPWD)	**Dr Rate** (mm/day)	**Basin WL** (mPWD)
	Drainage	**Gr Benefit**	**Damage**				
Pre-monsn							
Monsoon							
Comments:							

A6 Land Type Changes

Average (1:2.33 Year) Monsoon Flood Level in Subproject : .... mPWD
Design Basin Water Level in Subproject : .... mPWD

Land Type[1]	**Nature of Flooding**	**Pre-subproject Area** (ha)	**Post-subproject Area** (ha)
Non-cultivated highland	Not flooded		
F0 (d < 0.3 m) Highland	Intermittent		
F1 (0.3< d <0.9 m) Medium	Seasonal		
F2 (0.9< d <1.8 m) Medium	Seasonal		
F3 (d>1.8 m) Lowland	Seasonal >9 month		
Non-cultivated lowland and permanent water bodies	Perennial		
Floodplain Fish Habitat (F2+F3)			
Net Area (F0+F1+F2+F3)			
Gross Area			

[1] Areas of (i) pre-subproject land types are calculated by depths from average Monsoon (annual) Flood Level and (ii) post-subproject land types are calculated from Design Basin Water Level.

A7 FMD Subprojects: Area Benefited in Floods of Different Degrees

Reference Flood / Water Level Condition	**WL** (m PWD)	**Gross Area Below WL** (ha)	**Net Area Below WL** (ha)	**Benefit Area for Reference Condition** (ha)
Partial Flood Protection (Submersible Embankment) Subprojects				
1:10-yr Pre-Monsoon FL.				
1:2.33-yr Annual HFL				
1:10-yr Annual HFL.				
Pre-Monsoon Basin WL				
Full Flood Protection (High Embankment) Subprojects				
1:2.33-yr Annual HFL				
1:10-yr Annual HFL				
1:20-yr Annual HFL				
Design Basin WL				

A8 Design of Component Works

A. Drainage Khal Re-excavation

Nos	**Name of Khal**	**Length** (km)	**Design Section Dimensions (m)**		**Depth of Excavation** (average)
			Bed Width	**Depth**	
1					
2					
3					

[1]Attach output of the project specified standard computer program for channel design.

B. Embankment Re-sectioning / Upgrading

Nos	**Embankment Chainage**		**Length** (km)	**Design Section Dimensions (m)**			**Height above GL** (average)
	From	**To**		**Bed Width**	**Depth**	**Side Slope**	
1							
2							
3							

C. Hydraulic Structures

Nos	Name & Location	Size of Structure		Gate Type	Purpose of Structure
		No of Vents	Vent Size		
1					
2					

A9 Summary Quantities and Cost for Subproject

Nos	Names of Khal / Embankment / Structure	Quantity Km / No	Unit Cost	Estimated Cost (Tk)
A.	**Re-excavation of Khal**			
1				
2				
B.	**Embankment Re-sectioning / Upgrading**			
1				
2				
C.	**Hydraulic Structures**			
1				
2				
D.	**Others**			
1.				
2.				

Total Subproject Cost			

A10 Economic Viability Index

EIRR	
NPV	
B/C	

Appendix-B

DATA, ANALYSES AND DESIGN COMPUTATIONS

B1 Basic Data and Analyses of Data for Design Parameters

A. Climatic Data

Notes and Explanations: Climatic data for study of SSWRD subprojects will usually include Temperature, Evaporation, Evapo-transpiration and Rainfall. Sunshine hours, wind speed, etc may also be needed for certain specific subprojects. It may, however, be adequate to use required climatic data (refer section A2) from secondary sources.

[Provide basic data and analysis tables here. Use pages as required]

B. Rainfall Data

Notes and Explanations: **(i)** The Rainfall station that will most closely represent the rainfall at the subproject site shall be identified using hydrological station network map and its name and ID number, location, distance and direction shall be properly mentioned and described. **(ii)** The length of data record used shall also be mentioned. **(iii)** Daily rainfall records for the number of years considered in the analysis shall be arranged in tabular form with rows representing days (1 to 31) and columns representing months. Thus, each year's data will be accommodated in one page. These basic data shall then be organized and analyzed statistically for the required parameters (refer subsections A3.1 A, B). **(iv)** For the design storm rainfall, the process of synthesizing 1-day, 2-day, 3-day, 4-day and 5-day maximum cumulative rainfall amounts for each year from the basic data tables shall be explained/elaborated by referring to the values of the data tables. The series of 1-day rainfall data so obtained shall then be analyzed statistically to obtain the 1-day 10-year maximum rainfall. Similarly, the 2-day maximum cumulative rainfall data series shall be analyzed statistically to obtain the 2-day 10-year maximum cumulative rainfall. The procedure will be repeated for 3-day, 4-day and 5-day cumulative rainfalls also. **(v)** All assumptions made, formulas used and values of coefficients and constants involved should be mentioned and explained and all computations be shown elaborately, preferably arranged in tabular forms.

[Provide basic data and analysis tables here. Use pages as required]

C. Water Level Data

Notes and Explanations: (i) The Water Level station or stations, the records of which will be required to calculate water levels at the subproject site, shall be identified from the hydrological station network map and the names and ID numbers, locations, distances, directions, etc of the stations from the subproject shall be properly mentioned and described. (ii) The length of data record used for analysis shall also be mentioned. (iii) Daily mean WL for non-tidal stations and daily maximum High Tide Level (HTL) and minimum Low Tide Level (LTL) for tidal stations shall be the basic WL data. These basic WL data shall be organized in tabular form, one page for one year's data, with rows representing days (1 to 31 days) and two columns (one for HTL and one for LTL data) for each month. (iv) The basic data shall then be organized and analyzed statistically for the required parameters (refer subsections A3.2 A, B, C). (v) If interpolation or extrapolation between stations is required to calculate subproject water level, derivation of the required mathematical equation to be used for the interpolation or extrapolation should be shown and explained by a layout sketch and distances of the reference stations from the subproject. (vi) All assumptions made, formulas used and values of coefficients and constants involved should be mentioned and explained and all computations be shown elaborately, preferably arranged in tabular forms.

[Provide basic data and analysis tables here. Use pages as required]

B2 Engineering Analysis and Design Computations for Component Works

[This Section is to be read and worked with Section 10: Detail Engineering Designs of the Main Guidelines Text]

A Area-Elevation-Storage Calculations

Notes and Explanations: Area within the subproject boundary for each incremental ground elevation of 0.30 m starting from the lowest ground level shall be measured from the 4" to 1 mile topographic map of the subproject area having ground elevation contours at intervals of 30 cm (1-foot). If the subproject area is not surveyed as above, land elevation characteristics of the subproject area shall be established by conducting a survey for ground levels at specified grid points (usually at 100 m) and areas under incremental 0.30 m ground levels as mentioned above shall be determined. The incremental areas are then cumulated to establish a land elevation versus area relationship for the subproject area. Also, the volumes of water that can stand in storage in the subproject area below land elevations incremented as above, by 0.30m above the lowest ground level, shall be calculated. The relationships between cumulated values of ground elevation, area and storage volume are organized in Table for use by computer program for engineering analysis of the data. The relationship shall also be shown in linear graphs drawn with GL in y-axis and Area and Storage Volume in x-axis (giving two x-axes and two graphs in one drawing sheet).

[Provide data table and graph here]

B Design Basin Water Level and Drainage Rate Calculations

Notes and Explanations: Rainfall of the Design Storm (synthesized 5-day 10-year storm) established earlier occurring over the relevant catchment area shall be routed through the drainage channel of the subproject to establish an acceptable highest WL in the subproject (usually called Design Basin WL) and the corresponding rate of drainage, in mm per day, that is required to give the Basin WL using the project specified simplified routing program and crop damage criteria. The simplified routing program yields a Basin WL corresponding to crop damage scenario in respect of depth and duration of crop inundation when a trial drainage rate is applied. Thus, an acceptable Design Basin WL is obtained by trial and the corresponding drainage rate is taken as the design drainage rate. Design drainage rate shall be calculated for both (i) pre-monsoon and (ii) monsoon design storms.

[Provide design calculations of the routing program here]

C Discharge Calculations

Notes and Explanations: (i) Maximum drainage discharge of the subproject shall be calculated analytically using properly delineated catchment area (ha) of the drainage khal at the outlet of the subproject or at any other point on the drainage system and the design drainage rate (mm/day) corresponding to the monsoon design storm. The calculate discharge (Q m3/sec) is a day average maximum drainage discharge. (ii) The above calculated drainage discharge shall be cross checked by calculating capacity of the existing drainage khal using its surveyed cross-section, longitudinal bed slope of a representative reach at the place and the estimated maximum WL at the place. Mannings equation for uniform flow may be used to calculate the discharge (Q). (iii) For Water Conservation subprojects, minimum flow in khals where WRS will be constructed shall be calculated by measuring water flow area and velocity of flow during lean season (field measurement).

[Provide analytical design calculations here]

D Design of Khals/ Chharas for Re-excavation

Notes and Explanations: (i) The subproject may have one or more khals/chharas for re-excavation. If a khal is long or joined by branch khals of significant size, then the khal shall be designed in reaches. Design of all such khals/chharas shall be done by using the project specified standard program for design of khal re-excavation and program calculations of all individual khals shall be given here.

1. [Name of Khal]

[Give design calculations for the khal here]

2. [Name of Khal]

[Give design calculations for the khal here]

3. ……………..

E Design of Embankments – New or Re-sectioning/Upgrading

Notes and Explanations: (i) Design of embankment shall be done by using the project specified standard program and program calculations shall be given here. (ii) If embankments are in more than one stretch or in more than one reach requiring different cross sections or heights, then design calculations for each reach or stretch shall be provided.

1. [Reach 1: From Ch ……….. to Ch …………]

[Give design calculations for the embankment here]

2. [Reach 2: From Ch ……….. to Ch ……..….]

[Give design calculations for the embankment here]

3. ……………………….

F Design for Size of Hydraulic Structures (Regulator, Sluice, WRS, etc)

Notes and Explanations: (i) Design of size of Regulators, Sluices, etc shall be done for judiciously estimated design discharge (Q_{design}) by providing adequate safety margin (usually increased by 20%) to cover possible error in discharge estimation; (ii) WLs at the upstream and downstream of the structure, estimated or assumed, influence the structure size. These should be correct and pragmatic; (iii) Regulators, Sluices, WRS, etc shall be sized (vent size and number of vents) for passing Q_{design} at a maximum 0.30m differential head (dh) across the structure; (iv) Simplified standard computer programs are available that use standard Flow Type Equations and discharge Co-efficient to calculate number of vents of desired sizes; (v) Also, Tables in Design Catalogue can be used to determine sizes of regulators/sluices. The Tables 2-1 through 2-6 are reproduced here in Appendix D.

[Give design calculations for sizing of each structure here]

G Irrigation Water Requirement Calculations

Notes and Explanations: (i) Irrigation water requirements for weekly, decadal or monthly periods may be required in CAD and WC type subprojects. These shall be calculated by appropriately using potential evapo-transpiration (ETo), crop co-efficient (Kc), available effective rainfall (Re) and efficiency of irrigation according to requirement of details in the subproject.

[Give calculations in tabular form here]

Appendix-C

MAPS AND DRAWINGS

C1 Maps

A. Subproject Index Map

Notes and Explanations: The Index Map of the subproject shall be a comprehensive map incorporating almost all information that one might like to find therein. The Index Map shall be developed based on Topographical Map in scale 1:15840 with 1-foot land elevation contours prepared by Survey of Bangladesh. If the subproject is in an un-surveyed area, the whole subproject area may have to be surveyed for spot land elevations at grid point intervals as may be considered necessary (subproject type may dictate the requirement). In such case, the Index Map may be produced in a suitable scale to be able to show the surveyed levels. However, the map shall contain all relevant geo-physical and hydrological features and standard legends and colors. Index Maps shall be in standard A3 size. If necessary, more than one A3 sheets may be used showing match lines with contiguous sheets.

[The Subproject Index Map shall be attached in the *Feasibility Study and IEE/EIA Report* as **Figure-1** as has been referenced in Section 2.1: Location and Map]

B. Base Map

Notes and Explanations: The Base Map of the subproject shall be prepared on LGED Upazila Base Map of scale 1:50000 showing all salient features of the subproject – subproject boundary; rivers, khals, beels and haors; existing roads, bridges and culverts, growth centers/important markets, Union Parishad, etc and importantly all the works proposed under the subproject. This map shows location of the subproject in a wider surroundings in the Upazila and presents the setting in relation to communication system, markets, important places and towns, etc. This Map shall also be prepared in A3 size.

[The Base Map shall be attached in the *Feasibility Study and IEE/EIA Report* as **Figure-2** as has been referenced in Section 2.1: Location and Map]

C. Regional Map

Notes and Explanations: The Regional Map for the subproject shall be prepared using the 1:150000 LGED District Base Map showing BWDB's larger water resource projects (if any) and other subprojects of LGED (if any); hydrometric stations used in analysis; main rivers and khals; main roads and railways; District, Upazila and other main towns, etc. This Map shall also be prepared in A3 size.

[The Regional Map shall be attached in the *Feasibility Study and IEE/EIA Report* as **Figure-3** as has been referenced in Section 2.1: Location and Map]

C2 Longitudinal and Cross-sectional Profiles of Embankment

Notes and Explanations: (i) Longitudinal profile of the proposed flood protection embankment, be new or upgrading / re-sectioning of existing road / embankment, shall be drawn using data of cross-sections surveyed at 200m intervals. Profiles of existing crest level, existing GL on both riverside and countryside, bed level of khals and rivers crossed, top elevations of bridges and culverts, and any other features, levels, dimensions, etc surveyed shall be shown along with the profile of the design crest level in the Drawing. The embankment may be designed in reaches of different top level, cross-sections, etc. The long profile shall indicate the reaches and corresponding design parameters. (ii) All cross-sections surveyed, including additional ones that might have been surveyed at locations of changing ground levels, etc, shall be plotted and presented with all detail dimensions.

[Attach all Longitudinal and Cross-sectional profile Drawings here]

C3 Longitudinal and Cross-sectional Profiles of Khals/Rivers

Notes and Explanations: (i) Longitudinal profiles of drainage khals and small rivers that have been proposed for re-excavation shall be drawn using data of cross-sections surveyed at 200m intervals. Profiles of existing lowest bed level, existing GL on both banks, crest level of embankment along bank(s) if any, top and bottom elevations (for pacca floor) of bridges/culverts and regulator/sluices (if any) including their lengths, sizes, etc and any other features, levels, dimensions, etc surveyed shall be shown along with the profile of the design bed level for re-excavation in the Drawing. The khal may be designed in reaches of different bed level, cross-sections, etc. The long profile shall indicate the reaches and corresponding design parameters. (ii) All cross-sections surveyed, including additional ones that might have been surveyed at locations of changing ground levels, etc, shall be plotted and presented with all detail dimensions.

[Attach Longitudinal and Cross-sectional Profile Drawings of each Khal separately]

C4 Plan and Long Sectional Drawings of Regulators/ Sluices/ WRS

Notes and Explanations: Drawings of General Plan and Longitudinal Section of all the proposed structures – Regulators, Sluices, WRS and others if any shall be provided with all salient dimensions and details (type of gates). Standard Drawings from Design Catalogue (soft version) shall be prepared based on preliminary design of the structures.

[Attach Drawings of General Plan and Longitudinal Section of each proposed structure]

Appendix-D

TABLES FOR SELECTING STRUCTURE SIZE AND DIMENSIONS
(Reproduced From Design Catalogue Prepared Under SSWRDSP)

Table 2-1: Standard Opening Sizes of Hydraulic Structures

(in mm)

Regulator/Sluice		WRS	Weir	
RCC Pipe (Diameter)	**RCC Box** (Width x Height)	**(Width x Height)**	**Retention Height**	**Overflow Depth**
600	900 x 900	1200 x 1500	1000	600
900	900 x 1200	1200 x 1800	1200	800
1200	1000 x 1200	1500 x 1500	1500	1000
	1200 x 1200	1500 x 1800	1500	
	1200 x 1500	1500 x 2000		
	1500 x 1500			
	1500 x 1800			

Table 2-2: Standard Hydraulic Dimensions of Non-Tidal Regulators/Sluices

Conduit Size W x H (m)	**Discharge Capacity** **Q** (m^3/s)	**Glacis Drop** (m)		**Glacis Length** (m)		**Basin Length** (m)		**Basin Width** (m)		**Cutoff Depth** (m)	
		C/S	**R/S**	**C/S**	**R/S**	**C/S**	**R/S**	**C/S**	**R/S**	**C/S**	**R/S**
0.60 Dia.	0.5	0.20	0.30	0.60	0.75	3.60	3.75	1.80	1.80	1.20	1.20
0.90 Dia.	1.2	0.30	0.40	0.75	0.75	4.45	4.75	2.50	2.50	1.50	1.50
1.20 Dia.	2.2	0.30	0.40	0.75	0.75	4.45	4.75	3.20	3.20	1.50	1.50
0.90x0.90	1.5	0.30	0.40	0.75	0.75	4.45	4.75	3.00	3.00	1.50	1.50
0.90x1.20	2.1	0.30	0.40	0.90	1.20	4.75	5.00	3.20	3.20	1.50	1.50
1.00x1.20	2.3	0.30	0.40	0.90	1.20	4.75	5.00	3.30	3.30	1.50	1.50
1.20x1.20	2.7	0.30	0.40	0.90	1.20	4.75	5.00	3.50	3.50	1.50	1.50
1.20x1.50	3.4	0.30	0.50	0.90	1.50	5.10	6.00	3.70	3.70	1.80	1.80
1.50x1.50	4.3	0.30	0.50	0.90	1.50	5.10	6.00	4.00	4.00	1.80	1.80
1.50x1.80	5.2	0.40	0.60	1.00	1.80	6.00	7.20	4.50	4.50	2.10	2.10

Note: Discharge capacities Q in non-tidal structures represent discharges at 0.30m hydraulic head (dh).

Basin length and Cutoff wall depths represent values calculated at 0.60 m hydraulic head.

Higher values than shown in the above table obtained in detail calculations using computer program "SIZING OF REGULATOR/SLUICE" would indicate error in input data.

Table 2-3: Standard Hydraulic Dimensions of Tidal Sluices/Regulators in Zone 1 (Very Low Tide Level, Reference Area Patuakhali)

Conduit Size W x H (m)	Discharge Capacity Q (m^3/s)	Glacis Drop (m)		Glacis Length (m)		Basin Length/ Type (m)		Basin Width (m)		Cutoff Depth (m)	
		C/S	R/S	C/S	R/S	C/S	R/S	C/S	R/S	C/S	R/S
0.90x1.20	2.2	0.40	1.50	1.00	3.00	7.00(1)	7.00(2)	3.50	3.50	1.80	1.80
1.00x1.20	2.5	0.40	1.50	1.00	3.00	7.00(1)	7.00(2)	3.70	3.70	1.80	1.90
1.20x1.20	3.0	0.40	1.50	1.00	3.00	7.00(1)	7.00(2)	4.00	4.00	1.80	2.10
1.20x1.50	3.9	0.50	1.50	1.50	3.50	7.50(1)	8.50(1)	4.50	4.50	2.00	2.10
1.50x1.50	5.0	0.50	1.50	1.50	3.50	7.50(1)	9.00(1)	5.00	5.00	2.10	2.40
1.50x1.80	6.1	0.60	1.20	1.50	3.00	8.50(1)	10.00(1)	5.50	5.50	2.40	2.40

Table 2-4: Standard Hydraulic Dimensions of Tidal Sluices/Regulators in Zone 2 (Low Tide Level; Reference Area Barisal)

Conduit Size W x H (m)	Discharge Capacity Q (m^3/s)	Glacis Drop (m)		Glacis Length (m)		Basin Length / Type (m)		Basin Width (m)		Cutoff Depth (m)	
		C/S	R/S	C/S	R/S	C/S	R/S	C/S	R/S	C/S	R/S
0.60 Dia.	0.6	0.40	0.60	1.00	1.50	3.80(2)	4.00(2)	2.00	2.00	1.50	1.50
0.90 Dia.	1.3	0.40	0.90	1.00	2.00	5.00(2)	5.00(2)	2.70	2.70	1.80	1.80
1.20 Dia.	2.3	0.40	0.90	1.00	2.00	6.50	6.50(2)	3.50	3.50	1.80	1.80
0.90x0.90	1.7	0.40	0.90	1.00	2.00	6.00	6.00(2)	3.00	3.00	1.80	1.80
0.90x1.20	2.2	0.40	0.90	1.00	2.00	7.00	7.00(2)	3.50	3.50	2.00	2.00
1.00x1.20	2.5	0.40	0.90	1.00	2.00	7.00	7.00(2)	3.70	3.70	2.00	2.00
1.20x1.20	3.0	0.40	0.90	1.00	2.00	7.00	7.00(2)	4.00	4.00	2.00	2.00
1.20x1.50	3.9	0.50	0.90	1.50	2.00	7.50	8.00	4.50	4.50	2.10	2.10
1.50x1.50	5.0	0.50	0.90	1.50	2.00	7.50	8.50	5.00	5.00	2.10	2.10
1.50x1.80	6.1	0.60	0.90	1.50	2.00	8.50	9.00	5.50	5.50	2.10	2.10

Notes:

1. Discharge values Q of tidal structures shown in Table 2-3 and Table 2-4 represent approximate average discharge rate during drainage period for tidal conditions prevailing in Patuakhali and Barisal districts. These values can be used during the initial stage of subproject planning as indicative figures only. **During the preparation of final designs the structure discharge capacity should be calculated based on actual ground levels and tide levels applicable to the structure site.**

2. Figures in brackets indicate type of stilling basin; (1) = Indian Standard Stilling Basin Type 1, and (2) = USBR Stilling Basin Type 2.

Table 2-5: Standard Hydraulic Dimensions of Water Retention Structures (Gated)

(in meter)

Structure Size	Disch. Capacity (m^3/s)	Country Side				Sill Length	River Side				Basin Width	Chute Blocks Height	Baffle Blocks		Dentated End Sill Height
		Cutoff Depth	Apron Length	Glacis Length	Glacis Rise		Glacis Drop	Glacis Length	Apron Length	Cutoff Depth			Distan -ce	Height	
	Q	$d_{C/S}$	$L_{C/S}$	$Gl_{C/S}$	Gr	Sl	Gd	$Gl_{R/S}$	$L_{R/S}$	$d_{R/S}$	bw	h_{Ch}	d_b	h_b	h_s
1-1.2x1.5	2.90	1.80	5.75	0.75	0.30	1.60	0.60	1.50	7.70	2.10	3.50	0.35	1.20	0.42	0.30
2-1.2x1.5	5.80	1.80	5.75	0.75	0.30	1.60	0.60	1.50	7.70	2.10	5.00	0.35	1.20	0.42	0.30
3-1.2x1.5	8.70	1.80	5.75	0.75	0.30	1.60	0.60	1.50	7.70	2.10	7.00	0.35	1.20	0.42	0.30
1-1.2x1.8	3.60	2.00	5.75	0.75	0.30	1.60	0.60	1.50	9.20	2.50	3.50	0.45	1.35	0.54	0.33
2-1.2x1.8	7.30	2.00	5.75	0.75	0.30	1.60	0.60	1.50	9.20	2.50	5.00	0.45	1.35	0.54	0.33
3-1.2x1.8	10.90	2.00	5.75	0.75	0.30	1.60	0.60	1.50	9.20	2.50	7.00	0.45	1.35	0.54	0.33
1-1.5x1.5	3.60	1.80	5.50	1.25	0.50	1.60	0.80	2.00	8.70	2.40	4.00	0.35	1.20	0.45	0.30
2-1.5x1.5	7.30	1.80	5.50	1.25	0.50	1.60	0.80	2.00	8.70	2.40	6.00	0.35	1.20	0.45	0.30
3-1.5x1.5	10.90	1.80	5.50	1.25	0.50	1.60	0.80	2.00	8.70	2.40	8.00	0.35	1.20	0.45	0.30
4-1.5x1.5	14.50	1.80	5.50	1.25	0.50	1.60	0.80	2.00	8.70	2.40	10.00	0.35	1.20	0.45	0.30
								.							
1-1.5x1.8	4.50	2.00	5.75	1.25	0.50	1.60	0.80	2.00	9.70	2.90	4.00	0.45	1.40	0.56	0.35
2-1.5x1.8	9.10	2.00	5.75	1.25	0.50	1.60	0.80	2.00	9.70	2.90	6.00	0.45	1.40	0.56	0.35
3-1.5x1.8	13.60	2.00	5.75	1.25	0.50	1.60	0.80	2.00	9.70	3.00	8.00	0.45	1.40	0.56	0.35
4-1.5x1.8	18.10	2.00	5.75	1.25	0.50	1.60	0.80	2.00	9.70	3.00	10.00	0.45	1.40	0.56	0.35
1-1.5x2.0	5.10	2.20	6.25	1.25	0.50	1.60	0.80	2.00	10.80	3.00	4.00	0.50	1.50	0.60	0.40
2-1.5x2.0	10.30	2.20	6.25	1.25	0.50	1.60	0.80	2.00	10.80	3.00	6.00	0.50	1.50	0.60	0.40
3-1.5x2.0	15.40	2.20	6.25	1.25	0.50	1.60	0.80	2.00	10.80	3.00	8.00	0.50	1.50	0.60	0.40
4-1.5x2.0	20.40	2.20	6.25	1.25	0.50	1.60	0.80	2.00	10.80	3.00	11.00	0.50	1.50	0.60	0.40

For hydraulic energy dissipation during drainage period, Water Retention Structures are provided on the riverside with an Indian Standard Stilling Basin Type 1. The dimensions of the stilling basin appurtenances are determined from the recommended ratios given below. The width and spacing of the appurtenances may need to be adjusted to fit the floor widths of individual structures.

Chute Blocks: height (h_{ch}) = Pre-jump depth, d_1

width (w_1) = d_1

spacing (s_1) = d_1

Baffle Block: height (h_b) = $f(d_1, F_1)$

width (w_2) = $0.75\ h_b$

spacing (s_2) = $0.75\ h_b$

End Sill: height (h_s) = $0.2\ d_2$

spacing of dents (s) = $0.15\ d_2$

Table 2-6: Standard Hydraulic Dimensions of Weirs (Un-gated)

(in meter)

Weir Height	Flow Depth	Unit Discharge ($m^3/s/m$)	Total Head	Country Side		River Side					
				Cutoff Depth	Min. Apron Length	Apron Drop	Impact Blocks		Basin Length	End Sill Height	Cutoff Depth
							Location	Height			
P	H_e	q	Y	$d_{C/S}$	$L_{C/S}$	A_d	L_P	h_b	L_B	h_s	$d_{R/S}$
1.00	0.60	1.02	1.40	1.50	5.15	0.40	3.90	0.40	5.50	0.20	1.80
1.00	0.80	1.57	1.40	1.50	5.15	0.40	4.70	0.50	6.50	0.30	2.30
1.20	0.60	1.02	1.60	1.50	5.15	0.40	4.20	0.40	5.80	0.20	1.80
1.20	0.80	1.57	1.60	1.50	5.25	0.40	4.90	0.50	6.80	0.25	2.30
1.50	0.60	1.02	2.00	1.95	5.30	0.50	4.70	0.40	6.60	0.20	1.95
1.50	0.80	1.57	2.00	1.50	5.40	0.50	5.50	0.50	7.60	0.25	2.30
1.50	1.00	2.20	2.00	1.50	5.50	0.50	6.30	0.60	8.60	0.30	2.80
1.80	0.60	1.02	2.40	2.45	5.60	0.60	5.10	0.40	7.20	0.20	2.45
1.80	0.80	1.57	2.40	2.35	5.60	0.60	5.90	0.50	8.30	0.25	2.35
1.80	1.00	2.20	2.40	1.80	5.60	0.60	6.60	0.60	9.20	0.30	2.80

The recommended dimensions of impact blocks are:

Height (h_{bl}) = 0.8 d_{cr} (d_{cr} = critical depth of flow)

Width (w_1) = 0.75h_b

Spacing (s_1) = 0.75h_b

Appendix-E

FURTHER DETAILS ON DESIGN BASIN WATER LEVEL OF SUBPROJECTS

(For Post-Subproject Land Types and Design of Channels and Structures)

I. FLOOD MANAGEMENT SUBPROJECTS

A. Design Basin Water Level for Full FM Subprojects (High Embankments)

In Non-tidal Area

Case 1: Subproject area is in a sloping land and high embankments protect the area from flash floods of the outfall river. After the flash flood passes it is possible to drain rainfall runoff accumulated inside the subproject behind drainage sluice (or regulator equipped with flap gate on the riverside.

> **Design Basin Water Level is the maximum WL $_{basin}$ in m PWD determined from calculation of Monsoon Drainage Rate** (also called Drainage Modulus) in mm/day. It is the highest figure in column 6 of Drainage Rate calculations program output.

Case 2: Subproject area is flat and high embankments protect the area from inflow of monsoon flood lasting long time. Usually water levels in the outfall river remain high and it is not possible to drain rainfall runoff accumulating in the basin from end of June through September.

> **Design Basin Water Level is determined from Water Balance calculations.** Slide or flap gates on riverside are closed when river water starts entering the protected area in pre-monsoon. Water balance calculations should be carried out on monthly basis, using rainfall minus evapo-transpiration over the entire catchment area as an inflow. The net volume of rain inflow is added to the subproject elevation-storage volume curve (or table) to get the highest Basin Water Level. If the BWL exceeds the river flood water level, the subproject is not feasible; usually this happens when the subproject catchment is larger than the protected area.

Tidal Area

For effective drainage, Low Tide Levels (LTL) must be below the protected ground level.

> **Design Basin Water Level is the highest WL $_{basin}$ in m PWD determined from calculation of Monsoon Drainage Rate** in mm/day. It is the highest figure in column 6 of Drainage Rate calculations program output.

In case LTL is above the protected ground level, the subproject area cannot drain below the LTL. However, the embankment may reduce floods caused at High Tide Levels (HTL).

In areas where daily monsoon tidal range is small, as in Brahmanbaria, Faridpur, Dhaka districts, hydrological analysis for non-tidal area should be used. For such areas, monthly tidal range data should not be used as it represents extreme levels during the month, like for example, lowest LTL occurring in 1st July and highest HTL in 31 July.

B. Design Basin Water Level for Partial FM Subprojects
(Submersible Embankments in Haor Areas)

In Partial Flood Management subprojects, land types which are determined by average monsoon flood level, do not change.

> Pre-subproject FWL = Annual average FWL, in m PWD
> Post- subproject FWL = Annual average FWL, in m PWD (same as pre-subproject)

However, **the pre-monsoon pre-subproject and post-subproject flood levels are necessary for agricultural analysis**. 1:10-year outfall river FL up to 15 May determines the present flood conditions and level below which Boro crops are damage.

> **Design Basin Water Level is determined from Water Balance calculations up to 15 May.** The structure gates are closed when river water starts entering the protected area in March or April. Use average water level inside the subproject before the onset of pre-monsoon floods (or average outfall river water level at the end of March) as starting basin water level and carry out water balance calculations up to 15 May. Water level inside the subproject on 15 May is the **Design Basin Water Level,** which also should be used to determine the subproject net benefited area. Crops below the Design Basin Water Level can get inundated before harvest.

II. DRAINAGE IMPROVEMENT SUBPROJECTS (Dr)

In Drainage Improvement (Dr) subprojects, when the subproject is inundated, water level in the outfall channel is below ground elevation of the subproject's benefited area. The outfall channel does not control drainage (unless it is silted or obstructed, in which case it also has to be re-excavated), and water in the subproject basin accumulates above the elevation of the outfall channel due to constrictions "bottlenecks", silting of internal channels or general silting of locally depressed valleys that act as floodways.

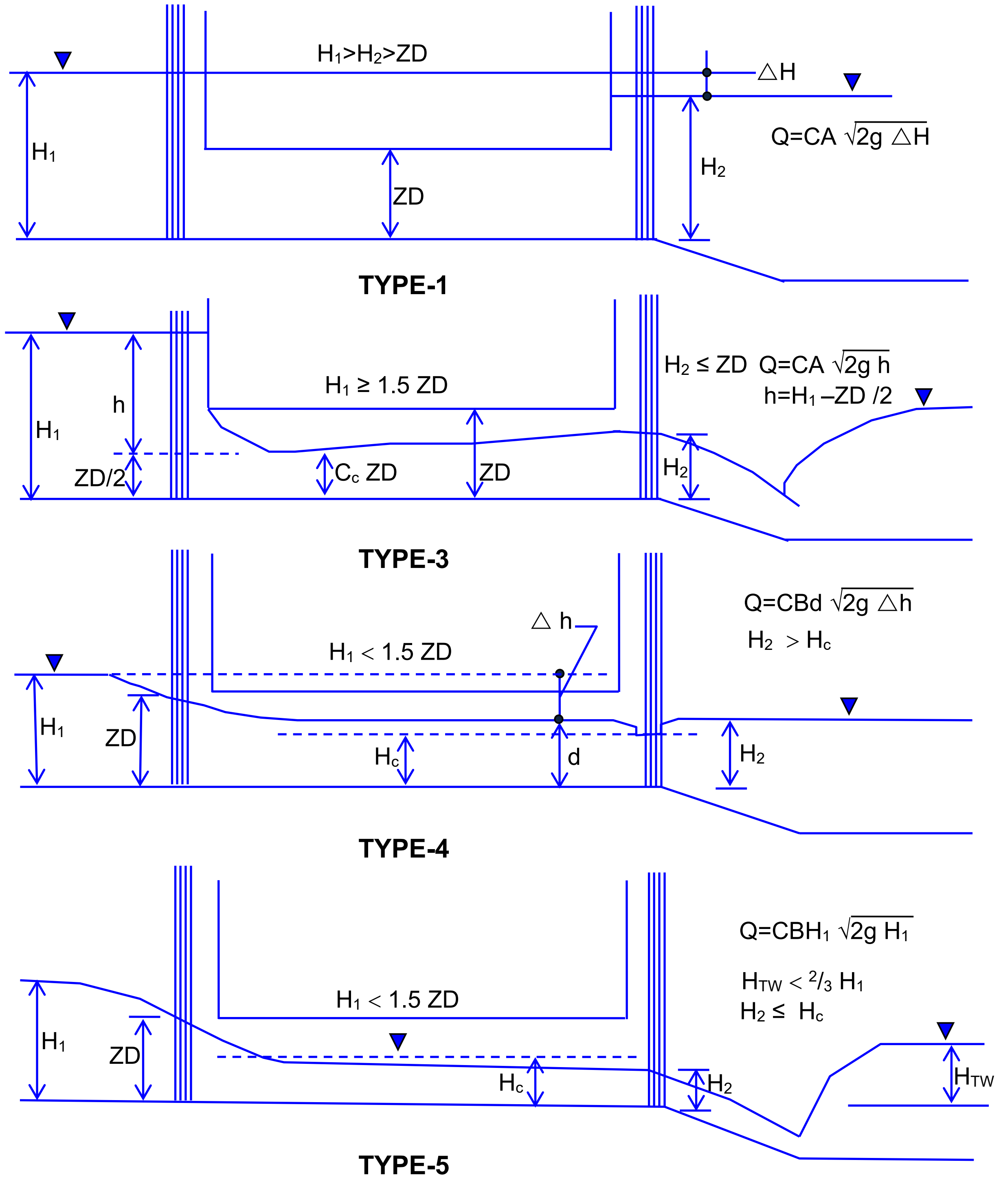
Generally, depth of inundation in drainage subprojects is small. For practical purpose, inundation of arable land can be assumed to be less than 0.3 m (except in landlocked depressions). Therefore, land types in drainage subprojects remain the same before and after the subproject implementation. That is, area of the identified land classes under the pre-subproject and the post-subproject scenarios remains the same.

> **In Drainage Subprojects, the Design Basin Water Level is determined from calculation of Drainage Rate.** It is the highest figure of $\mathbf{WL}_{basin}$ in m PWD in column 6 of Drainage Rate calculation program output. This water level should be used for the design of structures. Also it can be used for sizing channels (design of channel cross-section) if the Design Basin WL is below the channel banks.

If the channel is submerged along the entire length there is no need to size the channel for the whole design discharge (Q_{des}), as part of the discharge will pass over banks outside the channel section.

> Pre-subproject FWL = Annual average FWL, in m PWD
> Post- subproject FWL = Annual average FWL, in m PWD (same as pre-subproject)

Figure 11.1



CONDITIONS OF FLOW THROUGH SLUICES

EXHIBIT 12

PROCEDURES FOR FIELD INVESTIGATION AND DATA COLLECTION

EXHIBIT-12

PROCEDURES FOR FIELD INVESTIGATION AND DATA COLLECTION

1. PREPARATION FOR FIELD INSPECTION

1. Prior to the field inspection of a proposed subproject the feasibility study Consultant's WR Planning Engineer must have completed the following:

- Review subproject proposal
- Identify subproject boundary and catchment boundary on 4" to 1 mile scale BWDB irrigation planning map with land elevation contours and the proposed works along with important physical features to obtain a preliminary Index Map of the subproject;
- Identify the nearest/relevant water hydrometric stations and determine statistic or historic water levels at the subproject site
- Check the problems stated in the subproject proposal, pre-screening, and PRA reports against the topographic and hydrologic data (ground elevations from the contour map and the available water level data)
- Review the proposed type of intervention and possible solution(s) to solve the problems
- State possible impact of the intervention, i.e., elimination of pre- or monsoon flood, improvement of drainage that will result in earlier drainage or removal of water logging from the affected areas, improvement in water availability or irrigation facilities.
- Demarcate on the Subproject Index Map (4 inch to 1 mile) and also on Upazila Base Map preliminary subproject gross benefited area. The benefited area may include area presently affected by flood, prolonged inundation, water logging or area under potential irrigation. Depending on the subproject type the gross benefited area may or may not coincide with the catchment area.

2. On completion of the above tasks, the WR Planning Engineer should apprise his team, including Agronomist, Fisheries/Environment Specialist and Socio-economist about the subproject:

i. Present conditions (topography, existing infrastructure, water related conditions and problems)

ii. Proposed interventions, and

iii. The expected impacts.

Each team member should receive in writing the above information, copies of the preliminary Subproject Index Map and Upazila Base Map showing boundaries of the subproject and existing infrastructure (if the information is available) and other relevant information (PRA and other information received from IWRM). The Socio-economic survey team will use the Upazila Base Map for identification of the subproject villages within mouzas, which are identified by J.L. No. (Jurisdiction List Number). If necessary the team members should be given time to collect necessary secondary data and prepare for the subproject field inspection.

3. For efficient use of the Consultants' and the LGED field staff as well as the beneficiaries' time, it is advisable to conduct joint team field inspections (by the whole inspection team). An advanced field inspection by WR Planning Engineer and Agronomist may be carried out only in case the WR Planning Engineer see little scope for technical

viability of the subproject proposal, based on his review of the available information (topographic and hydrologic data). The rest of the team may carry out their investigation and data collection later on if the WR Planning Engineer and Agronomist find the proposal viable. If both WR Planning Engineer and Agronomist are convinced that the subproject has no scope, or is not needed, they may recommend dropping the subproject. A written statement justifying the recommendation to drop the subproject should be submitted to the IWRM Unit with a copy to the Project Consultants.

4. The Consultant's field inspections should follow standard rules and procedures, which should be known to all the involved parties and individuals; these are as follows.

i. The Consultant informs the LGED District Executive Engineer, by FAX message, the following information:

- Date of inspection (provide day and hour of arrival at the Executive Engineer's office)
- Name of subproject(s) to be inspected with names of Upazilas and Unions
- Name of Consulting Firm
- Names and designations of the inspection team members
- Additional information about the subproject that the team may require from the District LGED Office prior to commencement of the field inspection and technical assistance (but not personal assistance like transport, food and lodging which are the responsibility of the Consultant).

The above information should be sent to the Executive Engineer not less than 3 working days before the inspection and confirmed by telephone. A standard FAX form as attached at the end of this Exhibit should be used for the Consultant's field trip announcement. In follow up,

i. The Executive Engineer informs the Upazila Engineer about the Consultant's field inspection and instructs Jr. Water Resources Engineer to collect necessary documents, and be ready for assisting and accompanying the Consultant's team.

ii. The Upazila Engineer instructs Construction Supervisor (Project Staff) to make preparations for the Consultant's field inspection and accompanying them.

iii. The Jr. Water Resources Engineer and Construction Supervisor work together and meet with the beneficiaries representatives, usually Union Parishad Chairperson and Members and prepare for assistance of the Consultant's team.

2. CONDUCTING SUBPROJECT FIELD INSPECTION

2.1 Briefing LGED District Executive Engineer and Upazila Engineer

5. On arrival at the District Office, the Consultant's team brief the LGED Executive Engineer, Jr. Water Resources Engineer and Community Participation Officer about the subproject as per their findings to date, and their plans for the inspection (meeting should be short, no more than 30 minutes).

6. On arrival at the Upazila Office, the Consultant's team accompanied by the Jr. Water Resources Engineer and the Community Participation Officer will brief Upazila Engineer and his staff about their inspection program (the Construction Supervisor, concerned UP Chairperson and beneficiaries' representatives, if any, may be present at the Upazila Office).

2.2 Subproject Field Inspection

The objective of the field inspection is to verify the existence of the problems, which are listed in the subproject proposal, to identify new/additional problems if any exist, and to obtain more refined information and data that will be used in conducting feasibility analysis and designs.

7. The Jr. Water Resources Engineer, Community Partcipation Officer and Construction Supervisor should assist the Consultant's team during their field inspection. Upazila surveyor should accompany the team if Consultant's surveyor is present during the first inspection.

8. The WR Planning Engineer verifies in the field the subproject catchment boundary by walking around the subproject boundary previously defined from the maps. Any culverts and bridges must be marked on the Index Map with dimensions and direction(s) of flow, depth and dates of maximum and minimum flows.

9. The first round of inspection should start and end at the lowest point in the subproject area; the outfall channel or structure point in drainage and flood management subprojects. Starting field inspection from the lowest point will allow immediate verification of flood problems, which should be most serious in the lowest area and less serious or diminish in upper areas.

10. Once the subproject boundaries are verified and finalized, the Consultant team members start interviewing people to obtain specific data and information according to their disciplines. It is important that the Consultant's team members introduce themselves to every person they ask questions.

11. The Sociologist and Fisheries specialist will interview people and collect information from selected villages and households using the Fisheries Questionnaire. The Fisheries Specialist should ask people about existence of open water fisheries like flood plain fisheries, which is defined by more than 0.9 m depth of flooding. This information is vital for cross checking with agriculture and engineering conditions.

12. The WR Planning Engineer and Agronomist commence second round of subproject inspection, again starting from the lowest point, by asking farmers inside and also outside the subproject, about the current problems and their ideas about possible solution:

- The Agronomist collects information about cropping patterns, yields and constraints like crop damage by floods and drought. He should note dates of floods and mark on the map extent of floods, water logging and drought affected areas.
- The WR Planning Engineer collects information about water related problems, their causes, origin and possible solutions.

13. There are 3 basic types of water related problems:

- Flood
- Drainage, and
- Drought or shortage of water

Depending on topography and hydrological conditions these problems can appear as a single problem or as a combination of two or all the three problems.

14. For efficient use of resources, the collection of field information should be grouped into the following three categories of problems and the questions asked should be specific.

Investigation of Flood Problems

Flood management subprojects require construction of embankments or roads cum embankments to check the flood inflow and construction of drainage structures to drain excess water (local runoff or monsoon season inflow) from the protected area. In small scale subprojects drainage structures form an integral part of a FM intervention.

<u>Extent and levels of floods</u>

15. The term Flood refers to inundation of land by water of external or mixed origin; water coming from upper area and accumulating in lower area of the same catchment is also considered as flood. Typically the information to be collected includes:

- Pre-monsoon maximum flood level - flood that damages Boro crops before harvest (ask people to show water marks of this flood on houses, embankment, bridges, electric posts, etc. but not on trees as trees grow along with the marks).
- Limit of area in the field that is inundated during Boro crop season.
- Monsoon season maximum flood level
- Monsoon season average flood level
- Extent of deep monsoon flooding, i.e., limit of area in the field that remains inundated and no crops can be grown.

16. Limits of floods identified in the field should be marked on the subproject Index Map with contours, from which approximate flood elevations can be estimated. The flood elevations will be determined in more detail by surveying the flood-water marks (mPWD) during topographic survey.

<u>Source of Floods</u>

- Backflow through a khal connecting the subproject with adjacent or downstream river
- Overland flow from upper catchment
- Overtopping embankments and roads
- Source of the overland/overtopping flow
- What is the water level in the adjacent river at the time of subproject flooding (above or below the water level in the subproject; give approximate difference in cm or meters)

17. Local people should be asked about points, direction and dates/month of flood entry, and these should be marked on the Subproject Index Map.

Required Flood Prevention Works

18. Local people should be asked about their ideas on how to protect the area from floods:

- If construction of new flood embankments, inspect proposed alignment and mark on the index map required highlands and high homesteads.
- If re-sectioning of road or existing embankment, mark sections overtopped by high floods, and depth of overflowing water.
- Required structures – check the sites and make notes on required access road, link dykes or other works like channels for local drainage or depressions cut off by local dykes.

Investigation of Drainage Problems

Generally drainage subprojects comprise earthworks like excavation and re-excavation of khals and there is no need for embankments. Hydraulic structures are not usually required in drainage improvement subprojects unless specially needed to prevent over-drainage of beels, etc.

Drainage problems relate to prolonged inundation in local depressions and flat lands by water of local (rain over catchment) or external origin due to lack of or insufficient drainage facilities like channel(s) with too small longitudinal slope or reduced flow section. The channel flow section can be reduced by channel siltation, accumulation of debris, water hyacinth, construction of artificial cross-dams or improperly designed culverts and hydraulic structures.

Insufficient drainage exists when water level in the affected area remains high while water level in the outfall channel (khal or river) is falling down.

<u>Drainage Problems</u>

19. There are two types of drainage problems

    i. drainage congestion (external) and
    ii. water logging (internal).

Drainage congestion occurs when the capacity of external outfall channels is not sufficient to evacuate excess water from the subproject area. Generally removal of drainage congestion involves re-excavation of channels (rivers or khals) outside the subproject boundary.

Water logging occurs when the capacity of internal channels or drainage system is not sufficient to drain the excess water from the subproject area. All obstructions of flow including too small structures will cause water logging. Removal of water logging requires excavation/re-excavation of channels or construction of additional structures within the subproject.

[In practice, in the initial stages of subproject preparation including PRA investigation, drainage problems may be confused with flood problems as both result in inundation of land. Therefore, it is important that the Consultants collect relevant information and data necessary for proper identification of the existing problems].

20. Questions to be asked to local people should include:

- When the land inundation is a problem?
  - in pre-monsoon season
  - in monsoon season
  - in post-monsoon season
- Identify in the field areas inundated during pre-monsoon
- Period of inundation (dates and days)
- What is the source of inundation water
  - local rain
  - upstream overland inflow
  - backflow from downstream khal/river
- What is the water level in the outfall river/khal at the time of inundation?
  - the same as in subproject? - Yes/No
  - if lower, by how much ? (m)
- Is the area inundated during monsoon season?
- What is the water level in the outfall river/khal at the time of inundation?
  - the same as in subproject? Yes/No
  - if lower, by how much (m)
- If the problem is delayed post-monsoon drainage ?
  - average date when water drains from the area
  - date when land preparation is required for planting Boro rice

Investigation of Drought Problems

As drought or shortage of water in the dry season prevails all over Bangladesh, there is no need for verification of the problem; the field investigation should rather be directed entirely on finding means to facilitate irrigation water availability.

Two types of subprojects are implemented under the SSWRDSP to alleviate drought, Command Area Development (CAD) or irrigation and Water Conservation (WC) subprojects.

<u>Command Area Development (CAD) Subprojects</u>

[CAD subprojects include improvement and/or extension of irrigation systems. Irrigation water is lifted from a river channel with perennial flow by means of pumping (stationary or floating pump station)]

21. Field investigation for CAD subprojects generally comprises:

- collection of data on flood water levels during monsoon and minimum flow and water levels in the source river during the dry season
- inspection of existing irrigation systems with a view to improve/expand conveyance of irrigation canals, and
- inspection of additional area to be brought under irrigation; availability of irrigable land, required new canals and canal structures, availability of land for the works availability of adequate water to lift.

<u>Water Conservation (WC) Subprojects</u>

[The WC subprojects are designed for retention of water in a khal (drainage channel) at the end of monsoon. By heading-up water in the channel upstream from the structure the out flow from the subproject is reduced or terminated and water, that otherwise would drain out unutilized, is used for irrigation of Rabi and Boro crops. Usually, the retained water is lifted from the channel into adjacent fields by LLPs. With suitable topography the headed up water may be diverted for gravity irrigation downstream from the structure.

A continuous minimum flow in the channel throughout the dry season is the primary requirement for a successful WC subproject. Generally, if the channel dries out by the end of February, there is no scope for storing enough water for irrigation of Boro crops, even with enlarging storage capacity by re-excavation of the channel.]

22. Field investigation for WC subprojects comprises:

- verification of the catchment boundary upstream from the proposed structure site
- inspection of the proposed structure site (note khal dimensions, channel stability, bank erosion, existing nearby structure like bridge or culvert)
- minimum dry season flow (measure depth, area and velocity of flow to determine discharge)
- maximum flood water level, channel section and bed slope to determine maximum design discharge in case the catchment area cannot be defined (missing map coverage of hilly area or catchment is beyond international border).

23. During the field inspection the WR planner should obtain enough information about the state of the subproject khal(s) to determine if re-excavation is needed or not. He should mark on the index map the required surveys.

2.3 Completion of Field Inpection

24. Before the field inspection is completed the Consultant's WR Planning Engineer has to make sure that he has collected enough information to

i. carry out hydrological analysis, and

ii. plan field topographic survey and give precise instructions to the surveyor how to conduct and what to survey.

As a Team Leader he has to check the progress of other team members and exchange information about his findings and proposed changes if any about the type of intervention and the required works. Usually 2-3 days are required for the WR Planning Engineer and Agronomist for the first field inspection while Socio-economist and Environmentalist require more. The WR Planning Engineer will need to visit the subproject later on with the surveyor, to show him the required work.

25. On completion of his field inspection the WR Planning Engineer meets with the LGED District Executive Engineer to brief him and the project staff about the progress of inspection, findings, recommendations and required field topographic survey works, which will be carried out by the Consultant.

26. The WR Planning Engineer, after completion of the field inspection, shall prepare and submit a brief technical write-up on the outcome of the field inspection, termed as *Concept Plan* of the subproject, outlining the existing water management and agricultural problems and the concept of planning the subproject mentioning its location, boundaries and subproject type. The concept plan will provide a comprehensive Subproject Index Map based on 1:15,840 irrigation planning map with land elevation contours showing all natural and physical features and existing infrastructure, boundaries of subproject area, catchment area and benefited area and all the interventional works considered necessary by the FS Consultants as per their field inspection. The document shall provide tentative costs of the works, estimated incremental benefit and an estimate of economic viability of the subproject together with candid comments on its social and environmental soundness. The concept plan will be reviewed by the IWRM Unit of LGED and the Project Consultants and upon approval of the concept plan, topographical and, other detail surveys will proceed.

3. TOPOGRAPHIC SURVEYS

27. The Engineering survey required for detail feasibility study is undertaken upon finalization of the subproject planning concept. The WR Planning Engineer accompanies the surveyor to the field and shows him in person the works to be done, in addition to identifying the work on the Subproject Index Map and enlarged Upazila Base Map. The WR Planning Engineer this time has better opportunity to verify the information gathered during the first visit and collect additional information if needed.

28. Before the commencement of the field survey, the Consultant's survey party must report to the Upazila Engineer and inform him about their work plan.

29. The Jr. Water Resources Engineer and Construction Supervisor or Upazila Surveyor should be present in the field so they familiarize themselves with the subproject; location of khals, structures and alignment of embankments, as applicable and monitor the survey works on behalf of theUpazila Engineer.

30. On completion of the subproject survey work the Upazila Engineer should sign off the survey Level Books.

3.1 Criteria for Conducting Topographic Surveys

31. All surveys have to be referenced to PWD datum, so the survey data can be compatible with the 4" topographic maps and the water level data recorded at hydrometric stations. If there is no PWD or SOB Benchmark (BM) in the area, a subproject BM has to be established by transfer from the nearest SOB BM using closed-loop benchmark survey method. The subproject BM should be established and clearly marked in protected site like on bridge abutment, box regulator, plinth of brick house, etc. Small pipe structures on weak foundation and trees should not be used for establishing temporary (construction) Benchmarks (TBM), because 2 or more years may pass between the survey and construction and the BM may change its elevation or get damaged/destroyed. Other criteria are as given in table below.

Feasibility-level Surveys

<u>Embankment cross-sections</u>	at 200 m interval + additional sections at places of abrupt or visible change in ground elevation
<u>Channel cross-sections</u>	at 200 m interval + additional sections at places of abrupt or visible change in ground elevation
<u>Area survey</u>	200 m – grid spot level survey when level instrument is used, or Random spot survey at changing ground elevations when theodolite or level with horizontal wheel is used. *[Area survey is conducted for subprojects located in areas not covered by a 4 inch to a mile topographic mapping with contours].*

Final Design Surveys

<u>Embankment cross-sections</u>	at 100 m interval + additional sections at places of abrupt or visible change in ground elevation
<u>Channel cross-sections</u>	*at* 100 m interval + additional sections at places of abrupt or visible change in ground elevation
<u>Structure Site survey</u>	Plane Table survey of an appropriate area with spot ground level survey at 5 m grid points over the PT area. *[Structure Site or Plane Table survey should cover the entire structure site including link road, diversion channel, and work and material storage area]*

The surveyed cross-section data are used for the preparation of long sections (also called profiles) of embankments and channels.

3.2 Survey of Embankment

32. The survey of embankments include

i. delineation of embankment alignment, and
ii. level survey of cross sections along the embankment alignment (new and existing)

33. The delineation or establishment of actual embankment alignment in the field is a very important task as it affects engineering design and land acquisition; and it can take much more time than the actual survey. For this reasons it has to be done jointly by the Consultant, LGED and the project affected people, especially farmers whose land will be taken for the embankment.

34. The team working on embankment alignment should comprise:

- Consultant's Water Resources Planning Engineer
- Jr. Water Resources Engineer
- Community Participation Officer
- Construction Supervisor
- Upazila Surveyor
- Consultant's Surveyor
- Union Parishad Chairman, and
- Land owners whose land will be taken for the embankment.

If there are disagreements in finalizing the alignment, Upazila Engineer and/or LGED Executive Engineer may be called upon for help.

35. It is essential that the survey is carried out along the correct alignment as the data will be used for the design of the embankment, cost estimate for construction and for estimation of land acquisition payments to individual land owners.

36. The centerline of embankment alignment should be established in the field with wooden/half bamboo stakes driven into the ground (at 100 m or 200 m intervals, and closer at points of changing direction) at centerline of proposed new embankment or retired embankment or at the center of existing embankment crest. Two (2) stakes should be placed at each station, one 20 cm long driven at the centerline to the level with the ground (survey stake) and one 50 cm long driven 20 cm deep at 30 cm to the left side from center stake. The 50 cm stake is called witness (identifying location of the center stake that will be surveyed) and it should have written on it the stake number and chainage of the place. The survey stakes and witnesses should be left in the field for future reference of stations and chainage; elevations however should be checked using field BMs as the stakes can be distorted.

Surveying Cross-sections

37. Generally 3 spot levels at 15 m interval are sufficient for new embankment cross-section in flat land or land with regular slope: at R/S (river side), center line, and C/S (country or protected land side). If there is depression or locally elevated ground more spot levels need to be taken.

38. Minimum 7 spot ground levels need to be taken (3 on top – centre and c/s and r/s edges and 2 each on natural ground on the r/s and c/s) at cross-sections for re-sectioning of an existing embankment. R/S and c/s natural ground elevation should be surveyed at toe of the slope and at minimum 10 m distance from the toe.

39. If the embankment toe is close, less than 15 m, from a channel the channel section has to be included in the embankment survey. Full channel section, if it is a small channel, earth from the channel excavation will be used as fill material for the embankment. For rivers and deeper channels partial section showing full bank slope and of channel depth should be surveyed for proper design of embankment set-back distance (see **Figure 12.1**).

Embankment Survey Rules

i. The embankment survey should be carried out in clock-wise direction such that the riverside remains on the left side and the countryside or protected area on the right side.
ii. Cross-sections should be surveyed from left to right.
iii. The survey starting point (Chainage 0+000) should be easily identifiable in the field like road, homestead, or specified distance from permanent objects like bridge or other structures.

3.3 Survey of Khals / Channels

Channel Survey Rules

i. Channel surveys should proceed from downstream to upstream, with Station 1 or Chainage 0+000 at the lowest point, point in the channel where there is no need for re-excavation or at the outfall river/khal.
ii. The survey starting point should be easily identifiable in the field, like bridge, culvert or outfall channel.
iii. Cross-section or bed elevation of the outfall river should be included in the survey of drainage channels/khals.

40. In case there is an existing dike along the channel, the channel section should include the dike and it should extend 10 m beyond the toe of the dyke. In such case, both natural ground elevations (beyond the dyke) and the crest elevation of the dyke should be shown on the channel long section together with the bed profile of the khal.

Small Scale Water Resources Development Project
in Greater Mymensingh, Sylhet and Faridpur Areas

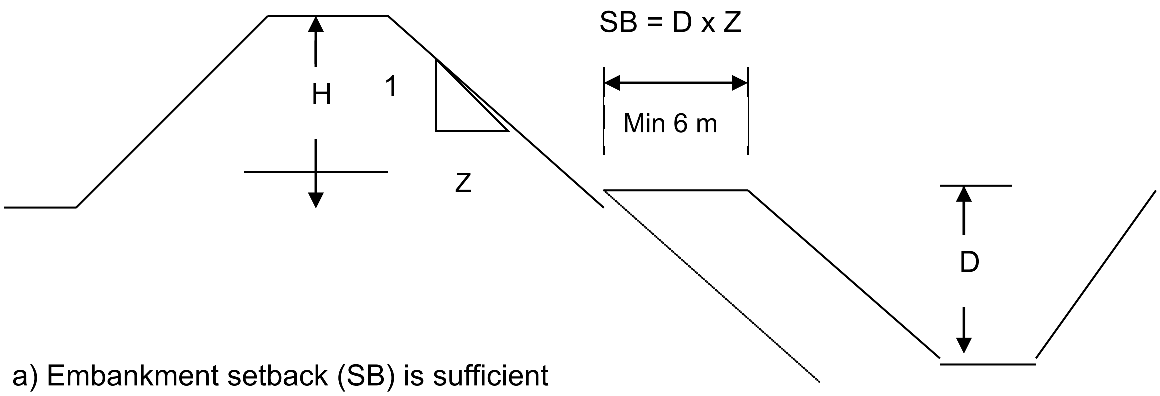
FAX Message
Subproject Field Inspection Program of Feasibility Study Consultant

To: LGED Executive Engineer ____________________District

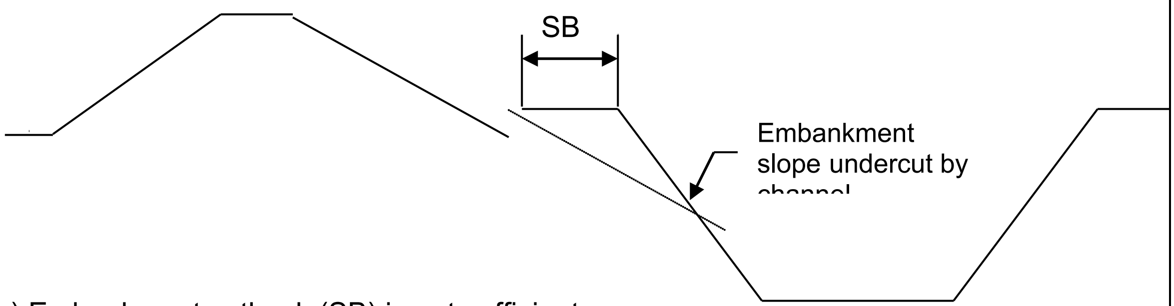
From: _____________________________________(Name of Consultant)	
Name of Subproject: ___________________________Upazila: ________________________	
Team Arrival Date: ____________________________Time: ________________________	
Designation and Name of Inspection Team: 1. Water Resources Planner ____ 2. Agronomist ____ 3. Socio-economist ____ 4. Environment/Fisheries Specialist ____ 5. Surveyor ____	
Briefing of (1) Executive Engineer and (2) Upazila Engineer	
At Start of Inspection Date and Signature of District XEN	At End of Inspection Date and Signature of District XEN
At Start of Inspection Date and Signature of UZ Engineer	At End of Inspection Date and Signature of UP Engineer
Comments:	Comments:

Note: Two copies of this form should be used; one copy to be sent by fax to XEN for information, and one copy retained for inclusion in the subproject Backup File.

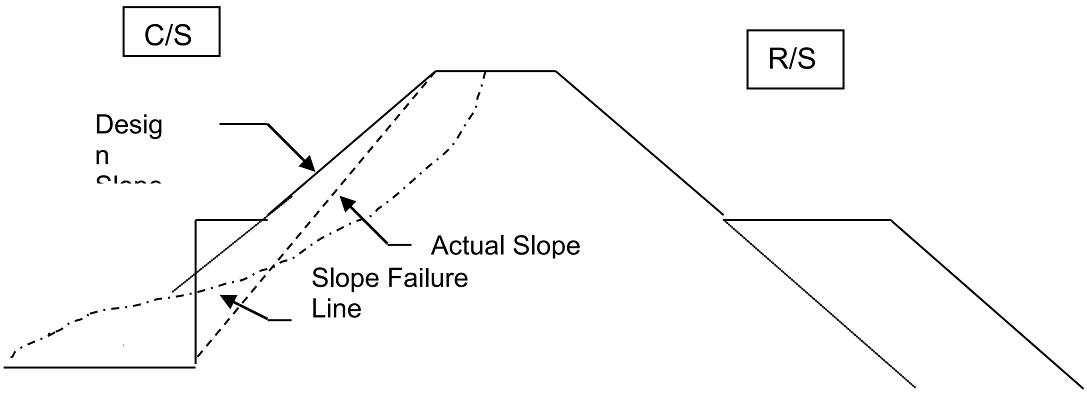
Figure 12.1: Defining Embankment Setback Distance



a) Embankment setback (SB) is sufficient



b) Embankment setback (SB) is not sufficient.
Berm above doted line will slide down.



c) C/S Borrow pit is too close to embankment toe.
Slope will slide down and embankment will fail.

EXHIBIT 13

FURTHER GUIDANCE ON FEASIBILITY ANALYSIS
(AGRO-ENGINEERING)

EXHIBIT 13

FURTHER GUIDANCE ON FEASIBILITY ANALYSIS
(AGRO-ENGINEERING)

1. Definitions Relevant to SSWR Subprojects

Water Resources Development Subproject

A Hydrological Unit within a defined catchment including all existing and planned infrastructure designed to improve water-soil relation for increase of agricultural production.

1. Net benefited area of a single SSWR subproject is limited to 1,000 hectares. The subproject must be technically viable, economically feasible, environmentally sound and socially acceptable and must comply with all the specified criteria of the Project.

Subproject Catchment Area

Catchment area (also called drainage area, catchment basin or watershed area) is an area enclosed by highest elevation points/line attributed to a specific lowest outflow point in the basin through which all rainwater runoff drains out from that basin.

2. A specific subproject catchment is separated from adjacent catchments (basins) by a divide line formed by natural topography of elevated land (successive hills and ridges) or artificial, man-made topography (elevated roads and/or flood embankments, homestead platforms), which can be traced on a topographic map by joining successive highest elevation points in a closed loop starting and ending at the outflow point.

3. Runoff from rain falling over a single catchment drains through the outflow point, ie., structure or section of channel/khal or land valley. In the context of small-scale water resource development, two types of catchments can be identified in flat topography areas: dry season catchment and monsoon season catchment. Monsoon season flood may overtop dry season divide boundaries and merge several dry season catchments into one common wet season catchment, which also may have several outflow points or outlets.

4. When demarcating a subproject catchment area, the planner should remember that catchment boundary (divide line) runs through highest points of hills but it should never cross: valleys, land depressions, ponds, beels, baors, haors, channels, khals and rivers.

5. In flat topography, there might be channels or small khals connected with other channels periodically draining to the outside of the subproject catchment. These are called double outlet channels with direction of flow depending on water levels in the adjoining basins. In this case the planner should examine the channel in the field, ask local people about direction of flow and water levels at which the flow changes direction. The channel in question must be surveyed. Based on the shape of the profile the planner can decide about the location of the catchment divide line, and leave it as it is or have it closed at the divide line.

Subproject Gross Benefited Area

Area affected by poor drainage, floods or drought, from which these problems shall be removed or mitigated after the subproject implementation.

6. Depending on type of subproject, the gross benefited area may comprise a part of or whole subproject catchment and it includes highland, homesteads, roads and water bodies if present within its boundary. Elevation of the design flood, the extent of water logging and elevation or distance to which water can be made available for irrigation define the boundary of gross benefited area.

Subproject Net Benefited Area

Subproject net benefited area is the area of cultivable land within the subproject gross benefited area. It is calculated by subtracting the area under water bodies, homesteads and infrastructure from the subproject gross benefited area.

Subproject Boundary

Subproject boundary is the outer limit of the area physically affected by the subproject interventions. Depending on land topography, subproject location and subproject type, subproject boundary may be represented by the boundary line of catchment area or by the boundary line of subproject gross benefited area. Usually, in subprojects with sloping topography, catchment boundary coincides with gross benefited area boundary in the lower basin while in the upper basin catchment boundary is farther away outside the gross benefited area boundary.

7. In Flood Management (FM) and Drainage (DR) subprojects located in coastal area and covering whole polders, and FM and DR subprojects located in floodplains of big rivers with entire subproject area inundated (excluding homesteads) the subproject boundary coincides with the *subproject catchment boundary*.

8. In Flood Management (FM) subprojects located in haor areas of greater Sylhet and Mymensingh Districts with entire subproject area inundated (excluding homesteads) the subproject boundary coincides with the *subproject catchment boundary*.

9. In Flood Management (FM) and Drainage (DR) subprojects located in non-tidal area having sloping basins, which are flooded only in lower part the subproject boundary coincides with the *subproject gross benefited area boundary*.

10. In Water Conservation (WC) subprojects located in hilly areas or having sloping basins the subproject boundary coincides with the *subproject gross benefited area boundary*.

11. In Command Area Development (CAD) subprojects the subproject boundary coincides with the *subproject gross benefited area boundary*. It may be within a single catchment or it may extend over parts of more than one catchment. This can be so because the most practical alignment of irrigation canals is over divide lines in higher lands.

2. The Importance of Understanding Definitions

Subproject Catchment Area

12. Subproject Catchment Area is the base parameter used for Hydrological and Engineering Designs of subprojects including location, type and size of earthworks and hydraulic structures.

13. Incorrectly demarcated catchment boundary may lead to design of a subproject, which is not a *hydrological unit/sub-unit* and as such covers only a part of or encroaches on neighboring catchments. This in turn will result in

- » design of a subproject with too small catchment area, or
- » design of a subproject with too large catchment area.

14. Subproject designed with <u>too small catchment area</u> will have undersized channels and structures to convey the actual discharges. As a result, post subproject conditions will worsen due to (1) increased drainage congestion and higher internal flood inside the subproject boundary, and (2) accumulation of flood and water logging outside the subproject embankments constructed across the actual subproject basin. Local people will have no choice but to cut embankments at both upstream and downstream end of the subproject, to relieve water accumulated outside embankment and drainage congestion inside the subproject. In such case the undersized structures will be prone to early damage and additional structure(s) will need to be constructed. Also additional embankments along the correct boundary may have to be constructed.

15. Subproject designed with too large catchment area will have excess capacity channels and structures, which results in an accelerated silting of channels due to reduced flow velocity. Also, the subproject construction will require higher capital investment cost and consequently larger beneficiaries' contribution for O&M.

Subproject Gross Benefited Area

16. The subproject gross benefited area dominates the *Institutional and Social aspects* of the subproject. It is the base data used for identification of the subproject beneficiaries. Since majority of the subproject farmers live within the subproject gross benefited area, it is very important that its boundaries are correctly defined in the field and demarcated on the Subproject Index Map.

17. The implications of incorrectly demarcated gross benefited area will result in WMCA membership including people who will not be getting any benefits from the subproject but will be demanded to make financial contribution to the subproject.

Subproject Net Benefited Area

18. The subproject net benefited area comprises cultivable land subject to improved conditions for agricultural production within the subproject or land positively affected by the subproject intervention. In other words, all the post-subproject changes in agriculture take place only within the net benefited area.

19. It is the base information used in agricultural planning and design, and determination of the expected subproject benefits.

20. The implications of incorrectly demarcated net benefited area will result in false claims of subproject benefits and/or implementation of not feasible subprojects.

3. Types of Subprojects with characteristic problems and infrastructure needs

21. Subproject type is governed by both the present or pre-subproject problems and by the proposed interventions that will define the future or post-subproject conditions in a defined subproject area. There are four basic types of subprojects according to problem solving:

i. **Flood Management (FM)**

Interventions are designed for prevention and/or mitigation of damages caused by flood inundation, Subprojects to keep floods away fully and year-round are called full FM and those to keep floods away during the pre-monsoon only are called partial FM or early FM subprojects.

ii. **Drainage Improvement (Dr)**

Interventions are designed for evacuation of excess water timely.

iii. **Water Conservation (WC)**

Interventions are designed for conserving and making surface water available, principally for irrigation, and

iv. **Command Area Development (CAD)**

Interventions are designed to improve water conveyance and distribution of existing community based irrigation systems to enhance irrigation efficiency and canal area for elimination of drought by providing/distributing irrigation water to croplands.

22. There may be other types of subprojects by combination of the above four types to solve more than one problem in the area. Currently, eight (8) types of SSWR subprojects are being implemented. These are listed in **Table 13.1** below along with related hydrological and agricultural problems and typical required interventions.

23. Many times, it is difficult to differentiate a flood management problem from a drainage improvement problem as in both cases land is flooded (inundated) during pre-monsoon and/or monsoon season. There are two indicators to be considered which will aid the

planner to identify the subproject type: (i) water levels in the outfall channel and (ii) depth of inundation (mainly used in planning of agriculture).

In Flood Management problem, during flood, water level in the outfall channel remains above ground elevation of the subproject's benefited area. The outfall channel water floods the subproject and it also controls drainage from the subproject. Also there are cases of floods caused by local rainfall or by runoff from upper catchment but still in these cases the outfall channel controls the outflow and as such makes the basin flood worse.

In Drainage Improvement needs, when the subproject is inundated, water level in the outfall channel is below ground elevation of the subproject's benefited area. The outfall channel does not control drainage (unless it is silted or obstructed, in which case it also has to be re-excavated), and water in the subproject basin accumulates above the elevation of the outfall channel due to constrictions (bottlenecks), siltation of internal channels or general siltation of locally depressed valleys that act as floodways.

Generally, depth of inundation in drainage problems is small. For practical purpose, the inundation of arable land can be assumed to less than 0.3 m (except in landlocked depressions). Therefore, land classes in drainage subprojects remain the same before and after the subproject implementation.

4. Pre-subproject Conditions and Expected Impacts of Subprojects

24. The typical indicators for analysis of pre-subproject conditions and the expected hydrological impacts to facilitate assessment of the projected changes in agricultural and fisheries production due to subprojects are summarized in **Table 13.2**. The planers studying feasibility of subprojects and also those who review the feasibility reports will be guided by the Table.

Table 13.1: Different Subproject Types: Usual Problems and Physical Works Required

Subproject Type	Present (pre-subproject) Problems		Possible Causes / Origin of the Problems	Subproject Infrastructure / Works Required
	Hydrological	Agricultural		
1. Flood Management (FM)	• Pre-monsoon river flood inundates the area. • Monsoon river floodwater enters the area at fast rate; frequent/repeated inundation by peak floods. • Deep flooding during monsoon.	• Inundation and damage of Boro rice before or at harvesting. • Inundation prevents plantation of Aus and Deep Water Rice (DWR), or damage young Aus or DWR seedlings. • Damage of mature Aus in early monsoon; fast inundation and damage of young T Aman rice. • Delayed transplantation of Aman; more than one transplantation is required; late plantation and reduced yield level. • No crops or only DWR can be grown during monsoon.	• Short duration high floods produced by medium and small size flashy rivers with hilly catchments. • Medium and large size rivers in northern part of Bangladesh. • Floodplains of medium and large rivers of Bangladesh. • High intensity rainfall in upper catchment.	• Construction of new flood embankment. • Re-sectioning / upgrading of existing flood embankment or road embankment. • Construction of sluices with automatic flap gates. • Construction of regulators, i.e., hydraulic structures with slide (vertical lift) gates.
2. Drainage Improvement (Dr)	• Delayed and slow drainage of pre-monsoon rain accumulated in lower parts of subproject. • Delayed/slow drainage of monsoon rainfall runoff accumulated in upper parts of subproject basin. • Water logging in land depressions in pre- and/or post-monsoon season.	• Inundation and damage of Boro rice before or at harvesting. • Inundation and damage of Aus or young Aman rice. • Excess water prevents land preparation and plantation of Kharif-1 crops. • Water remaining in the field prevents land preparation and plantation of Rabi crops.	• Insufficient capacity of internal drainage; too small or silted internal drainage channel. • Insufficient capacity of structure constructed over drainage channel; culvert or hydraulic structure with too high invert level or structure too small. • High water level in outfall drainage channel with sufficient section. • No drainage channel.	• Re-excavation / excavation of internal drainage channels (ditches, khals). • Construction of additional drainage structure (bridge, culvert, sluice/regulator or weir). • Excavation of drainage-link channel. • Re-excavation/dredging of outfall channel, if the channel is adjacent to the subproject. It may not be feasible under the project if channel is large or outside subproject.

Subproject Type	Present (pre-subproject) Problems		Possible Causes / Origin of the Problems	Subproject Infrastructure / Works Required
	Hydrological	Agricultural		
	• Drainage congestion; water does not drain or drains very slow from the subproject.		• Silted outfall drainage channel.	
3. Water Conservation (WC) (For technical viability of WC subprojects, minimum dry season flow Qmin, shall be 85 l/s)	• Shortage of water and drought conditions during winter and pre-monsoon season. • At the end of monsoon water drains fast and cultivable lands experience drought. • Periodic shortage of water during monsoon season.	• Rabi and Boro crops suffer drought damage or crops can be grown only in small area. • Soil residual moisture level falls fast and there is not enough water to grow Rabi crops and wheat. • Shortage of irrigation water for Boro rice cultivation. • Aman crops suffer shortage of water during dry spells in monsoon –require supplementary irrigation.	• Floodwater drains fast from the area at the end of monsoon. • Rainwater drains fast from the area due to high land slope. • General shortage of water for cultivation or increase of area under Rabi crops and Boro rice.	• Construction of water conservation facilities like gated water retention structure (WRS), fixed crest weirs, regulators/sluices with slide gates for retention of water in the channels; • Re-excavation of khals to increase water storage and facilitate water availability, particularly in tidal channels for LLP irrigation. *NOTE* *A minimum flow of about 85 l/s (0.085 $m^3/_5$) is usually considered necessary for a WC subproject.*
4. Command Area Development (CAD)	• Shortage of water and drought conditions during winter and pre-monsoon season. • Periodic shortage of water during monsoon season. (In northern parts of Bangladesh)	• Shortage of irrigation water for Boro rice cultivation. • Soil residual moisture level falls fast and there is not enough water to grow Rabi crops and wheat.	• Monsoon water drains fully from the area and soil moisture depletes in dry season. • Absence of facilities to provide irrigation for boro rice cultivation.	• Absence of facilities to provide irrigation for boro rice cultivation.- Construction of irrigation water delivery and distribution systems like lined irrigation canals or buried pipelines with distribution structures, structures to cross drainage khals,etc.. NOTE *Sufficient surface water availability and pumping facility to meet the irrigation water requirement of cultivated crops (river flow during entire dry season and number of pumps with required capacity) are essential requirements for CAD subprojects.*

Subproject Type	Present (pre-subproject) Problems		Possible Causes / Origin of the Problems	Subproject Infrastructure / Works Required
	Hydrological	Agricultural		
5. Flood Management and Drainage (FMD)	• Pre-monsoon river flood inundation. • Monsoon flood inundation. • Delayed drainage logging following heavy rain or river flood inundation. • Water logging in low lands	• Flood damage of Boro rice; grows only local variety Boro; low land remains fallow. • Flood damage of Aus and/or Aman rice; land remains fallow. • Late planting of Rabi crops; crops can not be cultivated.	• High river stages composed to subproject land elevations; • Inadequate drainage facilities. • Lack of drainage channel from isolated lowlands.	• Construction of / upgrading of roads to flood embankments. • Excavation / re-excavation of khals. • Construction of sluices or regulators.
6. Flood Management, Drainage and Water Conservation (FMD&WC)	• Pre-monsoon and/or monsoon flood inundation; • Slow/delayed drainage following heavy rain or river flood inundation; • Shortage of water in post monsoon and dry seasons.	• Flood damage of Boro rice. • Flood damage of Aus and/or Aman rice; land remains fallow. • Late planting of Rabi crops. • Boro crops suffer from water stress (droughty crops). • Expansion of Rabi and Boro crops not possible for shortage of water; crops cannot be cultivated.	• High river flood stages in relation to subproject land elevation. • Inadequate drainage facilities. • Lack of drainage channel from isolated lowlands. • Lack of or insufficient facilities for storage or control of water outflow.	• Construction of / upgrading of road to flood embankments. • Re-excavation of drainage channels. • Construction of sluices or regulators equipped with slide gates designed for retention of water.
7. Drainage and Water Conservation (DR& WC)	• Delayed and slow drainage during pre-monsoon. • Delayed and slow drainage during post-monsoon. • 3. Shortage of water in winter season.	• Flood damage of Boro crops; late or no planting of Kharif-1 crops. • Late planting of Rabi crops or crops canot be cultivated. • Drought damage of Rabi and limited area or droughty Boro crops; crops cannot be grown	• Silted up drainage khals. • Lack of drainage channel from isolated lowlands. • Lack of or insufficient facilities for storage or control of water outflow from subproject.	• Excavation / re-excavation of drainage channels. - Reconstruction or construction of additional drainage sluices. • - Construction of gated water retention structure (WRS) and / or providing sluices/regulators with vertical slide gates.

Subproject Type	Present (pre-subproject) Problems		Possible Causes / Origin of the Problems	Subproject Infrastructure / Works Required
	Hydrological	Agricultural		
8. Command Area Development and Drainage (CAD&DR)	• Shortage of water and drought conditions during winter and pre-monsoon season. • 2. Water logging in lower parts of subproject benefited area.	• Growing of crops during winter is not possible without irrigation. • During pre-or monsoon season crops are damaged due to water logging. Slow and late drainage in post-monsoon limits cultivation of Rabi crops.	• Silted up drainage facilities. • - Lack of drainage channel from isolated lowlands. - General shortage of water for cultivation or increase of area under Boro rice.	• Construction / re-construction of irrigation water delivery and distribution systems like lined canals,etc. and distribution structures, • - Improvement of drainage system (excavation / re-excavation of drainage channels)

Table 13.2: Indicators for Analysis of Subproject Imapcts

<table>
<tr><th rowspan="2">Problem</th><th colspan="2">Present (Pre-subproject) Conditions</th><th colspan="2">Future (Post-subproject) Impacts</th></tr>
<tr><th>Hydrological Indicators</th><th>Agricultural Indicators</th><th>Hydrological Indicators</th><th>Agricultural Indicators</th></tr>
<tr><td colspan="2">1. Flood Management (FM) Subprojects</td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">i. Pre-monsoon river floodwater inundates the area.

[Subproject designed for pre-monsoon flood protection is called partial Flood Management subproject or early flood management (EFM) subproject.]</td><td>• 1:2.33-yr river Flood WL in May is above arable ground elevation.</td><td>• Flood damage of Boro rice on land inundated more than 0.3 m deep.</td><td>• 1:2.33-yr subproject WL in May is reduced.</td><td>• Area of flooded Boro reduced or eliminated on the pre-subproject flooded lands.
• No change of Land Classes.</td></tr>
<tr><td>• 1:10-yr river Flood WL in May is more than 0.3 m above part of arable land elevation for more than 3 days.</td><td>• Flood damage of Boro rice on land below 1:10-yr pre-monsoon flood level.
Young Aus rice damaged.
• Boro (flooded) ____ ha
• Aus (flooded) ____ ha
• B. Aman (flooded) ____ ha
• Jute (flooded) ____ ha</td><td>• 1:10-yr Subproject WL in May reduced:
• from _____to ____ m PWD.</td><td>• Area of flooded Boro reduced or all Boro rice is flood free (normal).
• Boro rice crop flood free (normal) on land flooded less than 0.3 m.
• Area under Boro rice increased.
• No change of Land Classes</td></tr>
<tr><td rowspan="2">ii. Monsoon river floodwater inundates the area.

[Subprojects designed for monsoon flood protection also prevent inflow of the pre-monsoon flood into the protected area and are called full flood management subprojects]</td><td>• 1:2.33-yr Annual (monsoon) Flood Level inundates part of arable land by more than 0.3m.</td><td>• Flood damage of Aus rice.

• Flood damage of Boro Rice</td><td rowspan="2">In Non-Tidal Area:
• 1:10-yr monsoon WL in subproject area reduced:
• from ____ to ____m PWD.
• 1:2.33-yr flood level is difficult to reduce without pumping.

In Tidal Area:
• 1:2.33-yr monsoon WL in subproject area reduced: from____ to ___m PWD.

• 1:10-yr monsoon WL in subproject area (HTL) reduced: from____ to ___m PWD.</td><td rowspan="2">• Area of flood damaged Aus and Boro reduced.

• Area of flood damaged Aman crop reduce due to reduced subproject monsoon water level.

• Area of HYV Aman increase.

• Generally no change of land classes in non-tidal area but in tidal area, land classes change.</td></tr>
<tr><td>• 1:10-yr Annual (monsoon) Flood Level inundates part of arable land by more than 0.9 m.</td><td>• Flood damage of Aman rice.
• Aman transplantation delayed.
• Low yield DWR is grown in lowland under compulsion
• Lowest arable land remains fallow during monsoon.</td></tr>
</table>

Problem	Present (Pre-subproject) Conditions		Future (Post-subproject) Impacts	
	Hydrological Indicators	Agricultural Indicators	Hydrological Indicators	Agricultural Indicators
2. Drainage Improvement (Dr) Subprojects				
i. Delayed and slow drainage of pre-monsoon rainfall runoff.	• Water accumulates in subproject low land or local depressions to more than 0.3 m depth and stays for more than 3 days. • Drainage congestion affected area is ________ha. (to be determined from field survey of May water mark).	• Flood damage of Boro rice following local rainfall. • Aus plants (young rice damage are following local rainfall. • Rabi crops are damaged follows rainfall. • Boro (Flooded) area = ______ ha	• No water accumulation and water logging in the subproject basin during pre-monsoon.	• No flood damage of Boro rice. • No flood damage of young Aus rice. • No change of Land Classes.
ii. Water congestion following heavy monsoon rains	• Outfall river WL is low (there is no backflow from outfall river) but rainwater drains slow from parts of subproject basin.	• Aman rice is damaged following local rainfall.	• Better drainage and no water congestion in subproject area during monsoon if outside river WL is low.	• No or reduced damage to area of Aman. • No change of Land Classes.
iii. Slow post-monsoon drainage, water logging in lowlands	• Water drains slow from parts of basin though water level in the outfall river falls faster. • Low lands get water logged as drainage stops at some stage.	• Late or no planting of Rabi crops. Boro rice cultivated on limited area.	• Monsoon floodwater drains out from the subproject following water level in the outfall channel. • No. waterlogged area in the subproject.	• Rabi crops can be planted on time. • Rabi crop area expanded. • No change of Land Classes.
3. Water Conservation (WC) Subprojects				
i. At the end of monsoon, water drains fast from the subproject through drainage khal(s).	• Lack of facilities for checking outflow and conserving water in the subproject area.	• Shortage of water and soil moisture for Rabi crops. • Boro crops grown on small area and suffer drought stress.	• Water availability improved by checking water outflow at the end of monsoon and storing water in the khal behind WRS.	• Increased area of Rabi crops. • Increased area of Boro rice. • Area of Boro (droughty) reduced or eliminated. • No change of Land Classes.
4. Command Area Development (CAD) Subprojects				
i. Irrigation water supply facilities are inadequate or absent.	• Sufficient surface water available in adjacent river for expansion of irrigation area but delivery and distribution system is poor.	• Irrigated area small. • Crops on part of irrigated area suffer from drought.	• Irrigation water distribution facilities improved and expanded.	• Area of Boro (droughty) reduced or eliminated. • Increase of irrigated Boro rice area • No change of Land Classes.

EXHIBIT 14

GUIDANCE FOR REVIEW OF FEASIBILITY REPORTS

EXHIBIT 14

GUIDANCE FOR REVIEW OF FEASIBILITY REPORTS

1. Review of Feasibility Analysis

1. Review of feasibility analysis involves crosschecking for consistencies of hydrological and agronomical inputs with topographical data and verification of the inputs under both pre-subproject and post-subproject hydrological conditions.

2. Checklists, with additional explanatory information of common pre-subproject and post-subproject conditions, for the four basic types of subprojects have been compiled in **Table 14.1**. To avoid repetition, verification of multi-purpose subprojects like FMD or FMD&WC etc., has not been included in **Table 14.1**. The verification, however, of the combined type subprojects should be carried out by combining or repeating the checklist items of the basic types as applicable.

2. Checking of Feasibility Report Text and Figures

2.1 General

3. The overall process of checking Feasibility Reports, the text and figures, basically follows the process of planning and design of water resources development subprojects, which involves:

   i. Detailed study of individual components common to all types of subprojects and
   ii. Synchronized analysis, by comparison and crosscheck, of components unique to each type of subproject.

4. The components common to all subprojects include detailed study of topography, climate, hydrology, agriculture and fisheries of the subproject in order to assess the present (pre-subproject) conditions necessary for verification of the reported problems.

5. The synchronized analyses of specific components to subproject types are to determine impacts of the proposed interventions including earthworks, structures and water management through operation of structures on hydrological conditions in the subproject.

2.1 Verification of Subproject Components

6. The components common to most types of subprojects are itemized in **Table 14.2.** The verification tasks of items as they appear in the Appraisal Report, followed by the result and remarks, if any, are also included in the table.

Table 14.1: Checklist for Appraisal Studies Inputs and Outputs

Hydrology	Topography	Area of Cultivable Land	Crops Reported in Table 6 of Feasibility Report	Description of Pre- subproject/ Post-subproject Conditions	OK / NO
1. Subproject Type: Flood Management A. For Pre-monsoon Flood Management (Partial Flood Protection)				No change in land classes	
Pre-subproject Condition					
1:2.33-y FL in May ____ m PWD	Arable land elevation vary from ___ to ___ m PWD	Below 1:2.33-y FL ___ ha	HYV Boro (flooded) ________ ha	• If area of cultivable land below 1:2.33 yr FL is "0", there should be no HYV Boro (flooded) damaged by flood. (It might be damaged by drought or poor drainage and as such under different type of subproject)	
1:10-y FL in May _____ m PWD		Below 1:10-y FL _____ ha	HYV Boro (flooded) ________ ha HYV Aus (flooded) ________ ha	• 1. The area of HYV Boro (flooded) can not be more than the area of cultivable land below 1:10-y pre-monsoon FL.	
Post-subproject					
Basin WL in May ____ m PWD		Below Basin WL _____ ha	HYV Boro (normal) ________ ha HYV Aus (normal) ________ ha	• Basin WL must be lower than 1:10-y May FL. • Depending on Basin WL the area of HYV Boro (flooded) can be reduced down to zero. • Local Boro can be replaced by HYV Boro. • 4. Aus (flooded) can be replaced by Aus (normal).	

Hydrology	Topography	Area of Cultivable Land	Crops Reported in Table 6 of Feasibility Report	Description of Pre- subproject/ Post-subproject Conditions	OK / NO
B. For Monsoon Flood Management (Full Flood Protection Function)[1]				Land classes changed	
Pre-subproject					
1:2.33-y Annual FL ___ m PWD	Arable land elevation from ___ to ___ m PWD	Below 1:2.33-y FL___ ha	HYV Boro (flooded) ________ ha HYV Aus (flooded) ________ ha HYV Aman (flooded) ________ ha	• If the area of cultivable land below 1:2.33-y FL is zero there is no flood damage in average year and only fraction of area inundated by 1:10-y flood can be claimed as flooded.	
1:10-y Annual FL _____ m PWD		Below 1:10-y FL ____ ha (These figures come from elevation-area table)			
Post-subproject					
Basin WL(Annual) ____ m PWD		Below Basin WL ____ ha	HYV Boro (normal) ________ ha HYV Aus (normal) ________ ha HYV Aman (normal) ________ ha	• Basin WL must be lower than 1:10-y FL. • Depending on Basin WL area of HYV Boro (flooded) can be reduced down to zero. • Local Boro can be replaced by HYV Boro. • Aus (flooded) can be replaced by Aus (normal). • HYV T Aman (flooded) can be replaced by HYW T Aman (normal) and area increased. • LT Aman can be replaced by HYV T Aman. • LT Aus (flooded) can be replaced by HYV • T Aus (normal).	

[1] Monsoon Flood Management (Full Flood Management) subprojects protect from flood damage both the pre-monsoon and monsoon crops for flood damage.

Generally in the SSWR subprojects, full flood protection can be achieved only in tidal zone subproject (polders) and in non-tidal zone in subprojects located in slopping basins flooded by flashy rivers.

Flood Management Subprojects can be designed for protection of crops from 1:10-y annual flood (short peak floods) on small and medium rivers, while it is impossible to lower the average monsoon flood.

Hydrology	Topography	Area of Cultivable Land	Crops Reported in Table 6 of Feasibility Report	Description of Pre- subproject/ Post-subproject Conditions	OK / NO
2. Drainage Improvement (Dr) Subproject A. Pre-monsoon Drainage Improvement				No change in land classes	
Pre-subproject					
1:2.33-y FL in May ____ m PWD	Arable land elevation from ___ to ___ m PWD	Below 1:2.33-yr May FL: ______ ha Affected by poor drainage: ______ ha	HYV Boro (flooded) ________ ha	• Area of HYV Boro (flooded) may exceed area below the pre-monsoon 1:2.33-yr FL. • Area of lands inundated following flood and local rainstorm should be indicated on the Index Map and it should match area of flooded Boro in Table 6.	
1:10-y FL in May _____ m PWD		Below 1:10-yr May FL: _______ ha	HYV Boro (flooded) ________ ha HYV Aus (flooded) ________ ha	• Inundation due to poor drainage should not extend more than 0.3 m above the affected land (lowland in floodway). • 2. Area of Flooded Boro and Aus should be less than the area below 1:10-yr pre-monsoon flood, otherwise the subproject type should be Pre-monsoon FM&DR.	
Post-subproject					
1:2.33-y FL in May ____ m PWD		Area affected by poor drainage should be reduced or zero “0”.	HYV Boro (normal) ________ ha HYV Aus (normal) ________ ha	• HYV Boro (flooded) can be reduced or zero. • Local Boro can be replaced by HYV Boro. • 4. Aus (flooded) can be replaced by Aus (normal).	
There is no change in 1:10-y FL in May				As above.	

Hydrology	Topography	Area of Cultivable Land	Crops Reported in Table 6 of Feasibility Report	Description of Pre- subproject/ Post-subproject Conditions	OK / NO
B. For Monsoon and Post-monsoon Drainage Improvement				No change in land classes	
Pre-subproject					
Annual 1:2.33-y HFL __ m PWD Annual 1:10-yr HFL ___ m PWD	Arable land elevation from ___m ___ m PWD	Below 1:2.33-yr HFL __ ha Affected by inadequate drainage -____ ha Below 1:10-yr HFL ___ ha Land with poor drainage can be above 1:10-y flood.	HYV Aman (flooded) __ ha HYV Aus (flooded) ___ ha Rabi crops ____ ha	• Area of Aman crops (flooded) may exceed area below annual 1:2.33-y FL. • Area of water-logged lands following flood and/or local rainstorm should be indicated on the Index Map and it should match area of flooded crops given in Table 6. • Generally inundation due to inadequate drainage should not extend more than 0.3 m above the affected land (lowland in floodway).	
Post-subproject					
Annual 1:2.33-y HFL __ m PWD Annual 1:10-yr HFL ___ m PWD	Arable land elevation from ___m ___ m PWD	Area affected by poor drainage should be reduced or zero “0”.	HYV Aman (normal)__ ha HYV Aus (normal)____ ha Rabi crops _________ ha	• HYV Aman (flooded) can be reduced or zero. • HYV Aus (flooded) can be reduced or zero. • 3. Area of rabi crops increased.	

Hydrology	Topography	Area of Cultivable Land	Crops Reported in Table 6 of Feasibility Report	Description of Pre- subproject/ Post-subproject Conditions	OK / NO
3. Water Conservation (WC) Subprojects				No change in land classes	
Pre-subproject					
Annual 1:2.33-y FL ____ m PWD or Observed Average Annual Flood _____ m PWD (For determination of Land Classes)	Arable land elevation from ___m ___ m PWD	Land area affected by drought.	HYV Boro (droughty) ____ ha HYV Aman (droughty) ___ ha Wheat Rabi crops ______ ha	• In WC subprojects the khal with proposed WRS should have Minimum Flow of 85 e/s.	
Post-subproject					
Annual 1:2.33-y FL ____ m PWD or Observed Average Annual Flood _____ m PWD (For determination of Land Classes)	Arable land elevation from ___m ___ m PWD	Area affected by drought should be reduced or become zero.	HYV Boro (normal) ______ ha HYV Aman (normal) _____ ha Rabi crops ____________ ha	• HYV Aman (droughty) can be reduced or zero. • HYV Aus (droughty) can be reduced or zero. • Area of Rabi crops can be increased. • 4. Area of Wheat can be increased.	

Table 14.2: Checklist for Feasibility Reports

Report Components (As in FS Report)	Verification Task	Result (OK/NO)	Remarks
1. INTRODUCTION	Use standard text for all subprojects: *This Feasibility Study and IEE/EIA Report describe one of about 200 subprojects of the JiCA-funded LGED Small-Scale Water Resources Development Project. Only key information unique to this subproject is presented here. The SSWR Subproject Planning and Design Guidelines presents the essential components (technical, people's participation, institutional, and monitoring methodologies) common to all subprojects. Additional information including hydro-engineering analysis and the original field data are compiled in Annexes attached to this report.*		For all water management (WM) type subprojects that involve rehabilitation / construction of flood embankments EIA shall be used.
2. SUBPROJECT OVERVIEW			
2.1 Location and Map	Sample text: "*Bankirhat* Subproject is located in *Gazirhita* and *Trimohon* Unions of *Haluaghat* Upazila in *Mymensingh* District, between latidude 25^{o}-7' and 25^{o}-10' north and longitude 90^{o}-22' and 90^{o}-25' east. It is about 58 km northeast of *Mymensingh* and 6 km by earthen road from *Haluaghat* Upazila HQs. Detail map of the subproject showing subproject boundaries and the proposed works is provided in Figure 1. Subproject location on upazila map with access roads and main hydrologic network is shown in Figure 2. Location of relevant hydrometric stations is shown in Figure 3." - Verify Subproject location and names given above with those appearing in the maps. - Verify Subproject boundaries given in FS text under Para 2.1 with those appearing in Index Map. -Check Index Map (Fig.1) for unions and villages, rivers and khal/beel names for consistency with those in FS text; -Check Upazila Base Map (Fig.2) for consistency of subproject boundary shown on Index Map; -Check Regional Map (Fig.3) for major towns, roads, rivers, river WL stations and rainfall stations used in the study. - Check each map for correct bar scale, coordinates and consistent legend.		The coordinates (latitude and longitude) are for correct locating of the subproject on different maps. The location includes: - Union (s) - Upazila(s) - District
2.2 Concept Development	This section comprises the following: (1) Original concept of the beneficiaries for type of intervention and specific works (including		The subproject type must be consistent with

Report Components (As in FS Report)	Verification Task	Result (OK/NO)	Remarks
Identification of Problems	number of structures). (2) Clear statement of present problem(s) as verified by the Consultant. (3) Agreement with beneficiaries for changes proposed by the Consultant. (4) Key elements of the subproject: • Subproject Type - (FM, DR, WC, etc.) (Unchanged or Changed) • Concept - (Unchanged or Changed) • Subproject Boundary – (Unchanged or Adjusted) • Subproject Catchment Area __ ha • Subproject Gross Ben. Area __ ha • Subproject Net Benefited Area __ha		the problems and the required works given in Table 13.1 above. If Catchment and Gross Benefited Area are the same (in FM on flat land and polders) repeat the same numbers for both. Net Benefited Area must be from 50 to 1000 ha.
2.3 Interaction with BWDB Subprojects	Possible scenarios: 1. No interaction 2. Inside BWDB Project 3. Upstream of BWDB Project 4. Downstream from BWDB Project 5. Adjacent to BWDB Project 6. There is abandoned BWDB structure.		For scenario 2 to 6, describe project, structure, its purpose, problems and possible impact of the subproject.
2.4 Major Cost Components	Use standard text such as: "The subproject capital costs are itemized in Table 3 and O&M costs are itemized in Table 4. The proposed works include ------------------------------.		List all the proposed subproject earthworks and structures. All physical works given in Table 3 must be shown in Index Map.
3. DESCRIPTION OF THE ENVIRONMENT	This chapter describes general topography of the subproject, hydrological regime, and water related problems: • Description of subproject boundaries (natural and man made). • Description of natural land topography and man made infrastructures like roads and embankments; • Description of water courses, khals, beels and hydrological regime i.e., where water comes from, how it drains; • Relevant water related problems like water logging, external flood, drought. Subproject ground elevation vary from: ____ to ____mPWD Present water levels: pre-monsoon 1:2.33 yr................. mPWD pre-monsoon 1:10 yr.................... mPWD monsoon 1:2.33 yr....................... mPWD pre-monsoon 1:2.33yr.................. mPWD Check if names of places and rivers, khals and beels mentioned in the text are shown in the Index Map.		In Engineering Analysis verify ground elevation in elevation-area table with those shown in Index Map and survey sections. Check water levels for correct analysis.
4. IMPACTS AND IMPACT	This chapter describes the expected changes of hydrological conditions and the resulting impacts		

Report Components (As in FS Report)	Verification Task	Result (OK/NO)	Remarks
MANAGEMENT MEASURES	on various disciplines.		
4.1 Hydrology / Land Types	Specified expected changes due to the subproject intervention. **<u>In FM subprojects</u>**: - Flood levels (in pre- and monsoon season) ➢ 1:2.33-yr from __to _ 1:10-y from _ to _ ➢ land type changes (if any). For details refer to Table 13.1. **<u>In DR subprojects:</u>** ➢ Reduced depth of inundation (not more than 0.3 m) over .... ha ➢ Reduced duration of inundation in weeks/days **<u>In WC subprojects:</u>** ➢ Reduced drought over __ ha		
4.2 Agriculture	Described (i) Main benefit of subproject in terms of reduced /eliminated flood and/or drought, and (ii) As a result, reduced crop damage, increased cropping opportunities due to changed land classes and increase in crop production: - Cereals (rice + wheat) from __ to _ Tons - Non-cereals from __ to __ Tons There should be a standard statement at the end of the section: *"The SSWRDSP-2 will assist the WMA in preparing Subproject Agriculture Development Plan taking advantage of available water resources, with the support of DAE, DLR and SRDI".*		
4.3 Fisheries	Short description of - present fisheries - expected impacts, and - proposed mitigative measures.		
4.4 Socioeconomic	Short description of socio-economic profile of subproject population; current employment status and labour availability. Expected impact of the subproject on well being of the population, especially poor and landless. Need for land acquisition, resettlement and compensation.		The text provided herewith should be consistent with data in Table 13.2.
4.5 Other	Other impacts inside and outside subproject; navigation, roads communication, resettlement, land acquisition, social aspects.		

Report Components (As in FS Report)	Verification Task	Result (OK/NO)	<u>Remarks</u>
5. INSTITUTIONAL REQUIREMENT AND MONITORING PROGRAMME	This chapter should include (i) The institutional requirements of the		<u>Sample text:</u> *"The institutional requirements and monitoring programs common to all subprojects are*

	SSWRDP; (ii) Type of the subproject and main aspects of water management and maintenance. (iii) The required training needed for WMA and beneficiaries to take over O&M and to assure the expected benefits, and (iv) Proposed monitoring program (for selected subprojects).		*present in Chapter 9 of the SSWRDP Subproject Planning and Design Guidelines.* *This is a DR&WC subproject and in order to derive the expected benefits, beneficiaries will have to maintain the re-excavated khals and operate the structures, which will be the responsibility of the WMCA.* *The WMCA members will be provided with training in modern agricultural practices including environment friendly use of compost and green manure fertilizers, integrated pest management and fish culture.* *The LGED will carry out water testing to determine any changes in surface water and groundwater quality as a result of subproject interventions in sample subprojects, 1 in each greater district."*
6. FINDINGS, RECOMMENDATIONS AND CONCLUSIONS	This chapter should comprise: (i) Consultant's findings about technical and financial feasibility, and their recommendation for implementation or dropping the subproject. (ii) PRA findings and recommendations supporting the Consultant's recommendations. (The PRA findings should refer to social aspects and willingness to form WMA and take responsibility for O&M)		<u>Sample text (i):</u> "The subproject is found technically and economically feasible, and its implementation requires simple works. It will benefit area inhabitants and has favorable ERR. Therefore, it is recommended for implementation by LGED under the SSWRDSP-2 in the 2003-04 construction season."

FIGURES

Figure 1

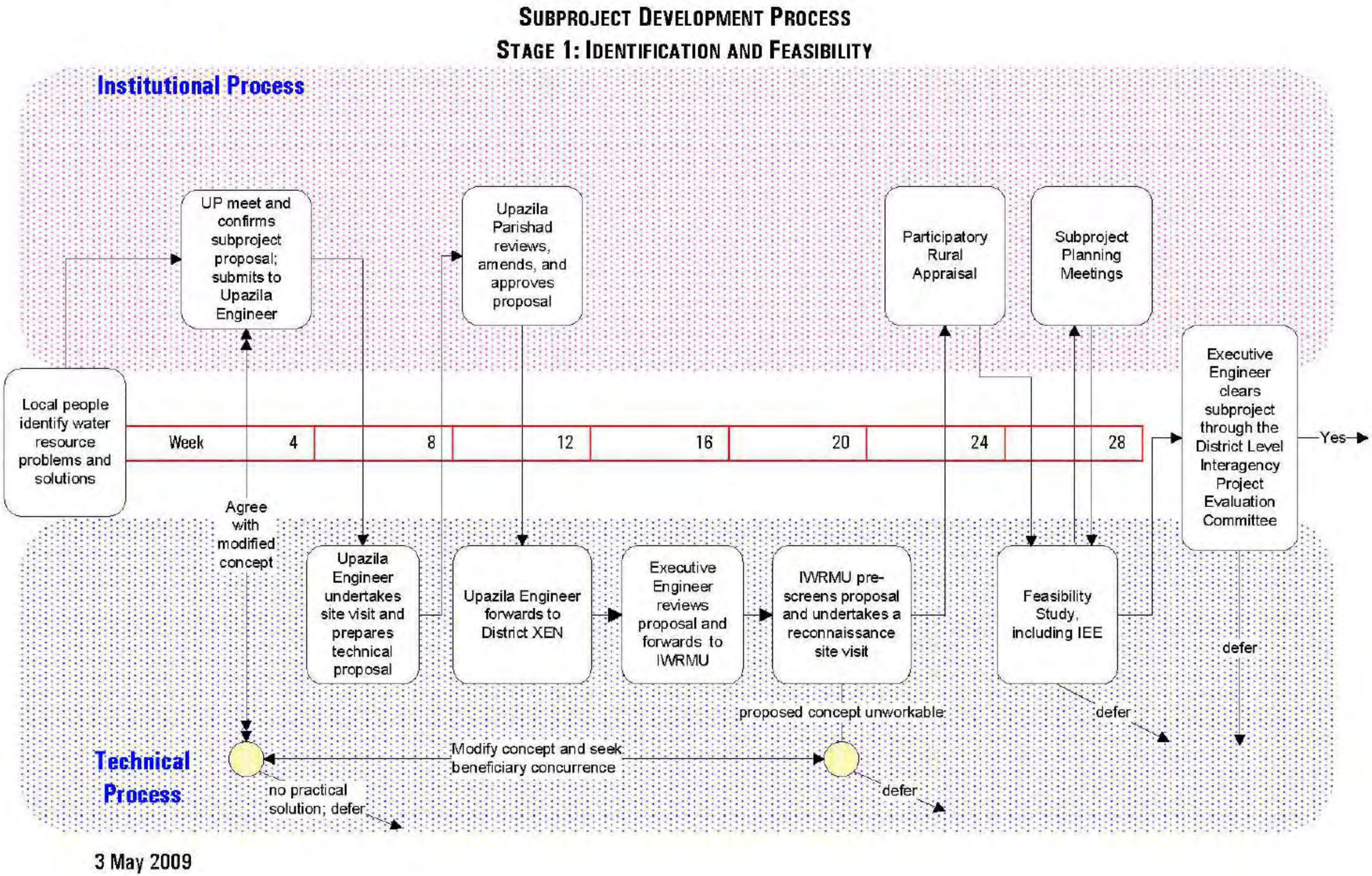

SUBPROJECT DEVELOPMENT PROCESS
STAGE 1: IDENTIFICATION AND FEASIBILITY
Institutional Process
Local people identify water resource problems and solutions
UP meet and confirms subproject proposal; submits to Upazila Engineer
Upazila Parishad reviews, amends, and approves proposal
Participatory Rural Appraisal
Subproject Planning Meetings
Executive Engineer clears subproject through the District Level Interagency Project Evaluation Committee
Yes
Week
4
8
12
16
20
24
28
Agree with modified concept
Upazila Engineer undertakes site visit and prepares technical proposal
Upazila Engineer forwards to District XEN
Executive Engineer reviews proposal and forwards to IWRMU
IWRMU pre-screens proposal and undertakes a reconnaissance site visit
Feasibility Study, including IEE
defer
proposed concept unworkable
defer
Technical Process
Modify concept and seek beneficiary concurrence
no practical solution; defer
defer
3 May 2009

Figure 1

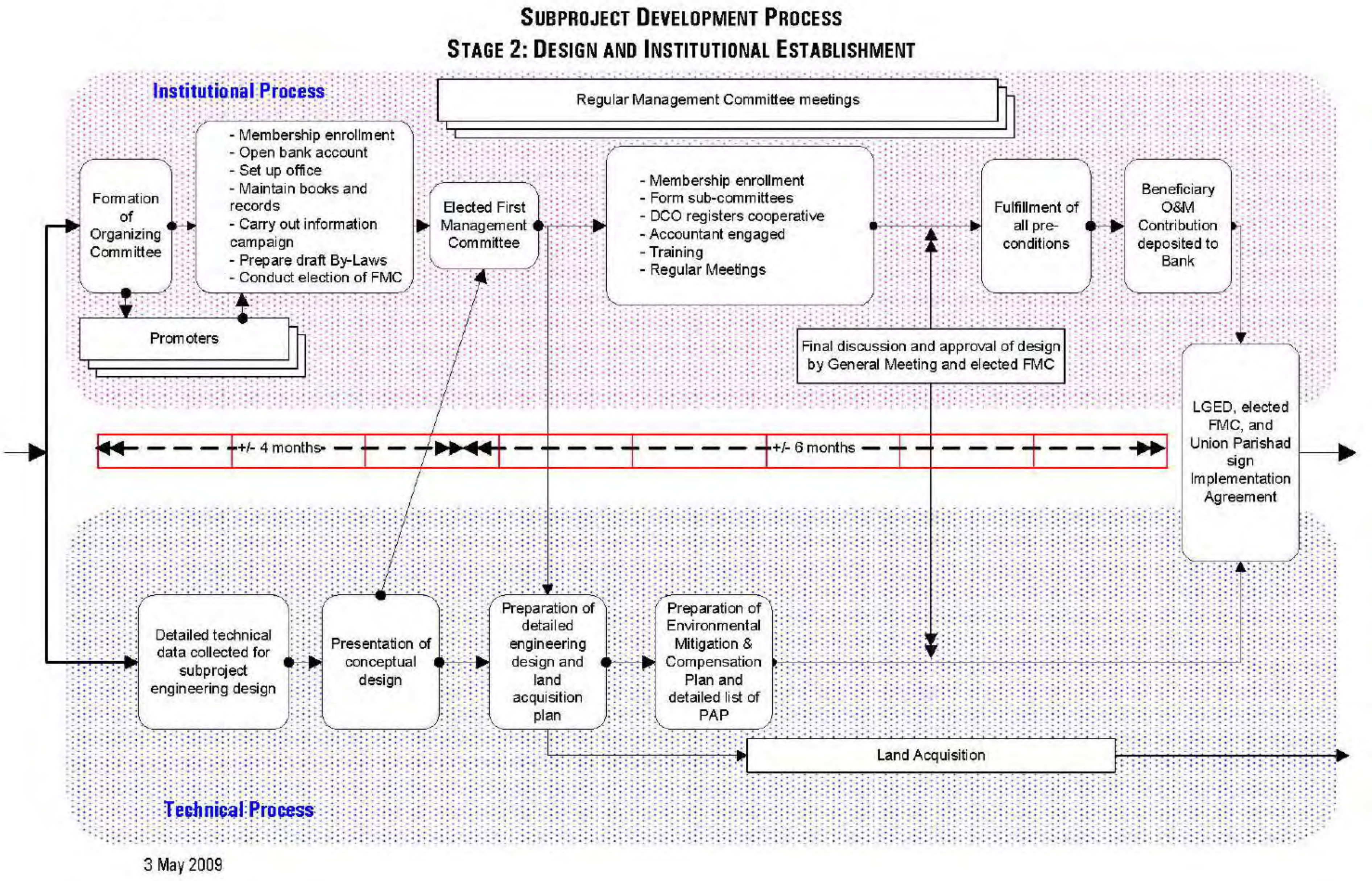
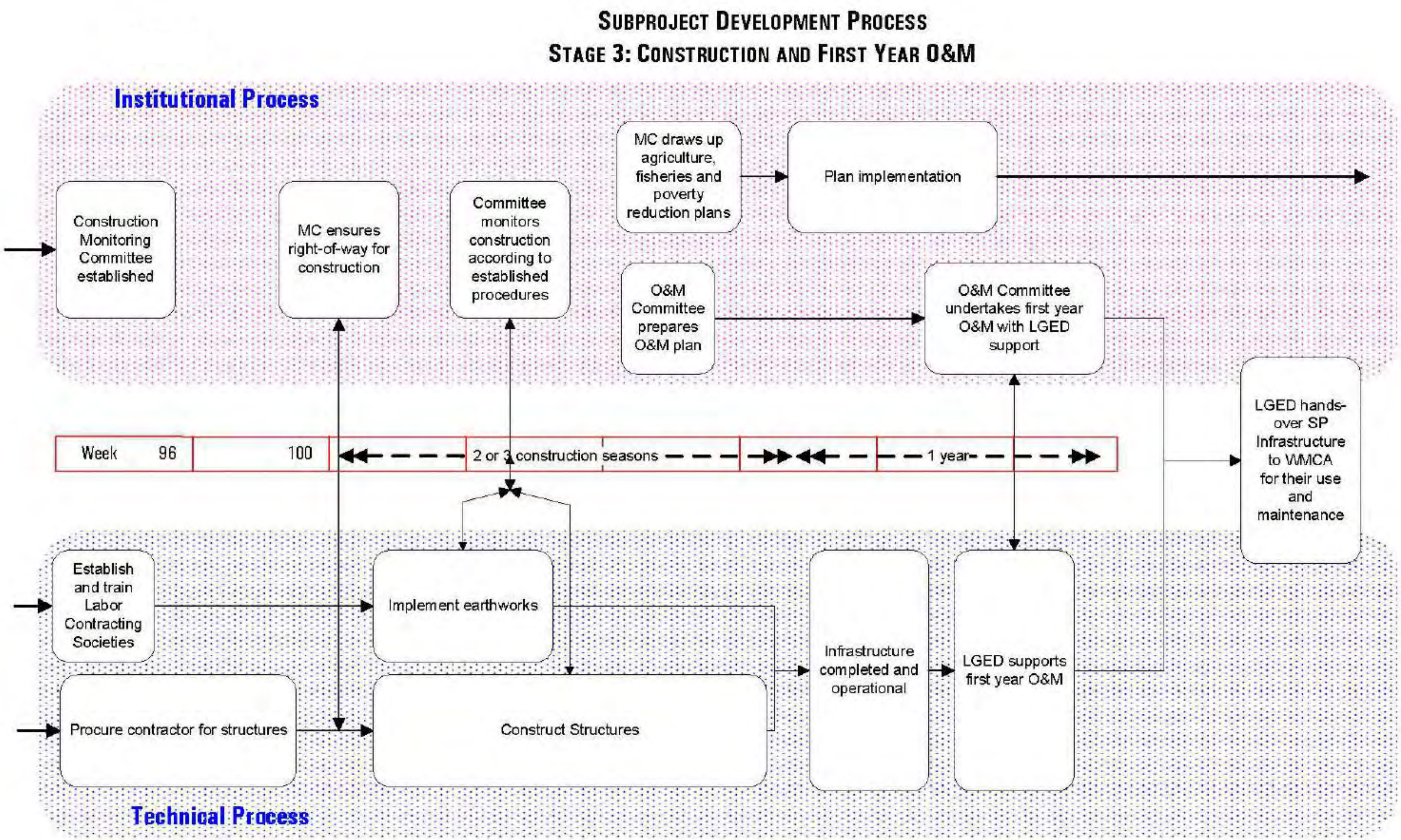
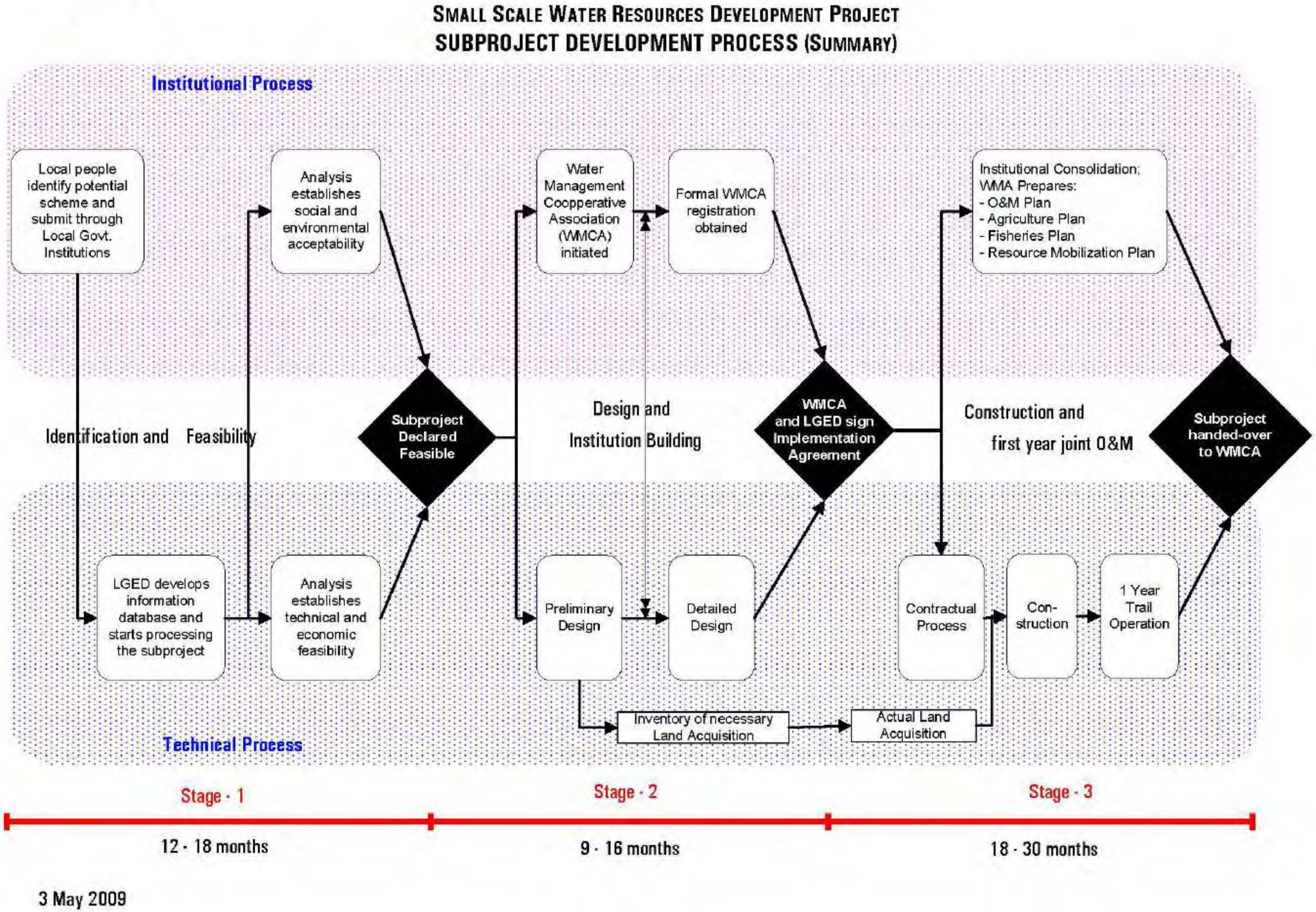

SUBPROJECT DEVELOPMENT PROCESS
STAGE 2: DESIGN AND INSTITUTIONAL ESTABLISHMENT
Institutional Process
Regular Management Committee meetings
Formation of Organizing Committee
- Membership enrollment
- Open bank account
- Set up office
- Maintain books and records
- Carry out information campaign
- Prepare draft By-Laws
- Conduct election of FMC
Promoters
Elected First Management Committee
- Membership enrollment
- Form sub-committees
- DCO registers cooperative
- Accountant engaged
- Training
- Regular Meetings
Fulfillment of all pre-conditions
Beneficiary O&M Contribution deposited to Bank
Final discussion and approval of design by General Meeting and elected FMC
LGED, elected FMC, and Union Parishad sign Implementation Agreement
+/- 4 months
+/- 6 months
Detailed technical data collected for subproject engineering design
Presentation of conceptual design
Preparation of detailed engineering design and land acquisition plan
Preparation of Environmental Mitigation & Compensation Plan and detailed list of PAP
Land Acquisition
Technical Process
3 May 2009

Figure 1



3 May 2009

Figure 1


SMALL SCALE WATER RESOURCES DEVELOPMENT PROJECT
SUBPROJECT DEVELOPMENT PROCESS (SUMMARY)
Institutional Process
Local people identify potential scheme and submit through Local Govt. Institutions
Analysis establishes social and environmental acceptability
Water Management Coopperative Association (WMCA) initiated
Formal WMCA registration obtained
Institutional Consolidation; WMA Prepares:
- O&M Plan
- Agriculture Plan
- Fisheries Plan
- Resource Mobilization Plan
Identification and Feasibility
Subproject Declared Feasible
Design and Institution Building
WMCA and LGED sign Implementation Agreement
Construction and first year joint O&M
Subproject handed-over to WMCA
LGED develops information database and starts processing the subproject
Analysis establishes technical and economic feasibility
Preliminary Design
Detailed Design
Contractual Process
Con-struction
1 Year Trail Operation
Inventory of necessary Land Acquisition
Actual Land Acquisition
Technical Process
Stage - 1
Stage - 2
Stage - 3
12 - 18 months
9 - 16 months
18 - 30 months
3 May 2009

Attachment II-8

Guidelines for Environmental Assessment of SSWRD Subprojects

Guidelines for Environmental Assessment

of SSWRD Subprojects

September 2017

Japan International Cooperation Agency

Environment assessment process

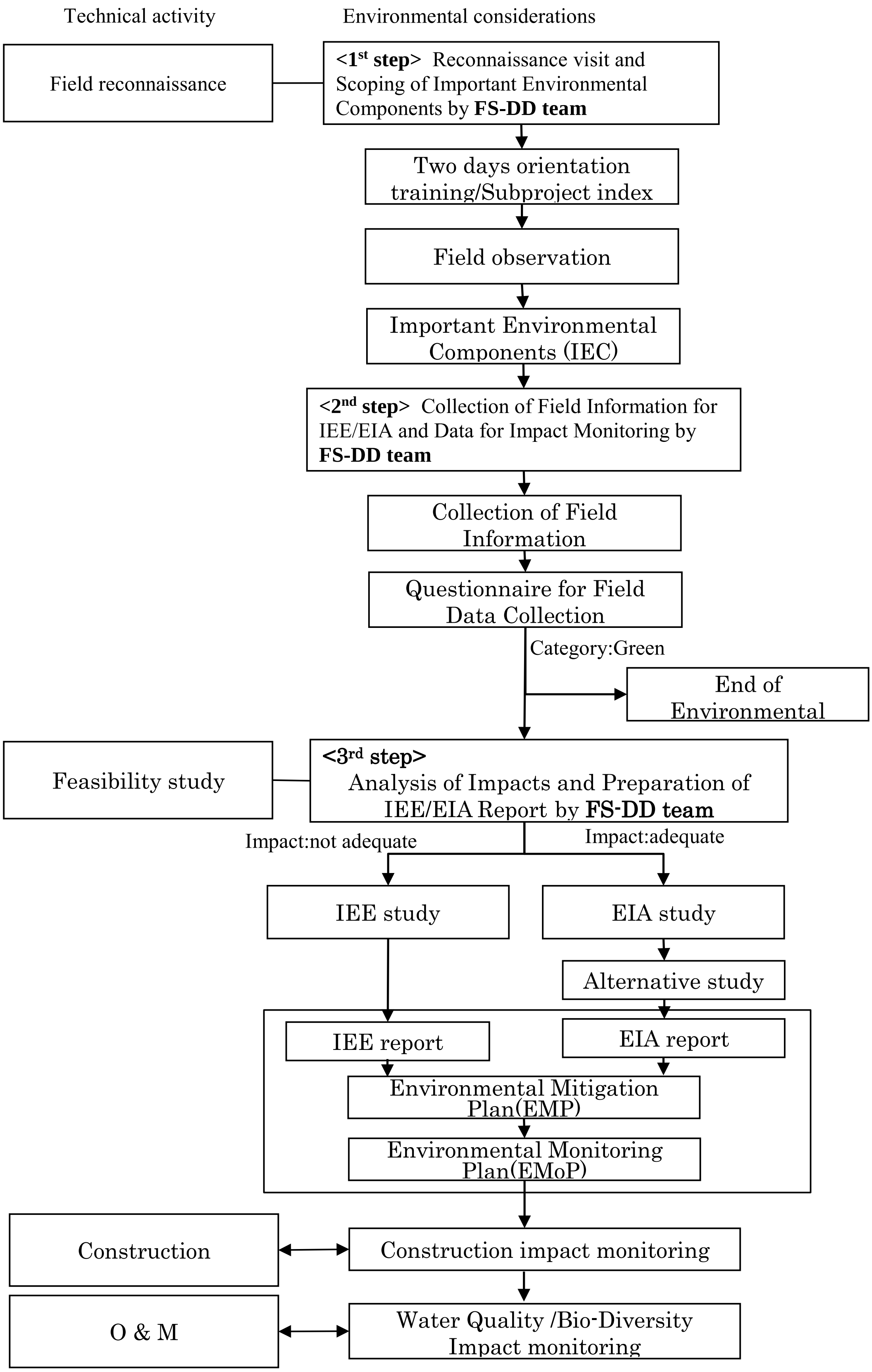


Table of Contents

ABBREVIATIONS AND ACRONYMS

ADB	Asian Development Bank
CO	Community Organizer
CS	Construction Supervisor (Project Based – Upazila Level)
DAE	Department of Agricultural Extension
EIA	Environmental Impact Assessment
EMP	Environmental Mitigation Plan
FSDD	Feasibility Study and Detailed Design
GoB	Government of Bangladesh
IEE	Initial Environmental Examination
JBIC	Japan Bank for International Cooperation
JICA	Japan International Cooperation Agency
ICM	Integrated Crop Management
IWRMU	Integrated Water Resources Management Unit (of LGED)
LGED	Local Government Engineering Department
NGO	Non-Governmental Organization
O&M	Operation and Maintenance
PAP	Project Affected Person
PE	Performance Enhancement
PMO	Project Management Office
PRA	Participatory Rural Appraisal
SP	Subproject
SSWR	Small Scale Water Resources
UE	Upazila Engineer
UP	Union Parishad (local council)
WMCA	Water Management Cooperative Association

1 Background

The JICA will support Small Scale Water Resources Development Project (SSWRDP) in Dhaka Mymensingh, Sylhet and Rangpur divisions. The main objective of the project is to achieve sustainable agricultural development through institutionalization of stakeholders for integrated management of water resources. The project includes implementation of more than 200 subprojects of different categories having benefited areas of 50-1000 ha each by rehabilitation and/or upgrading of existing water management systems. There are 3 types of subproject, New development subproject (New SP), Additional development subproject (Additional SP), and Flagship development subproject (Flagship SP). In New SP and Additional SP, the identified project components are water conservation (WC), drainage improvement (Dr), flood management (FM), and command area development (CAD). The major physical interventions in respect of these four types of subprojects will be re-excavation of khals, rehabilitation/construction of embankments, and construction of water management structures like sluices, regulators, water retention structures, weirs, etc. In addition, Flagship SC includes Rural road, Rural market, and Multi-functional facilities. The SSWRDP is funded by JICA and the Government of Bangladesh (GoB). The Local Government Engineering Department (LGED) of the GoB is the implementing agency of the project. The estimated total project cost is JY 16,117 million (Tk. 11,679 million). The time frame for the project is 2017-2023.

The policy of JICA is to promote environmentally sustainable economic development in developing countries using Japanese assistance. In order to implement this policy, JICA has formulated some guidelines for environmental assessment of its' projects. The document is intended to protect environment in its projects. The environment policy of the GoB governed by the Department of Environment (DoE) requires Initial Environmental Examination (IEE) for all projects and Environmental Impact Assessment (EIA) for only red listed projects that include projects involving construction of road, embankment, etc.

All projects are classified from environmental point of view into three different categories as following.

Category A: Projects expected to have significant adverse environmental impacts. An EIA is required to address the significant impacts in such projects.

Category B: Projects judged to have some adverse environmental impacts, but of lesser degree and/or significance than those for Category A projects. An IEE is required to determine whether or not significant environmental impacts warranting an EIA are likely. If an EIA is not needed, the IEE is regarded as the final environmental assessment report.

Category C: Projects unlikely to have adverse environmental impacts. No EIA or IEE is required, although environmental implications are still reviewed.

Most of the subproject types of SSWRDP namely Dr, WC, and CAD are likely to fall under category-B and therefore environmental assessment will require conduction of an IEE to determine any significant environmental impact for warranting another step for an EIA. In absence of any significant environmental impact the IEE will be regarded as the final environmental assessment report. A few of the subprojects of SSWRDP, namely those that involve rehabilitation/construction of embankment will fall under category-A. Therefore these types of subprojects will require a full scale EIA to fulfill the conditions set by GoB as well as JICA.

A monitoring program for two important environmental indicators namely water quality and bio-diversity for a group of representative sample subprojects (approximately 10-15) based on each agro-ecological zone and subproject type will have to be carried out for a minimum period of 5 years. A set of baseline data will have to be collected before starting operations of the subprojects and the same are to be followed and compared with those collected during operation stage. The results of monitoring will then be analyzed and evaluated for designing the required appropriate protective measures against any adverse impacts.

In addition, implementation of a common program for the protection and enhancement of natural resources and its habitat will be necessary for all proposed subprojects. This will facilitate environmental sustainability of the project development initiatives and at the same time it will enhance natural resource base in the concern subproject locality. This common program will include the following.

- Integrated pest management (IPM) training for the farmers
- Use of LGED environmental laboratory and training of WMCA for water quality impact monitoring of subprojects.
- Agricultural land soil analysis and soil fertility dose fixation for the farmers
- Environmental awareness raising through education and training for the stakeholders and
- Fishery production training for the professional fishermen and fish farmers.

Details about the common program are described in Appendix A.

These environmental guidelines for the subprojects of SSWRDP are subject to modification using new experiences from the field, if any, during implementation and post implementation period of individual subprojects.

2 ASSESSMENT OF ENVIRONMENTAL FEASIBILITY

The entire process of environmental feasibility assessment in respect of individual subprojects of SSWRDP should be completed following the three steps described below.

2.1 Step-1: Reconnaissance Visit and Scoping of Important Environmental Components (IECs)

Reconnaissance visit is to be undertaken by a multidisciplinary team comprising water resources engineer, agriculturist, fishery specialist, environmentalist and sociologist of the contracted consulting company. The IWRMU Environmentalist is to accompany the team, whenever possible, following screening and identification of the proposed subprojects. The concerned Executive Engineer and Upazila Engineer of LGED are to coordinate the field program and assist in arranging reconnaissance trip to the subproject sites.

Before starting for field visits the reconnaissance team is to receive two days orientation training on environmental field survey methodology through beneficiary participation process. Preparatory activities including communication with field offices of LGED will be mainly done by the WR engineer as the Team Leader. However, the environmentalist will get himself familiar with the working and procedure of field investigation as detailed in **Appendix A.** In case of the field investigation visit being the first one of the FS Consultant firm, the PMO-Project Consultants will provide the team with a brief training on the project and the procedure of working including quality requirements. The training also will cover environmental impact data collection and analysis, IEE/EIA report preparation, and benchmark data collection for environmental impact monitoring program. The reconnaissance team must carry the proposed subproject index map prepared on the basis of available Upazila Base Map, Topo Map, Mouja Map and Water Resources Planning Map (4″to 1 mile scale) from LGED, Survey of Bangladesh and/or Bangladesh Water Development Board. In order to gain a quick impression about the subproject environmental conditions, the subproject index map must indicate exact locations of river, khal, beel, baor, haor, water flow directions, natural forests, plantations, etc., along with the settlements, roads, bridges, culverts, and community places in and around the subproject area. Following reconnaissance, the same team is to start a scoping process from field observations and local people's opinion, and finally select the important environmental components (IECs) of the concerned subproject and simultaneously prepare a note sheet of the same to take into account for impact survey in the next step.

2.2 Step-2: Collection of Field Information for IEE/EIA and Data for Impact Monitoring

The field information and benchmark data for impact monitoring are to be collected by the multidisciplinary reconnaissance team following separate questionnaires in respect of water resources, agriculture, fishery, socio-economics, and environmental issues. A set of structured questionnaires will be developed in Bangla and these should cover all aspects of environmental issues as outlined in the recommended IEE and EIA report formats. A sample questionnaire for field information collection for IEE of the subprojects of SSWRDP is presented in **Appendix B**. Same questionnaire is subject to adjustment in line with subproject area, type and other local conditions.

The answers to the questions relevant to the selected IECs, as noted down in Step-1 above, are to be checked-in first with ticks in respect of Yes/No/Unknown from pre-arranged group discussions with beneficiaries and affected groups at environmentally sensitive/important sites of the village. Following this exercise, more questions are to be put to collect detailed information and record those in appropriate boxes provided in the questionnaire sheets. Information sheet for the subproject area and adjacent area are to be filled-in separately, with one sheet provided for each village. For example, if the subproject area consists of four villages then four separate sheets (Sheet No. 1,2,3,4) are to be filled-in. However, in case of subprojects with more than 4 villages the representative villages are to be chosen before starting the data collection process. Selection of representative villages will depend on field observation, discussion with the local people and secondary source information about environmentally sensitive / important sites. The collected information and data are to be cross checked with the survey results from another independent specialist team, the PRA team, consisting of professionals deployed by contracted PRA Firms/NGOs. The PRA findings should come from at least two consultation meetings with both beneficiaries and affected groups in each environmentally sensitive site of the proposed subproject.

2.3 Step-3: Analysis of Impacts and Preparation of IEE/EIA Report

The multidisciplinary team of the consulting company will then combine the individually completed questionnaires into separate sheets for the subproject area and adjacent area. An objective assessment of impacts for the subproject area is to be made upon completion of a qualitative evaluation of the potential impact of the IECs based on their field observations, PRA findings, and available secondary source information.

If the assessment results indicate no potential adverse impact, no mitigation plan will be required. But, in case of any negative impact, an Environmental Mitigation Plan (EMP) should be developed taking into consideration the magnitude of adverse impacts and their possible mitigation measures. The step of preparing the mitigation plan is shown in **Appendix E-1**.

The Mitigation Measures Table shown in **Appendix E-2** and **Appendix E-3** should be consulted while formulating the EMP. This step will reduce the degree of adverse impact and in such case the remaining impact will be taken as residual impact. Finally, based on the overall results of impact assessment and mitigation measures, if any, the IEE/EIA report is to be concluded as a draft report for environmental feasibility of the proposed subproject. The draft report is to be reviewed by the Project Consultant Environmentalist for any correction or modification and will be finalized from environmental point of view upon consultation with the reconnaissance team and the IWRMU, LGED.

For adjacent area, following an objective assessment of the negative impacts based on the collected field information and PRA report, mitigation measures are also to be formulated consulting the Mitigation Measure Table (Appendix E) and the same are to be included in the IEE/EIA Report.

The structure of the IEE Report and EIA Report as recommended is shown in **Appendix C** and **Appendix D**, respectively. The same structure should be followed in IEE/EIA report preparation for environmental feasibility study of proposed subprojects under the SSWRDP. Regarding the alternative study, it will be required for subproject with potentially large environmental impact. Therefore, alternative study must be conducted on EIA study.

3 Impacts Monitoring and Evaluation

The environmental monitoring will lead to evaluate the physical performance and impact of the interventions inside and outside of the subproject area technically, economically and socially. In case of mitigation measure will be required for appropriate environmental and social consideration, the Environmental Monitoring Plan (EMoP) of subproject should be prepared. (**Appendix-F**)

3.1 Construction Impact Monitoring

The activity of construction which have large scale and long duration will cause impact to the physical environment such as dust, noise & vibration, turbid water and occupational safety. The contractor should monitor the negative impacts and should take counter measures if impact will be significant.

The scopes of this impact monitoring will be as follows.

- Formulation of appropriate mitigation measures in respect of compliance the specification. (see **Appendix-G "Environmental Management Plan and Safety at Site", Appendix-H "Corrective-Action Request", Appendix-I "Follow-up Actions Checklist for Corrective Action Request (CAR)"**)
- Protection of physical environment baseline or criteria during construction works.

3.2 Water Quality Impact Monitoring

The activities of SSWRDP can have either positive or negative water quality impact. For example, in drainage type subprojects, quick disposal of stagnant and polluted water is likely to improve water quality. On the other hand, early drainage will create scope for one more crop production leading to increased use of fertilizer and pesticides thereby deteriorating water quality condition. So, monitoring of water quality impact and adoption of necessary protective measures against any adverse situation will be necessary for the sustainability of the subproject activities.

Two monitoring sites in each subproject, one for surface water quality and the other for ground water quality will have to be selected. A representative number of sample subprojects are to be included under water quality changes monitoring program on the basis of hydrological zones, agro-ecological zones, districts/greater district as well as subproject types. The water quality parameters to be monitored are: pH, dissolved oxygen, salinity, electrical conductivity, nitrate, phosphate, arsenic, faecal coliform bacteria and total hardness. The program will be implemented in-house by using the resources and facilities of the LGED environmental laboratories within or nereby the project area districts.

The scopes of this impact monitoring will be as follows.

- Formulation of appropriate mitigation measures in respect of harmful water quality impact
- Protection of the water resources and aquatic habitat including fish from pollution effects
- Sustenance of the development activities in agriculture sector
- Contribution to the national water quality database

3.3 Bio-diversity Impact Monitoring

The haor basins of Sylhet and Mymensingh districts are very rich in biodiversity and therefore carry great ecological and commercial values, both nationally and internationally. But the resources of these wetlands are now under serious degradation due to over exploitation of natural aquatic resources. Implementation of SSWRDP in these areas may accelerate this degradation process if not mitigated properly. So, a biodiversity monitoring program especially fish bio-diversity, needs to be carried out to correlate any impact with the SSWRDP physical interventions and to formulate the protective-cum-mitigation measures.

Four EFM/FCD subproject sites in the haor basins, two in greater Sylhet area and two in greater Mymensingh area will have to be selected. The monitoring program needs to be contracted out to an NGO experienced in wetland surveys and studies.

The scopes of bio-diversity impact monitoring will be as follows.

- Identification of key indicator species for the local ecosystem at the selected sites
- Establishment of EFM/FCD subproject impacts on wetland characteristics, specially, fish bio-diversity
- Selection of suitable sites for establishing fish sanctuary / conservation areas
- Inventory list of common, rare, endangered and threatened flora and fauna species in the survey sites.

Appendix

Appendix A

Appendix A Issues of Environmental Sustainability

1. Integrated Pest Management (IPM) Training

1) Rationale / Objective

Use of pesticides is very common in Bangladesh. Carcinonogenic, bioaccumulative, and stable type of organochlorine pesticides such as, aldrin, endrin, heptachlor, DDT, etc. are frequently used in HYV rice, potato, and sugar cane cultivation. These pesticide chemicals easily destroy the natural habitats and create imbalance in the ecological system. The SSWRDP is expected to intensify agricultural production through introduction of pest sensitive high yielding variety crops. So, it is likely that the project will have an adverse impact on the environment through increased application of pesticides. So, mitigation measures are to be taken to minimize these negative impacts. The local farmers can best achieve this mitigation through integrated pest management (IPM) training and practice. The IPM training program is already well established in the ongoing SSWRD Subproject.

2) Scope

- Application of biological pest control method
- Conservation of beneficial predators and their habitats
- Protection of natural resources and their habitats from environmental degradation
- Cost effective agricultural production

3) Cooperation

Department of Agricultural Extension (DAE)

2. Environmental Laboratory

1) Rationale and Objective

LGED is implementing SSWR subprojects since 1995 and by now has implemented some 600 subprojects throughout the country. This JICA assisted SSWRDP in greater Mymensingh, Sylhet and Faridpur areas will implement about 200 new SSWR subprojects. Similar projects will come for implementation in future also. Water management interventions may impact water environment, particularly the water quality aspect, negatively. For example: keeping water conserved / confined in a closed stagnant condition for long time as in FMD and WC subprojects may alter the quality of water, increased crop production through improved water management involves increased use of chemical fertilizer and pesticide that deteriorate water quality, etc. Increased crop production and use of chemical fertilizers impact soil quality also. Thus, it is important that environmental laboratories are established in areas where water resources development and management projects are implemented, particularly, to monitor water and soil quality changes as an impact of the project.

2) Locations

LGED has established 5 Regional Environmental Laboratories at Barisal, Khulna. Rangpur, Mymensingh and Comilla. These Regional Laboratories provide facilities for a wide range of water and soil quality tests. The JICA assisted SSWRDP will be supported by the Mymensingh (within project area) and Comilla (near greater Sylhet area) and Barisal/Khulna (for greater Faridpur area) Regional Laboratories. Besides, 21 District LGED Laboratories including 5 Project districts (Sylhet, Mymensingh, Tangail, Jamalpur and Faridpur) have mobile Kits for performing selected water (Dissolved Oxygen, pH, Arsenic, etc.) and soil (N-P-K) quality tests.

3) Scope

- Enhancement of departmental capability in analytical laboratory works
- Water and soil test performance required by the different project activities
- Skill development of engineers and material testing laboratory staff in analytical methods
- Income generation through customer service facilities in analyzing water and soil samples

4) Co-operation

Department of Environment (DOE); Department of Soil Science, University of Dhaka; ICDDR'B Laboratory, Dhaka

3. Soil Analysis and Soil Fertility Level

1) Rationale / Objective

Best management practices in agriculture depends on sustainable soil productivity, which can be achieved through extension services to the farmers for regular analysis of soil samples for nutrient levels, organic carbon, moisture, etc., and fixation of required fertilizer doses and pesticides.

2) Area

Twenty sample sites in each subproject

3) Scope

- Fertilizer dose recommendation for the farmers
- Balanced fertilizer use in agricultural lands
- Regular checking of soil nutrient level changes

4) Co-operation

Soil Resources Development Institute (SRDI) for soil sample analysis and Department of Soil, Water and Environment, University of Dhaka for training Agriculture Facilitators (Project staff) and Laboratory Technician (LGED Staff).

4. Environmental Education and Training

1) Rationale / Objective

Active participation of the stakeholders during all stages of planning, construction, operation, and maintenance is the key for sustaining any development project. Subprojects of the SSWRDP will be handed over to the stakeholders upon successful completion and one-year trial operation and maintenance. So, it is important that the stakeholders are not only trained in structure operation and maintenance but their knowledge is also enhanced in respect of wise use of sensitive ecosystems.

2) Area

WMCA members and general beneficiaries in all subprojects.

3) Scope

- Environmentally sustainable use of all natural resources
- Care taking of natural resources by resource users
- Protection of conserved forests, wetlands, rare/endangered species, etc.
- Enhancement of bio-diversity and maintenance of ecological balance
- Implementation of country's environmental safeguard policies and compliance with the environment conservation rules.

4) Co-operation

Department of Environment (DoE) ; IUCN – The World Conservation Union.

5. Tree Plantation Program

1) Rationale / Objective

A countrywide tree plantation program is ongoing in Bangladesh for the last few years. The SSWRDP will create scope for plantation beside embankments, khals, and at water control structure sites. So, all the subprojects of the SSWRDP should include compulsory tree plantation program with the objective of economic benefit for the WMCA members local landless people in particular the poor women as well as contribution to the national economy. The proposed tree plantation program is already well established in SSWRD Subprojects through earlier SSWRD Sector Projects.

2) Location

Berms of embankments, banks of khals, and water regulatory structure sites in all subprojects of the SSWRDP.

3) Scope

- Supply of food, medicine, fuel, and materials for house construction for the rural community
- Providing effective protection to the embankment, khal, and structure sites from air/wave erosion
- Enhancement of plant bio-diversity thereby providing shelter for birds as well as preservation of ecological balance
- Economic benefit to the poor and destitute women and WMCA members.

6. Fish Production Training

1) Rationale / Objective

In FMD and Dr subprojects there is a possibility of partial loss in fish production within floodplain areas. So, the people engaged in monsoon fishing are likely to be affected in these two types of subprojects. Some sort of training such as, rice-fish culture in floodplains, fish culture in ponds, fingerling production in borrow pits, establishment of fish hatchery, etc. will compensate this partial loss and at the same time will improve overall livelihood of both professional and subsistence fisher people.

2) Area

All subprojects of the SSWRDP with potentiality for fish culture.

3) Scope

- Compensation for partial loss of fish catches from floodplain areas
- Development of skill among fisher/fish farmer people in fish production technology
- Availability of fingerlings for fish culture from local hatchery/nursery ponds
- Development of community based fishery extension agent.

4) Co-operation

Department of Fisheries (DOF) and Fisheries Research Institute (FRI) Mymensingh will conduct the training.

Appendix B

Appendix B Sample Questionnaire for Field Data Collection

Name of the Subproject:.............................. Subproject ID Number:....................

Location (UP/Upazila/Dist):........................ Name of Villages:.............................

Area of the Subproject:................................ Population (2001 census):..............

Main River/Khal:.. Catchment Area of River/Khal:......

Length of Navigable Route:........................ Irrigated Land Area:.........................

Land Elevation/Topography:...................... Soil Type/Texture:............................

1. Subproject Area Information (Sheet No…..)

1.1 Physical Environment

1.1.1	Flood Regime	
Q.1	May the subproject implementation bring any change in the high flow regime of any river/khal in and around the area?	Yes/No/Unk
	If yes, name the river/khal and give peoples comment about the present situation and expected changes.	
1.1.2.	Ground Water Table	
Q.2	May the subproject cause a fall or rise of ground water table inside and/or outside the area?	Yes/No/Unk
	If yes, give your comments about the impact on drinking water well, STW, DTW, wetland, etc., and on water logging in low lying agricultural lands.	
1.1.3	Water Quality	
Q.3	May the subproject activity influence present water quality status either obstructing or creating flushing provision?	Yes/No/Unk
	Give comments about present status and possible impact on water quality.	
1.1.4	Water logging and Siltation	
Q.4	May there be any water logging or siltation problem due to subproject activities?	Yes/No/Unk
	If yes, describe the present situation and give ideas about possible water logged area in km^2 and length of silted water way/canal in km.	
1.1.5	Soil Characteristics / Fertility	
Q.5	May the subproject implementation obstruct natural replenishment of flood plain agricultural soil or require topsoil cut from fertile land?	Yes/No/Unk
	If yes, give the present status of soil fertility and put local people's comments about the impact and mitigation suggestion, if any.	

1.2 Biological Environment

1.2.1	Aquatic Habitat	
Q.6	May the subproject bring any change to the wetlands (beel/haor/depression/lake/ river/khal) in the area?	Yes/No/Unk
	If yes, name the wetland and it's present condition. Describe how it can be changed, and mitigation suggestion, if any, in case of adverse impact.	
Q.7	Is there any habitat for aquatic lives, which can be affected by the subproject?	Yes/No/Unk
	If yes, describe how it can be affected and give comments on possible impact on habitat species.	
1.2.2	Terrestrial Habitat	
Q.8	May the subproject change ecosystem of any natural forest or significant terrestrial habitat for bird, animal etc.?	Yes/No/Unk
	If yes, name the terrestrial habitat. Describe how it can be affected and mitigation suggestion, if any, in case of adverse impact.	
1.2.3	Fisheries	
Q9	May the subproject activities reduce natural fisheries production by preventing fish migration and/or disconnecting breeding ground for them?	Yes/No/Unk
	If yes, give an estimate of the loss of production compared to the present situation and include mitigation suggestion, if any, from the beneficiaries.	
Q10	May the subproject activities directly or indirectly change artificial fisheries situation and its associated activities?	Yes/No/Unk
	If yes, describe present situation of aquaculture. Give an estimate of the loss of production and mitigation measure, if any, from the beneficiaries.	
1.2.4	Biological Diversity	
Q11	May the subproject activities affect any rare, endangered, or threatened plant or wildlife species in and around the area?	Yes/No/Unk
	If yes, name the species, describe present status and make suggestion how it can be preserved.	
1.2.5	Eutrophication	
Q12	May the subproject implementation create anaerobic condition or eutrophication, in any of the water pools, ditches, borrow pits, etc.?	Yes/No/Unk
	If yes, state local people's comment and suggestion about how it can be managed.	

1.3 Social Environment

1.3.1	Land Acquisition	
Q13	May the subproject implementation require land acquisition?	Yes/No/Unk
	If yes, give the type and approximate area of land to be acquired as well as the number of landowners affected.	
1.3.2	Agricultural Development	
Q14	May the subproject implementation lead to more crop production with increased land for boro and rabi cultivation, crop diversification, etc.?	Yes/No/Unk
	If yes, describe the present situation and estimated production, area of land increase, and name of the crops.	
1.3.3	Accessibility and Employment	
Q15	May navigation /boat communication system be interrupted by the subproject activities?	Yes/No/Unk
	If yes, give approximate length of present navigation route, expected changes and period of interruption.	
Q.16	May the subproject activity promote accessibility resulting in growth center development and employment opportunity in the area?	Yes/No/Unk
	If yes, describe the present situation and expected changes from the comments of beneficiaries.	
1.3.4	Health and Nutrition	
Q.17	May there be any change in disease incidences in the area as a result of subproject implementation?	Yes/No/Unk
	If yes, describe the prevalent diseases, especially water related, in the area and mention the type and degree of change anticipated.	
Q.18	May the subproject implementation directly or indirectly affect nutrition in the area?	Yes/No/Unk
	If yes, give your comments about how it can be affected and to what extent.	
1.3.5	Community Impact	
Q.19	May the subproject cause increase in unemployment in any professional community?	Yes/No/Unk
	If yes, name the community and their suggestion for mitigating the problem.	
1.3.6	Cultural Values	
Q.20	Is there any historical / archaeological site, or recreation / tourism spot which may be affected due to subproject implementation?	Yes/No/Unk
	If yes, name the site and provide suggestion for mitigation.	

1.4 Environment under Construction

1.4.1	Physical Environment during Construction	
Q13	May construction of subproject affect to the physical environment of project site? (e.g. heavy use of construction machinery for long duration, Generation and discharging of turbid water from construction site)	Yes/No/Unk
	If yes, give the approximate number of construction machinery as well as the duration of construction or discharging muddy water.	
1.4.2	Biological Environment during Construction	
Q14	May construction activities adversely affect the natural environment (ecosystem)? (e.g. temporary change of natural forest or wetland during construction).	Yes/No/Unk
	If yes, describe the present situation and estimated affected area of natural environment.	
1.4.3	Social Environment during Construction	
Q15	May construction activities adversely affect the social environment? (e.g. temporary inconvenience to the local people during construction, raising the risk of accident or incident on construction work)	Yes/No/Unk
	If yes, describe the kind of adversely effect of local society or construction site.	

2. Adjacent Area Information (Sheet No…..)

Name of the Village:………………………………Area of the Village:…………………………………

Location (UP/Thana/Dist):………………………Population (2001… census):…………………

Q.1	Is the village a flood prone area? If yes, mention the period of last flood, its source, and consequences.
Q.2	Is there any disaster shelter center in the area? If yes, how many, where it is located, and did people take shelter during the last flood? Did they receive any flood disaster management training?
Q.3	Give local people's comment in respect of any risk, like flood, water scarcity, obstacle to boat movement, epidemics, etc., or any other type which can appear as a result of subproject implementation and their suggestions to mitigate any such problems.
Q.4	Give local people's comments in respect of any positive impact like, more agricultural and fisheries production, better accessibility, employment opportunity, agro-industrial development, etc., that can be developed as the result of subproject implementation.

Appendix C

Appendix C IEE Report Format[1]

1. Introduction

This section usually will include the following:

1) Purpose of the report, including (a) identification of the project and Project Proponent; (b) brief description of the nature, size, and location of the project and of its importance to the country; and (c) any other pertinent background information. (e.g. ecological condition of location using DOE checklist, **Attached table 1**)
2) Extent of the IEE study: scope of study, magnitude of effort, person or agency performing the study, and acknowledgement.

2. Description of the Project[2]

Furnish sufficient details to give a brief but clear picture of the following (include only applicable items):

1) Type of project
2) Category of project
3) Need for project
4) Location (use maps showing general location, specific location, and project site layout)
5) Size or magnitude of operation
6) Proposed schedule for implementation
7) Description of the project including drawings showing project layout, components of project, etc. *This information should be of the same type and extent as is included in feasibility reports for proposed projects,* inorder to give a clear picture of the project and its operations.

3. Description of the Environment (in area affected by the project)

Furnish sufficient information to give a brief but clear picture of the existing environmental resources including the following (to the extent applicable):

1) *Physical resources* (topography, soils, climate, surface water, ground water, geology/seismology).

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[1] This typical report format is recommended by ADB and may be adjusted as necessary to suit this SSWRDP supported by JICA.

[2] IEE shall be conducted for each individual subproject and therefore the word "Project" herein should be taken us "Subproject".

2) E*cological resources* (fisheries, aquatic biology, wildlife, forests, rare or endangered species).

3) *Human and economic development* (including, but not limited to) (where applicable): population and communities (numbers, locations, composition, employment, etc.; industries; infra-structural facilities (including water supply, sewerage, flood control / drainage, etc.) institutions; transportation (roads, harbors, airports, navigation); land use planning (including dedicated area uses); power sources and transmission; agricultural development; and mineral development.

4) *Quality of life values* (including but not limited to): socioeconomic values; public health; recreational resources and development; aesthetic values; archaeological or historical treasures; and cultural values.

4. Screening of Potential Environmental Impacts and Mitigation Measures

Using the checklist of environmental parameters for different sector projects (see Bank's Environmental Guidelines), this section will screen out "no significant impacts" from those with significant adverse impact by reviewing each relevant parameter according to the following factors or operational stages. Mitigation measures, where appropriate, will also be recommended.

1) Environmental problems due to project location

2) Environmental problems related to design

3) Environmental problems associated with construction stage

4) Environmental problems resulting in project operations

5) Potential environmental enhancement measures

6) Additional considerations.

5. Institutional Requirement and Environmental Monitoring Program

This section will describe the required institutional capability (both hardware and software needs) and the monitoring or surveillance program and submission of progress reports.

6. Public Consultation and Disclosure

This section will describe the process undertaken to involve the public in project design and recommended measures for continuing public participation; summarize major comments received from beneficiaries, local officials, community leaders, NGOs, and others, and describe how these comments were addressed; list milestones in public involvement such as dates, attendance, and topics of public meetings; list recipients of this document and other project related documents; describe compliance with relevant regulatory requirements for public participation; and summarize other related materials or activities, such as press releases and notifications. This format is attached in **Attached table 2**.

7. Grievance Redress

This section will describe the ensured grievance redress mechanism of the SSWRD subproject.

8. Findings and Recommendations

This section will include an evaluation of the screening process and recommendation will be provided whether significant environmental impacts exist needing further detailed study or EIA. If there is no need for further study, the IEE itself, which at times may need to be supplemented by a special study in view of limited but significant impacts, becomes the completed EIA for the project and no follow-up EIA will be required.

9. Conclusions

This section will discuss the result of the IEE and justification if any of the need for additional study or EIA. If an IEE or an IEE supplemented by a special study is sufficient for the project, then the IEE with the recommended environmental management plan, institutional and monitoring program becomes the completed EIA.

Attached table 1

Department of Environment (DoE) Environmental Checklist For Ecologically Restricted or Conservation Area

No.	Description	Yes	No
1.	Is the proposed subproject located within any conserved natural and/or planted forests on elevated lands (Barind/Garh) areas in Greater Dinajpur, Dhaka or Mymensingh Districts?		
2.	Does the proposed subproject encroach on any conserved natural and/or planted forests on mountain valleys near the Indian border in Greater Sylhet District?		
3.	Is the proposed subproject situated within any conserved natural and/or planted forests in Greater Chittagong District?		
4.	Will the proposed subproject development intervene with any conserved and/or planted forests of the Sundarban area and south coast of the Bay of Bengal?		
5.	Is the subproject within 10 km peripheral distance from the 762,034 ha Sundarbon reserve forest area in Bagerhat, Khulna or Satkhira Districts?		
6.	Is the proposed subproject situated within the 10,465 ha conserved area containing sand rim, estuary, forest, wetland, etc, on both sides of the Cox's Bazar – Teknaf sea beach in Cox's Bazar District?		
7.	Is the subproject proposal from Narikel Jinjira and/or Sonadia Ghoti Bhanga mouja/s (village/s) of Saint Martin Deep and the 4,916ha Sonadia Deep in Cox's Bazar District? No		
8.	Are the subprojects located within the 18,383ha inundation zone of Hakaluki Haor in Moulvi Bazar/Sylhet District/s and the 9,727ha Tanguar Haor in Sunamgani District? No		
9.	Is the subproject situated within the 200ha floodplain of Marjat Baor in Jhenaidan District? No		
10.	Is the subproject located within any very sensitive aquatic ecosystem of the Ganges floodplain or the Meghna estuaries? No		

Attached table 2

Summary of Interview for Public Consultation
(Local/Community People)

1. Outline of Interview

Project Title	**SSWRDP-2**		
Date and Time of Interview		**Venue**	
Name of District & Upazila			
Interviewer			
Interviewee(s)	**---------------------- Upazila, -------------------- District** **Sl.** **Name** **Profession** 1. 2. 3. 4. 5. 6. 7. 8. 9. 10.		
Form of Consultation	Focus Group Discussion (FGD) / Community Consultation		

2. Environmental and Social Impacts of the Project (Negative and Positive)

Perception of local people on environmental impacts of the project

(1) Environmental Issues:

(a) Drainage Congestion:

(b) Regional Hydrology/Flooding:

(c) Water Pollution:

(d) Fishery:

(e) Soil Erosion and Siltation:

(f) Air Pollution:

(g) Landscape and Aesthetic:

(h) Road Safety:

Perception of local people on Social impacts of the project

(2) Social Issues:

(a) Land Acquisition and Resettlement:

(b) Gender Issue/Development:

(c) Employment Opportunity:

(d) Protection of Religious/Cultural Sites:

(e) Agricultural Land Loss:

(3) Other concerns and complaints (if any) in relation to environmental & social aspects:

Appendix D

Appendix D EIA Report Format[3]

1. Introduction

This section usually will include the following:

1) Purpose of the report (prepare an EIA), including (a) identification of the Project and Project Proponent; (b) brief description of the nature, size, and location of the project and of its importance to the country, (c) any other pertinent background information.

2) Stage of project preparation.

3) Extent of the EIA study: scope of study, magnitude of effort, person or agency performing the study, and acknowledgement.

4) Brief outline of the contents of the report including mention of any special techniques or methods used.

2. Description of the Project

Furnish sufficient details to give a brief but clear picture of the following (include only applicable items):

1) Type of project

2) Need for project

3) Location (use maps showing general location, specific location, project boundary and project site layout)

4) Size or magnitude of operation including any associated activities required by or for the project

5) Proposed schedule for approval and implementation

(vi) Description of the project including drawings showing project layout, components of project, etc. *This information should be of the same type and extent as is included in feasibility reports for proposed projects,* in order to give a clear picture of the project and its operations.

3. Description of the Environment (in area affected by project)

Furnish sufficient information to give a brief but clear picture of the existing environmental resources and values including the following (to the extent applicable):

1) *Physical resources* (topography, soils, climate, surface water, ground water, geology / seismology).

[3] This typical report format is recommended by ADB and may be adjusted as necessary to suit this SSWRDP supported by JICA.

2) *Ecological resources* (fisheries, aquatic biology, wildlife, forests, rare or endangered species, wilderness or protected areas).

3) *Human and economic development* (including, but not necessarily limited to): population and communities (numbers, locations, composition, employment, etc.; industries; infra-structural facilities (including water supply, sewerage, flood control / drainage, etc.); institutions; transportation (roads, harbors, air ports, navigation); land use planning (including dedicated area uses); power sources and transmission; agricultural development; mineral development; and tourism resources.

4) *Quality of life values* (including but not limited to): socioeconomic values; public health; recreational resources and development; aesthetic values; archaeological or historical treasures; and cultural values.

4. Alternatives

In the event serious losses of natural environmental resources and/or serious health effects are expected to result from the proposed project, the EIA report will justify the need for the project considering other alternative projects. In addition, various other relevant options such as site, design and technology will be included in the investigation. This section will also cite the advantages / disadvantages of these alternatives from the point of view of environmental protection. The discussion will justify the need for the project and indicate that all feasible alternative options have been considered. Other than advantages and disadvantages, justification of the project will go beyond the least-cost option and touch upon a need to diversify by implementing different project subtypes to address national security risk (eg. preference for a mix of project subtypes such as geothermal, coal or natural gas over a single source of fuel for the entire country or region).

In most cases, environmental impacts "with" and "without" project alternatives will be examined and in some cases, this could be the best and the only presentation in this section.

For each alternative considered, the environment specialist (ES) will: (i) summarize the probable adverse impacts, and (ii) relate the impacts to the proposed project and other alternatives. The best alternative will be selected from an environmental perspective and will be examined in the overall context of the project feasibility.

5. Anticipated Environmental Impacts and Mitigation Measures

1) *Item by Item Review:* This section of the report will evaluate the expected impact (in as quantified terms as possible) of the project on each resource or value and in the applicable sectoral environmental guidelines wherever any significant impact is expected[4]. Environmental impacts to be investigated will include those due to project location, those caused by possible accidents, those related to

[4] This could include environmental risk assessment, where appropriate.

design, during construction, during regular operations and final decommissioning or rehabilitation of a completed project. Where adverse effects are indicated, discuss measures for minimizing and/or offsetting these, and opportunities for enhancing natural environmental values will be explored. Both direct and indirect effects will be considered, and the region of influence indicated. This analysis is the key presentation in the report and if not sufficiently completed it may be necessary to delay the project until the analysis can be completed. It is necessary to present a reasonably complete picture of both the human use and quality of life gains to result from the project due to the utilization, alteration, and impairment of the natural resources affected by the project, so that fair evaluation of the net worth of the project could be made.

2) *Offsetting and Mitigating Adverse Effects:* For each significant adverse environmental impact, the report will carefully explain how the project plan/design minimizes the adverse effects and in addition how the project plan/design, to the extent feasible, includes provision for offsetting oe compensating of adverse effects and for positive enhancement of benefits or environmental quality. Where substantial cost of mitigation measures is involved, alternative measures and costs will be explored.

3) *Irreversible and Irretrievable Commitments of Resources:* The EIA report will identify the extent to which the proposed project would irreversibly curtail the potential use of environment. For example, highways that cut through stream corridors, wetlands, or a natural estuary can result in irretrievable damage to those sensitive ecosystems. Other impacts that may be irreversible include alteration of historic sites, and expenditure of construction materials and fuels. Also, projects through estuaries, marshes, etc., may permanently impair the natural ecology of the area; or elimination of recreation areas and parklands can precipitate drastic changes in the social and economic character of the project area.

4) *Temporary Effects During Project Construction:* In the event the construction phase of the project involves special environmental impacts (to be terminated on completion of construction), these will be separately discussed including proposed remedial measures.

5. Economic Assessment[5]

This section will include: (a) costs and benefits of environmental impacts; (b) costs, benefits and cost effectiveness of mitigation measures; and (c) for environmental impacts that have not been expressed in monetary values, a discussion of such impacts, if possible in quantitative terms (e.g. weight or volume estimates of pollutants). This information should be integrated into the overall economic analysis of the project.[6]

[5] This section may be drawn from the economic analysis conducted for the feasibility study; the economic assessment, as applicable, should be used in the economic analysis of the projects.
[6] It is recognized that not all environmental benefits and costs could be quantified and presented in monetary terms.

6. Institutional Requirements and Environmental Monitoring Program

This section of the report will describe the required institutional capability including staff skills, tools and equipment, and monitoring or surveillance program, including periodic progress reports to be established and continued by the Project proponent following granting of approval for the project to proceed. The objective of these reports is to assure the concerned government environment agency that all necessary environmental protection measures are being carried out on a continuing basis as envisioned in the approved project plan, and that proper special measures will be taken for containing any adverse impacts not envisioned in the project plan.

7. Public Involvement

This section will describe the process undertaken to involve the public in project design and recommended measures for continuing public participation; summarize major comments received from beneficiaries, local officials, community leaders, NGOs, and others, and describe how these comments were addressed; list milestones in public involvement such as dates, attendance, and topics of public meetings; list recipients of this document and other project related documents; describe compliance with relevant regulatory requirements for public participation; and summarize other related materials or activities, such as press releases and notifications.

8. Conclusions

The EIA report will present the conclusions of the study including: (a) gains which justify implementation of the project; (b) explanation of how adverse effects could be minimized or offset and compensated for to make these impacts acceptable; (c) explanation of use of any irreplaceable resources; and (d) provisions for follow-up surveillance and monitoring. Simple visual presentations of the type and magnitude of the impacts may aid the decision-maker.

Appendix E-1

Appendix E-1 Guidelines for Preparing Environmental Mitigation Plan

All subprojects of the JICA supported SSWRDP will undergo environmental assessment study in the form of IEE and/or EIA followed by preparation of an environmental management plan (EMP). The environmental mitigation plan is aimed at mitigating the adverse environmental impacts and it forms a part of the EMP. The contracted consulting firms of SSWRDP will carry out the IEEs/EIAs leading to preparation of the mitigation plan of the EMPs. The mitigation plan will be prepared in such a way that all adverse impacts found in the IEE/EIA reports are mitigated to the highest possible extent and the project-affected peoples (PAPs) are consulted and their opinions are incorporated in the plan as effective mitigation measures.

The following are the procedural steps to be followed in preparing the Mitigation Plan, which will be signed by LGED Executive Engineer, project affected peoples (PAPs), and representatives from Water Management Co-operative Associations (WMCAs) (see attached sample sheet for Environmental Mitigation Plan).

Steps for Preparing Environmental Mitigation Plan

Step 1: Finding of potential impacts and identification of adverse impact issues from environmental assessment study report (IEE/EIA)

Step 2: Cross checking of identified adverse impact issues with PRA findings

Step 3: Identification of PAPs from both IEE/EIA and PRA reports

Step 4: Primary formulation of mitigation measures in line with mitigation measures table (**Appendix E-2, E-3).**

Step 5: Presentation of identified impacts and their best possible mitigation options in meeting with PAPs and collection of their opinion in implementing the program (see **attached sample plan of Environmental Mitigation Plan**)

Step 6: Finalization of mitigation plan after detail discussion with PAPs (see item 6 in the attached sample Environmental Mitigation Plan) and incorporation of recommended options in subproject engineering design

Step 7: Fixing of implementation schedule for finally accepted Mitigation Plan (see **attached sample plan of Environmental Mitigation Plan**) and endorsement of the document by the concern LGED Executive Engineer, PAPs, and representatives from WMCAs

Note: All works as in the signed mitigation plan should be clearly mentioned in the Implementation Agreement of the concern subproject.

Attached sample plan

Environmental Mitigation Plan (EMP)

A.	Subproject Information	Name	:..	
		Type	:..	
		Gross Area	:..	
		Village/Mouza	:..	
		Union	:..	
		Upazilla	:..	
		District	:..	
B.	Proposed Interventions	Khal re-excavation/excavation		............km
		Re-sectioning/Construction of embankment		.......km
		Construction of:	Regulator/Sluice	no
			WRS	no
			Rubber Dam	no
		Irrigation canals:	Open (pucca/earthen)	.........km
			Buried Pipeline	............km

C. Implementation Schedule

Name of the work/activities	Start	End
1. Construction	....	....
2. Re-excavation	....	....

D. Design Discussion Meeting including Environmental Mitigation Measures
Place:....................................Date: ....Chaired by:............................
PAPs present:..........Number:.....................Communities/Groups:......................
Person to represent all PAPs:..Signnature:................

E. Signing of Environmental Mitigation Plan (at the time of signing Implementation Agreement)

Place of Signing: ………………... Date of Signing: ………………

LGED	WMCA
(……..………………..)	(……..………………..)
Executive Engineer, LGED	Chairperson, WMCA

Steps for Preparing Environmental Mitigation Plan:

1. Finding of potential impacts and identification of adverse impact issues from environmental assessment study report (IEE/EIA).
2. Cross checking of identified adverse impact issues with PRA findings.
3. Identification of PAPs from both IEE/EIA and PRA reports.
4. Presentation of identified impacts and their best possible mitigation options in meeting with PAPs and collection of their opinion in implementing the program.
5. Finalization of EMP after detail discussion with PAPs and incorporation of recommended options in the engineering design.
6. Fixing of implementation schedule for finally accepted Mitigation Plan and endorsement of the document by the concerned LGED Executive Engineer, PAPs, and representatives from WMCAs.

Note: *All works/activities in the signed mitigation plan should be clearly mentioned in the Implementation Agreement of the concern subproject.*

Appendix E-2

Appendix E-2 Possible Mitigation Measures for Environmental Impacts of SSWRD Subprojects

No.	Potential Negative Impact	Possible Mitigation Measure
1.	Changes in flood regime and water flow in river / khal	• Incorporation of adequate flow (1:10-yr Qmax) provision in the design criteria of regulators/sluices and khals • Avoidance of beel bypass during construction of embankment • Provision for adequate bridges / culverts for free drainage flow
2.	Fall of ground water table	• More recharge by increasing inundation area or water storage and period • Reduction of ground water abstraction volume • Increase of surface water irrigation facilities
3.	Deterioration of water quality	• Protection of water bodies from domestic and sanitary waste disposal, and agricultural field run-off • Providing for adequate natural flushing • Reduction of agro-chemical use by introducing IPM practice
4.	Water logging in low lying areas and silting of khals	• Installation and maintenance of adequate drainage system • Prevention of seepage from irrigation canal • Regular maintenance of re-excavated khals for removing deposited silt • Measures to minimize soil erosion from roads / embankments
5.	Loss of soil fertility	• Avoidance of top soil cut from fertile agricultural land • Provision for natural replenishment of flood plain soil by flood water inundation • Agricultural extension services for manure preparation training and motivational program for using organic fertilizer
6.	Change of eco-system of aquatic or terrestrial habitat	• Locating sub-project to minimize loss or avoid encroachment on sensitive areas • Conservation of valuable wetland sites and training of local beneficiaries on community based wetland management • Plantation on available lands with local suitable species
7.	Decline in fisheries production	• Construction of fish passage ways in structures and timely operation of gates to facilitate hatchling migration • Conservation of reproduction sites like beels, haors, etc. • Construction of fish shelters in re-excavated khals at regular intervals and protecting the shelters for mother fishes. • Incorporation of culture fishery including hatchery and restocking in sub-project Environmental Management

No.	Potential Negative Impact	Possible Mitigation Measure
		Plan • Training pond owners and interested farmers on aquaculture • Introduction of IPM for crops and rice-fish farming in the paddy fields
8.	Effect on rare, endangered, or threatened biological species	• Restoration of suitable alternative habitat for rare, endangered, or threatened plant or wildlife species
9.	Eutrophication and spreading of nuisance plant	• Incorporation of nuisance plant destruction program in the sub-project mitigation plan • Agriculture extension services for training farmers on water hyacinth based compost preparation and motivational program for using compost fertilizer
10.	Dislocation of habitat due to siting (alignment) of infrastructure	• Relocation of affected people in suitable areas with proper compensation for resources lost, and scopes for employment opportunities
11.	Increase of water related diseases	• Measures for controlling disease vectors by destroying their habitats • Disease prophylaxis and treatment • Training for domestic water management and low cost water sanitation technology
12.	Unemployment of professional community	• Identification of affected professional group and incorporation of in-kind compensation for losses in the sub-project planning
13.	Enhanced flood risk in adjacent areas	• Construction of refuse shelter for flood affected people • Training on flood disaster management, especially for women
14.	Water and air pollution from construction activities	• Pollution control by careful location of waste disposal sites and construction camps
15.	Soil erosion in road, embankment, bank of river / khal	• Compliance with construction standards like, blanket cover, proper slope ratio, compaction, turfing, etc • Regular maintenance work to minimize erosion

Appendix E-3

Appendix E-3 Table for Environmental Mitigation Plan (EMP)

<table>
<tr><th rowspan="2">Sl.</th><th rowspan="2">Subproject Impact on Important Environment Components (IECs)</th><th colspan="3">Mitigation Measures</th><th rowspan="2">No. of PAPs</th><th rowspan="2">Signature of PAP representative(s)</th><th rowspan="2">Responsible Entity/ Party</th></tr>
<tr><th>During design</th><th>During construction</th><th>During O&M</th></tr>
<tr><td colspan="8">Physical Environment</td></tr>
<tr><td>1.</td><td>Regional Flood Regime/Hydrology
□ Increase flood intensity
□ Change in river/khal water flow and flooding pattern
□ Enhanced flood risk in adjacent areas
□ Fall of ground water table</td><td>□ Design to ensure no induced flooding
□ Incorporation of adequate flow in design of hydraulic structures
□ More recharge by increasing inundation area and period
□ Increase in surface water irrigation</td><td>□ Excavation & re-excavation of more ponds, ditches & water reserves</td><td>□ Proper and timely opening / closing of regulator gates, maintaining gates and hoisting gears/systems in good operable condition, etc.</td><td></td><td></td><td>Design: FSDD Firm, PIC
Construction:
O&M: WMCA, Upazila Engineer</td></tr>
<tr><td>2.</td><td>Drainage /Water-logging
□ Create/increase drainage congestion
□ Cause excessive/unwanted drainage (reducing permanent water body/affecting soil moisture)
□ Water logging in low lying areas
□ Partial drain out of the beel, water bodies, flood plain areas</td><td>□ Design to avoid drainage congestion: in lower area inside or outside the subproject by draining upper/ inside areas, inside subproject area due to inadequate drainage path/ diversion channel during construction;
□ Design to ensure no excessive drainage reducing permanent water body significantly;
□ Design to provide adequate drainage facility
□ Design to prevent significant seepage from irrigation canal</td><td>□ To conserve water in newly excavated & re-excavated water reserves, ponds, ditches, dighis etc.
□ Spoilages and wastes during construction should not be dumped or deposited in any water body or basin like depressed land</td><td>□ Maintaining drainage channels clear of fish bundhs, water weeds/hyacinths,
□ Maintain Seal of gates property and close gates properly/timely to prevent loss of water required to be conserved,
□ O& M of regulator should consider water conservation in in reserves, ponds, ditches, dighis from khal, floodplain</td><td></td><td></td><td>Design: FSDD Firm, PIC
Construction:
WMCA O&M subcommittee, Upazila Engineer (UE)</td></tr>
<tr><td>3.</td><td>Soil Characteristics / Soil Fertility
□ Degradation of soil fertility due to: removal of top soil, intensive/ diversified agriculture (increased use of inorganic fertilizers, pesticides), preventing nutrient rich sediment deposition on lands
□ Loss of soil fertility due to hindrance in natural replenishment of flood plain soil by flood water inundation.
□ Gradual degradation of fertility by topsoil erosion due to lowering of soil moisture in land for not flooding in the SP area</td><td>□ Design for provision for natural replenishment of flood plain soil by maintaining soil moisture contents
□ Top soil erosion control by soil conservation planning through turf, addition of organic matter in the land, increase in plantation and vegetation in the subproject areas for increase in organic matter and moisture holding capacity to check top soil loss
□ Suitable Soil Conservation methods should be designed to check fertility</td><td>□ Ensure no top soil removal from fertile agricultural land (top soil to be excavated and kept reserved at one place, take soil for construction in shallow cutting from the land and spread the preserved top soil on land again;
□ Turf ad vegetation in the possible soil and land erosion occurring areas</td><td>□ Training to farmers on IPM / ICM through DAE/SRDI support
□ Analysis of soil samples (base data) of subprojects cultivated land and use fertilizer application at SRDI/DAE recommended doses
□ Enhnce use of organic manure by farmer</td><td></td><td></td><td>Construction:
Contractor, Supervisor (CS)/Upazila Assistant Engineer (UAE)
WMCA, Department of Agricultural Extension (DAE) and other Supporting Agencies</td></tr>
</table>

Sl.	Subproject Impact on Important Environment Components (IECs)	Mitigation Measures			No. of PAPs	Signature of PAP representative(s)	Responsible Entity/ Party
		During design	During construction	During O&M			
4.	Erosion and Siltation ☐ Increase sediment and loose soil deposit on land outside embankment, ☐ Erosion of loose soil from new earthwork (embankment/spoil) and deposit ion on agricultural land ☐ Increased siltation of river/khal bed due to construction of WRS/regulator ☐ Top soil erosion will occur due to lowering of soil moisture in the land for absence of flooding in the SP areas ☐ Deposition of silt and loose soil on the crop lands at the both banks of the khal due to re-excavation.	☐ Design to consider existing risk and cause no significant induced impact (provide close turf on top and side slopes of embankments, set sill levels of structures at lower levels or use other techniques to flush out most of sediment load; ☐ Top soil erosion control by soil conservation planning through turf on the slopes of the embankment, addition of organic matter in the land, increase in plantation and vegetation in the subproject areas for increase in organic matter and moisture holding capacity to check top soil loss ☐ Plantation and vegetation along the banks of khal /embankment	☐ Adopt appropriate construction management to minimize erosion of soil from excavations, embankments/spoil deposits, etc. during rains; ☐ Turf and vegetation in the possible soil and land erosion occurring areas ☐ Quick disposal of wastes from the deposited lands	☐ Include in the O & M program special care taking of new earthwork structures under both routine and periodic for the initial 2-3 years to reduce erosion of soil during rain and deposition on nearby crop lands. ☐ Include in the O&M program removal of deposited silt from the channel bed upstream of weirs; ☐ Periodic disposal of deposited silts and wastes from the khal beds ☐ Plantation and vegetation along the banks of embankment			Design: FSDD Firm, PIC Construction.: Contractor, CS O&M subcommittee: WMCA, UE
Biological/ Ecological Environment							
5.	Terrestrial Habitat: ☐ Removal /cutting trees and vegetation	☐ Design considering minimum removal / clearance of trees and vegetation ☐ Re-plantation, more vegetation and social forestation in the SP areas	☐ Do not undertake unnecessary clearance of vegetation/felling trees during construction ☐ Initiative for re-plantation, more vegetation, social forestation in SP areas	☐ Include social afforestation program on available land (roadside, khal bank, structure site, etc)			Design: FSDD Firm, PIC Construction: Contractor, CS, IWRMU. WMCA: Community Organizer (CO)
6.	Wetland Habitat: ☐ Drying up or drastic reduction of permanent water bodies/areas ☐ Significant reduction of seasonal floodplain area	☐ Design to avoid complete drying up of water bodies ☐ Design to minimize reduction of seasonal floodplain area	☐ Excavation & re-excavation of more ponds, ditches & water reserves	☐ Ensure compliance to the timely operation of gates of hydraulic structures (meant for water conservation)			Design: FSDD Firm, PIC Construction: WMCA O&M subcommittee, CO
7.	Fisheries: ☐ Decline in fish production ☐ Reduction of fish habitat ☐ Reduction of fish biodiversity ☐ Fish migration into the khal due to construction of regulator may be hampered ☐ Livelihood of the genuine, neo and subsistence fishers may be deteriorated	☐ Consider provision of fish-pass fish friendly operation to facilitate migration; ☐ Design for provision of fish shelter in khals, fish sanctuary in the Beels and fixing of fish net at the drainage structure to restrict out-migration of fish ☐ Provision for excavation & re-excavation of new water reserves, ponds, ditches, dighis for increase of culture fish production	☐ Should excavate, re-excavate fish shelter in the khals, fish sanctuary, water reserves, ponds, ditches and dighis for fish habitats ☐ Keep provision of fish-pass, fish friendly structure to facilitate hatchling and migration	☐ Utilization of all subproject wetlands for fish production. ☐ Fish-friendly gate operation schedule to facilitate in-migration of fish for breeding and spawning ☐ Training on improved fisheries technology, community based culture fisheries, hatchery and restocking program			Design: FSDD Firm, PIC Construction: WMCA O&M subcommittee, CO, Department of Fisheries (DoF)

Sl.	Subproject Impact on Important Environment Components (IECs)	Mitigation Measures			No. of PAPs	Signature of PAP representative(s)	Responsible Entity/ Party
		During design	During construction	During O&M			
		☐ Provision for resettlement/ rehabilitation					
8.	Biodiversity: ☐ Loss of biodiversity (due to decrease of aquatic and terrestrial habitat)	☐ Design to consider no drastic reduction in permanent water bodies, plant and forest area	☐ Preserve, excavate and re-excavate water bodies, ponds, dighis and ditches ☐ Develop plantation, vegetation and social forestation in the area	☐ Include social afforestation program on available land (roadside, khal bank, structure site, etc) ☐ Preserve water bodies, water reserves			Design : PC Construction: IWRMU O&M subcommittee, CO
Social Environment							
9.	Land Acquisition/Land Loss: ☐ Loss of small strips of agricultural land/homestead from embankment sides ☐ Dislocation of habitat ☐ Economic livelihood disruption of the genuine, neo and subsistence fishers ☐ A small piece of land to be acquired for construction of WMCA Office.	☐ Consider in the design avoidance/ minimization of land acquisition ☐ Provision for compensation and/or resettlement of PAPs ☐ Minimize disruption of livelihood and provide for compensation ☐ Involve the genuine, neo and subsistence fishers in culture fisheries and IGAs.	☐ Employ affected people in construction works	☐ Engage/employ affected persons in O&M and IGAs activities by WMCA ☐ Land losers along the toe of embankment may be given share of trees grown on embankment slopes under management of WMCA			Design: FSDD Firm, PIC Construction: Contractor, CS O&M subcommittee LGED
10.	Unemployment ☐ Unemployment / reduction of scope of employment of professional community (i.e. fisher, boat men, etc.)	☐ Identification of affected professional group and incorporation of in-kind compensation for losses in the subproject planning ☐ Plan and design for different income generation activities(IGAs) development of culture fisheries with the help from to women, youths, fishers, boatmen and different professional groups	☐ Employ local people, especially women in construction works.	☐ Employ local people, especially women in O&M activities ☐ Involve in different income generation activities (IGAs), development of culture fisheries with the assistance from WMCA to women, youths, fishers, boatmen and different professional groups			Design: FSDD Firm, PIC Construction: Contractor, CS O&M subcommittee
11.	Navigation / Boat Plying facilities ☐ Hindrance/obstruction to boat plying	☐ Consider in the design boat-pass facility in hydraulic structure s, as far as possible	☐ Preserve boat passing facility as per design	☐ Ensure compliance to operation of hyd. structures for boat pass ☐ Synchronize the opening and closure of the gate(s) and vent with boat passing			Design: FSDD Firm, PC Construction: IWRMU O&M subcommittee, CO
12.	Facilities for Workers: ☐ Water Supply and Sanitation Facilities for Workers ☐ Health and Safety Measures for Workers	☐ Provision for adequate water supply and sanitation/toilet facilities for workers in the site areas and WMCA office	☐ Provide adequate water supply and sanitation/toilet facilities to workers and WMCA office ☐ Adopt appropriate safety measures, and provide first aid services	☐ Provide adequate water supply and sanitation/toilet facilities to workers in the site area and WMCA office ☐ Make workers aware of health risks and how to avoid these			Construction: Contractor, O&M subcommittee, CO

Sl.	Subproject Impact on Important Environment Components (IECs)	Mitigation Measures			No. of PAPs	Signature of PAP representative(s)	Responsible Entity/ Party
		During design	During construction	During O&M			
			☐ Make workers aware of health risks				
Other Environmental Attributes							
13.	☐ Air pollution through dust generation due to subproject works		☐ Spay water regularly on dry work surfaces creating dust problems				Construction: Contractor, CS O&M subcommittee, CO
14.	☐ Noise pollution from construction activities		☐ Avoid unnecessary noise near the vicinity of homestead areas				Construction: Contractor, CS O&M subcommittee, CO
15.	☐ Pollution of water from application of high doses of inorganic fertilizers/ pesticides			☐ Periodic analysis of representative water samples (surface & groundwater) of subproject area			Construction: IWRMU/LGED District Executive Engineer O&M subcommittee
16.	☐ Environmentally sensitive area, Archaeological / Historical Sites	☐ Avoid archaeological/ historical sites, environmentally sensitive areas (Ramsar Sites:Tanguar Haor and Hakaluki Haor; National Protected area: Laua Chhara Forest /other national reserve forest areas)	☐ Implement as per design avoiding archaeological /historical sites, environmentally sensitive areas	☐ Monitoring should be needed for those areas during O&M			Design: FSDD Firm, PIC Construction: IWRMU O&M subcommittee, UE

Instructions to Complete the EMP format: 1. Put Tick (✓) in appropriate Box/Measure to confirm the action to be taken.

2. Complete only the IECs that are identified in the IEE to have adverse impacts

3. Any action/measure to be taken other then the mentioned ones should be described against the empty boxes and the box should also be ticked (✓).

Executive Engineer, LGED

WMCA Chairperson

Date of signing:...

Place of signing: ....

Appendix-F

Appendix-F Environmental Monitoring Plan (EMoP)

Monitoring Item	Location	Monitoring parameters and Method	Monitoring and Reporting Frequency	Monitoring Responsibility
Ambient Air Quality				
Surface water Quality				

Note: This table should be completed through preliminary consideration by using following attached check list.

Attached check list

Environmental Compliance Monitoring Checklist
(Environmental Impacts and Mitigation Measures)

[Put Tick (✓) in appropriate Box to confirm compliance to the measure, and (x) for unsatisfactory or non-compliance]

Contractor's Name:
Subproject's ID &Name:
Location: Vill: ***Union:*** ***Upazila:*** ***District:***

Possible Impact	Mitigation during Design	Mitigation during Construction	Mitigation during O & M	**Specific observation, if any**
Soil Fertility ☐ Degradation of soil fertility due to removal of top soil		☐ No topsoil removal. Stockpile the topsoil of 15 cm depth from areas of construction campus site /stack Yards, and spread back the stockpiled topsoil on the land once the camp and the other installation is no longer required.	☐ Training to farmers on IPM / ICM through DAE/SRDI support ☐ Enhance use of organic manure by farmers	
Erosion and Siltation ☐ Erosion of loose soil from new earthwork ☐ Increased siltation of river/khal bed due to construction of WRS, Weir, and Rubber Dam etc. ☐ Spoils from khal excavation		☐ Adopt appropriate construction management to minimize erosion of soil from earthworks ☐ Organize appropriate arrangements for removal /deposit of excavation spoils		
Terrestrial Habitat ☐ Removal /cutting of trees and vegetation		☐ Do not undertake unnecessary clearance of vegetation/felling trees during construction	☐ Include social afforestation program on available land (roadside, khal bank, structure site,etc)	
Unemployment ☐ Reduction of scope of employment of professional community (i.e. fisher, boatman, etc.)		☐ Employ local people, especially women in construction works.	☐ Employ local people, especially women in O&M activities	
Facilities for Workers ☐ Labor Camp Facility for Workers		☐ Provide hygienic labor camp facility to workers		

Possible Impact	Mitigation during Design	Mitigation during Construction	Mitigation during O & M	**Specific observation, if any**
☐ Water Supply and Sanitation Facilities for Workers		☐ Provide adequate water supply and sanitation/toilet facilities to workers		
☐ Health and Safety Measures for Workers		☐ Adopt appropriate safety measures at work, and provide first aid services ☐ Make workers aware of health risks and how to avoid these		
☐ Management of wastes generated from labor camps to avoid pollution of surrounding water quality		☐ Maintain camp site waste disposal facilities by installing adequate garbage bins, and regular collections for safe disposal ☐ Prevent discharge of waste water from labor camps ☐ Prevent spills of oil and lubricants from equipments, machineries, vehicles, etc.		

Inspection by: ***Name:*..***Date of Inspection:* ....**

***Signature:*..**

***Designation*..**

Appendix G

Appendix G Environmental Management Plan and Safety at Site

Sl. No.	Environmental issues/Aspects	Action to be taken	Responsible Party /Entity for Action	Time Frame/ Frequency
a) *Pre-Construction Stage* Land and structure acquisition, training, work site survey, pegging and all approvals/permits shall be undertaken or obtained prior to the commencement of improvement works				
1.	*Environment Clearance* According to the Environmental Conservation Rules, 2007, the project falls under category Red A and thus under the provisions of the Bangladesh Environment Conservation Act. 1995.	LGED as the Proponent of the SSWRDP shall obtain the necessary environment clearance from the Department of Environment (DoE), Govt. of Bangladesh	PD, PMU	prior to the commencement of project works
2.	*Approvals and Permissions* Approvals/permits will be required form the concerned District Collector to undertake sand mining in the rivers, if proposed by the Contractor. Permissions from private landholders will also be required to undertake activities on their land.	Permission for Sand Mining: To obtain permit/approval from the District Collector to undertake sand extraction from river beds. The Contractor requires providing a copy of all permits/approvals to the PMU, LGED. The Contractor shall comply with statutes relevant to environment management at site. Permission from Private Land owners: To obtain permissions in wring from all private landowners whose land will be temporary utilized for borrow pits, CC block casting, materials storage, workforce camps etc. Permission shall be obtained prior to the commencement of these activities and copies shall be provided to the Engineer to the contract and the DDS Consultant. Land Acquisition: Private land and structures will need to be acquired for the proposed improvement works. Acquisition shall be undertaken in accordance with the provisions of the Land Acquisition Act. 1894. LGED as the Project Proponent shall ensure that the necessary land acquisition procedures are completed prior to the commencement of works at site.	Contractor Contractor PD, PMU	prior to the commencement of project works

Sl. No.	Environmental issues/Aspects	Action to be taken	Responsible Party /Entity for Action	Time Frame/ Frequency
3.	*Training*	In order to help improve the understanding and appreciation of the required standard of quality for coastal improvement and environmental management works, Environmental Management training and accreditation is required for Contractor's Field Supervisors/ Assistant Environment & Safety Managers	PMU, LGED, M&E Consultant	At least 1 month prior to the commencement of the implementation of first year works programme.
4.	*Worksites Survey, Pegging and Approval*	The proposed embankment, structure and ancillary sites to be surveyed and pegged prior to any construction or related activities to ensure the correct setting out of the lines and levels of formations, side slopes, drainage works, carriageway and shoulders in accordance with the detailed designs and permits/approvals obtained from the Engineer to the contract. Sites shall be located in accordance with the following criteria. • No ancillary site shall be located within 100m of identified archaeological, religious or cultural site • Ancillary sites shall be above flood level and at least 10m away from watercourses • Borrowpits, workforce camps, material storage areas shall be as per the relevant contract specifications.	Contractor	Prior to commencing any related activities. *Note:* All requirements to survey peg and seek approval for proposed works in phases or at any one point in time, not the entire contract length/area of work.
5.	*Construction Machinery and Vehicles*	All the construction machinery and vehicles to be used for improvement and ancillary works shall be of proven efficiency and shall conform to GOB standards for emissions and noise levels. All the construction machinery and vehicles shall be operated and maintained at all time so as conform to GOB standards for emissions and noise levels.	Contractor	At all times

Sl. No.	Environmental issues/Aspects	Action to be taken	Responsible Party /Entity for Action	Time Frame/ Frequency
b) *<u>Construction Stage</u>* The key principles that have to be adhered to are: limiting the area of disturbance and land-take, sequencing constructing activities to save the double handling of materials, and progressively re-vegetating the completed batters.				
6.	*Vegetation Clearance*	Vegetation clearance shall be confined to the minimum area required for construction. Trees within the boundaries of ancillary sites shall be retained wherever possible. Shall have to protect all remaining vegetation within the construction zones and at ancillary sites by ensuring that: • No spoil or topsoil is removed or added to the base of remaining trees; • No harmful materials are placed adjacent to the remaining vegetation; • No vegetation is harvested by construction workers for their personal use or sale; shall dispose of removed vegetation at locations approved by the Engineer.	Contractor	1 week prior to the commencing of construction works within the approved sites
7.	*Topsoil Saving and Re-use*	Topsoil shall be removed from areas of fill or sub-surface excavation and stockpiled at designated locations for reuse in covering embankment slopes, berms, and other disturbed areas. Top soil is to be stockpiled from all temporarily acquired ancillary site areas that are to be disturbed for subsequent re-use in rehabilitation of these sites.	Contractor	During ancillary sites development and their rehabilitation
8.	*Disposal of Unsuitable and Spoil materials*	Unsuitable and spoil materials shall be disposed promptly and properly from the site at locations approved by the Engineer to the contract.	Contractor	Prior to the commencing of construction works
9.	*Reinstatement of Services*	All interrupted services (irrigation tubewells, channels, drainages ditches and walking trails) shall be progressively reinstated to their previous capacity as soon as project improvement works has been completed in the vicinity.	Contractor	During construction, at any one point in time

Appendix-H

Appendix-H Corrective-Action Request (Non - compliance Reporting)

Contractor's Name: ……………………………………

Subproject's ID No:……………………Subproject Name:………………………………

Village:…………………………Union:…………………………Upazila:…………………………

District:…………………………

Inspection of the subproject work was found to demonstrate non-compliance to some of the items of the contract Specification and Implementation of EMP.

The contractor is hereby requested to rectify the non-compliant works as tick (√) marked below within --------days.

Non-compliant works detail

- ☐ Construct environment friendly labor shed or workforce camp
- ☐ Provide sanitation facilities by installing sanitary latrine, urinal and bathroom (at least 1 no. of each separately for women and men).
- ☐ Provide adequate supply of arsenic-free water for drinking and other purposes by installing tube wells in workforce camp (at least 1 for women and 1 for men).
- ☐ Provide adequate first-aid facilities at workforce camp and construction site.
- ☐ Provide health safety gears like hand gloves, helmet and gumboots to the workforce to avoid health risk.
- ☐ Provide sufficient garbage bins for collection and safe disposal of wastes generated at camp site.
- ☐ Suppress dust pollution at camp site/construction area by spraying water at regular intervals.

Inspection by: Name:…………………………Date of Inspection: ……………

Signature:………………………………………………………………………………

Designation:……………………………………………………………………………

Appendix-I

Appendix-I Follow-up Actions Checklist for Corrective Action Request (CAR)

Follow up actions for suggested actions against registered non-compliances

Sl. no	Name of Subproject (where non-compliances recorded)	Type of non-compliances recorded	Issuing date of Correcting Action Request (CAR)	Follow up status of compliances
1		• • •		
2		• • •		
3		• • •		
4		• • •		
5		• • •		
6		• • •		

Attachment II-9

Guidelines for Small Scale Water Resources Development Project

G3 Participatory Rural Appraisal of Subproject

Attachment II-9

Guidelines for Small Scale Water Resources Development Project

G3 Participatory Rural Appraisal of Subproject

Local Government Engineering Department

Local Government Division
Ministry of Local Government, Rural Development and Cooperatives
Government of the People's Republic of Bangladesh

Guidelines for
Small Scale Water Resources Development Project

G3 Participatory Rural Appraisal of Subproject

October 2017

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Document Architecture of the New Set of Guidelines for SSWRD Project

[Small Scale Water Resources Development (SSWRD) means, from physical points of view, implementing appropriate water management subprojects of small sizes, not exceeding 1000 hectare benefit area by the current definition, to resolve existing water management constraints to agriculture that in turn enhance rural employment leading to reduction of rural poverty. Implementation of SSWR subprojects involve long process from proposal of a subproject from Local Government bodies (Union Parishad and Upazila Parishad) to its final selection, study of feasibility from different considerations (social, environmental, technical, economical), preparing detail design and costing, constructing required physical works to standard quality and finally its operation and maintenance by its beneficiaries. The process has multiple facets too. It needs to be comprehensively beneficiaries' and other stakeholders' participatory, acceptable to people of widely varying social and socio-economic conditions, friendly to the surrounding environment, etc. Thus, Guidelines for SSWR Development is, of necessity, complex.

The long and complex process has been divided into major distinguishable steps and separate Guidelines for works and activities involved in those major steps have been developed. Environmental study applies to the subproject as whole and is of different nature. So, Guidelines for Environmental Assessment is made a separate document. Following this principle, the Ten (10) Guidelines with Alpha-numeric ID Numbers and Names as below constitute the Documentation of Guidelines for SSWR Development.

This list will appear in all the individual Guideline Documents with highlight of the current Document name for the user to refer when necessary]

The List of New Set of Guidelines for SSWRD Project

G1	Policy and Development Process
G2	Identification of Subprojects
G3	**Participatory Rural Appraisal of Subproject**
G4	Feasibility Study of Subproject
G5	Environmental Assessment of Subproject
G6	Detail Design of Subproject Structure
G7	Construction of Subproject Structure
G8	Operation and Maintenance
G9	Monitoring and Evaluation
G10	Integrated Rural Development Plan between SSWR and Rural Road/Market

AMENDMENT AND UPGRADATION RECORDS

This document ***"*Guidelines for SSWR Development: G3 Participatory Rural Appraisal of Subprojects"** has been issued following amendments and up-gradations as outlined below:

Revision	Description	Date
	Guidelines for Conducting Participatory Rural Appraisal of Small Scale Water Resources Development Subprojects - initially developed for ADB-supported SSWRD Sector Project (1995-2002) was used in two consecutive ADB-supported Projects – SSWRDSP (1995-2002) and Second SSWRDSP (2002-2009).	1995-96
A	The same document Guidelines for Conducting Participatory Rural Appraisal of Small Scale Water Resources Development Subprojects was adopted for use in the JICA-supported SSWRDP (2009-2015) by only nominal modifications in respect of project area and supporting agency attributes.	April 2009
B	This Document **"Guidelines for SSWR Development: G3 Participatory Rural Appraisal of Subprojects"** is the ***Third*** Document of the series of Guidelines for SSWR Development finalized and approved by a Working Group of LGED Professionals with proven experience in SSWR development with assistance from Specialist WRD Consultants under a JICA-LGED Technical Co-operation Project. The Document builds upon the "Guidelines for Conducting Participatory Rural Appraisal of Small Scale Water Resources Development Subprojects (April 2009)" along with incorporation of more extensive coverage of appraisal programs and lessons learned over the time.	August 2017

GLOSSARY

Aman	Rice grown during the wet season (Kharif), and harvested late (Nov-December). Yields: (i) Broadcast, deep water 1.5t/ha; (ii) Transplanted, local variety 2.2t/ha; (iii) Transplanted, high yielding variety, 3.25t/ha
Aus	Rice grown during the wet season (Kharif), and harvested early (July-August). Yields: (i) Broadcast 1.25t/ha; (ii) Transplanted, high yielding variety, 2.5t/ha
Beel	Saucer shaped low-lying area with pond of static water as opposed to moving water in rivers and canals.
Boro	Irrigated rice grown in the early dry season (Rabi). Transplanted in December-January and harvested in April-May. Yield: Transplanted, high yielding variety, 4.25t/ha
District	Second administrative unit of the government comprising 6-9 Upazilas. There are 64 districts in Bangladesh.
Haor	Haor is a wetland ecosystem in the north eastern part of Bangladesh. Physically a bowl or saucer shaped shallow depression, also known as a back-swamp
Integrated Water Resources Management Unit	Unit comprising two sections: (i) planning & design, and (ii) operation & maintenance, with a mandate to guide LGED's activities in the water sector with specific responsibility to assist in enunciation of policies, formulation of strategies and plans, preparation of new projects, inter-agency coordination and with external agencies, undertake studies and to provide long term support to the completed projects
Khal	Natural or man-made water channel (canal)
Kharif	Wet (monsoon) season
Local Stakeholder	Local Stakeholders are inhabitants of an area directly or indirectly affected by water management, be it as beneficiaries or as "project affected people".
Project Affected People	People negatively impacted by investment in water management projects and / or subprojects or by the manner in which water regulating infrastructure is managed.
Project Consultants	Project implementation consultants working with the PMO
Project Management Office	A unit comprising LGED staff appointed to manage implementation of a Project
Rabi	Dry / winter cropping season (November to March)
Stakeholder Groups	Stakeholder groups are collections of individuals who have similar interests concerning water. Among others, such stakeholder groups are men and women, farmers (low, medium low, medium high and high land farmers), fishers, boatmen, landless, elected representatives, LGED employees, BWDB employees, employees of other government departments, contractors, consultants, and development partners.
Union	Subdivision of Upazila and the lowest governance institution in the country. There are 4,889 Unions in Bangladesh.
Union Parishad	Local government institution at Union level. The Union Parishad consists of an elected council & chairman, and is the oldest government institution in Bangladesh
Upazila	Administrative unit, sub-division of District and lowest administrative tier of the government. In all, there are 482 Upazilas in Bangladesh.
Upazila Parishad	2nd tier of local government institution at Upazila. According to the Upazila Parishad Act 2009, Upazila Parishad consists one elected Chairman and two Vice-chairmen, Chairmen of UPs and Mayor of Municipality within each Upazila including representatives from line agencies with an Upazila Nirbhai Officer as the Secretary. The election of the Upazila Parishad was held on 22 January 2009. Upazila Parishad runs the local administration.

ABBREVIATIONS AND ACRONYMS

ADB	Asian Development Bank
AE	Assistant Engineer
BWDB	Bangladesh Water Development Board
CA	Community Assistant (Project Based – Subproject Level)
CO	Community Organizer
CPO	Community Participation Officer (Project based, District level)
CS	Construction Supervisor (Project Based – Upazila Level)
DAE	Department of Agricultural Extension
DDM	Detailed Design Meeting
DLIAPEC	District Level Inter-Agency Project Evaluation Committee
DOC	Department of Cooperatives
DOF	Department of Fisheries
DWRA	District Water Resources Assessment
EIA	Environmental Impact Assessment
EMP	Environmental Mitigation Plan
FMC	First Management Committee (of WMCA)
FSDD	Feasibility Study and Detailed Design
GoB	Government of Bangladesh
IEE	Initial Environmental Examination
JBIC	Japan Bank for International Cooperation
JICA	Japan International Cooperation Agency
ICM	Integrated Crop Management
IWRMU	Integrated Water Resources Management Unit (of LGED)
LCS	Labour Contracting Society
LGED	Local Government Engineering Department
MC	Management Committee (of WMCA)
MEP	Member Education Program
MIS	Management Information System
MLGRDC	Ministry of Local Government, Rural Development and Cooperatives
NGO	Non-Governmental Organization
O&M	Operation and Maintenance
PAP	Project Affected Person
PE	Performance Enhancement
PEA	Performance Enhancement Appraisal
PM	Planning Meeting
PMO	Project Management Office
PRA	Participatory Rural Appraisal
QC	Quality Control
SAE	Sub-Assistant Engineer
SAPROF	Special Assistance for Project Formulation
SP	Subproject
SSWR	Small Scale Water Resources
SSW-1	SSWR Development Project Phase I (ADB), 1996-2002
SSW-2	SSWR Development Project Phase II (ADB), 2002-2009
SSW-3	SSWR Development Project (JBIC), 2009-2016
SSW-4	Participatory SSWR Project (ADB) 2010-2017
TA	Technical Assistance
UDCC	Union Development Coordination Committee
UE	Upazila Engineer
UP	Union Parishad (local council)
UzP	Upazila Parishad
WMCA	Water Management Cooperative Association
XEN	Executive Engineer (usually used in LGED)

FARM, LAND AND SUBPROJECT CATEGORIES

FARM CATEGORIES

Land Holding		Farm Category
(ac)	(ha)	
<0.51	< 0.21	Landless
0.51 – 1.00	0.21 - 0.40	Marginal Farmer
1.01 – 2.49	0.41 – 1.00	Small Farmer
2.50 – 7.49	1.01 – 3.03	Medium Farmer
>7.50	>3.03	Large Farmer

LAND CATEGORIES

Depth of Average Monsoon Flooding		Land Category
(m)	(ft)	
<0.3	<1.0	Highland
0.3-0.9	1.0-3.0	Medium Highland
0.9-1.8	3.0-5.9	Medium Lowland
>1.8	>5.9	Lowland

INTRODUCTION

1. The National Water Policy envisages that water resources development activities, in particular the SSWRD projects will be implemented through peoples' active participation. In follow up, the first ADB-supported SSWRD Project (1995-2002) introduced Participatory Rural Appraisal (PRA) as part of the process of developing local stakeholders' active participation in the process of subproject planning and implementation. The process was developed and improved over the other projects implemented since then and proved to be a successful tool to understand if there is a good degree of support of local people for the subprojects and if there is any group of people who might be adversely affected by the subproject. The brief grass-root level appraisal has also been a good tool to indicate justification of investment in processing the subproject.

Accordingly, all SSWRD projects are required to undertake PRA of subprojects to understand their social and socio-economic viability in the first place and a qualitative understanding of their technical and environmental soundness.

OBJECTIVES OF PRA

1.1 Purpose

2. The purpose of PRA is to obtain a comprehensive overview of the perceptions of different local stakeholder groups concerning water issues in the proposed subproject area. PRA findings will be useful in selecting socially and environmentally sound and sustainable subproject design. Moreover, PRA is a vital tool in understanding the social and institutional context of a subproject. Its findings can provide early and essential information about who will be affected by the project (positively and negatively); who could influence the subproject (positively and negatively); which individuals, groups or agencies need to be involved and how; and, whose capacity needs to be built to enable them to participate effectively. Therefore, it provides a strong foundation and framework outline of the participatory planning, implementation, and monitoring that follows after the subproject is selected.

1.2 Specific Objectives

3. PRA aims to define the existing social profile in the subproject area and find out from the various stakeholder groups, their views and opinions about the problems and constraints they face relating to water resources in the area and, having given and explained the solution that is being planned to solve the problems and constraints, understand their opinion about the proposed subproject plan and readiness or reluctance to offer support and co-operation in implementing the planned subproject. In this context, the PRA includes the following:

- Inventory of local water resources and their present use;
- Identify the social / socio-economic profile of the beneficiary groups in the subproject area;
- Perceptions of local stakeholders' groups on (i) existing water related problems and constraints in relation to domestic, agricultural, fisheries, environmental and other usages and (ii) the solution/redress of the problems and constraints that will be obtained from the proposed subproject plan; and
- Understanding of the support and co-operation that the beneficiary people and communities are ready to render in implementing and subsequent operation and maintenance of the subproject facilities so that the benefits would be sustainable.

4. The PRA seeks to answer the following four key questions for each of the proposed water resources development and management subprojects:

- Is there broad, popular support for the proposed subproject?
- Is there any opposition to the proposed subproject, and if so, by whom, why and how many people are against it?
- What are the likely adverse impacts and what possible mitigation measures can be taken?

5. Are the beneficiaries willing to:

  - pay the cost of operation and maintenance, that is usually taken as 3% of earthwork and 1.5% of structure costs;
  - assist with land acquisition; and
  - take full responsibility for operation and maintenance of the completed subproject.

PRA PROCESS IN SSWRD SUBPROJECTS

1.3 Overview of Subproject Selection Process

6. A subproject proposal is initiated by Union Parishad and Upazila Engineer (UE) prepares the subproject proposal in technical format which is considered in the Upazila Parishad and given approval for implementation. The subproject proposal, thus having recommendation of Local Governments, is submitted by Executive Engineer of the District to IWRM Unit of LGED at Dhaka for further processing under an implementing project.

7. In the IWRM Unit, the subproject proposal is pre-screened for adequacy of supporting data-information and papers and upon satisfaction of having sufficient merit, a multidisciplinary field reconnaissance by professional persons are undertaken to assess potential of the proposed subproject from technical, social and environmental considerations.

8. Upon recommendation of the professional reconnaissance team, the Participatory Rural Appraisal (PRA) of the subproject is undertaken by a contracted Firm. PRA is a quick social appraisal of the subproject to ascertain if expectations of would-be beneficiaries are contained in the subproject proposal and if they have spontaneous support for the subproject and is willing to undertake and bear responsibility of the subproject's subsequent operation and maintenance activities through an association of themselves.

9. The PRA, if conducted meaningfully, provides a thorough insight into the social soundness of the proposed subproject and potential of having a meaningful and pro-active institution of the beneficiaries for operation, maintenance and sustainability of the subproject. PRA is thus considered a very important and final tool for selection of a SSWR subproject.

1.4 PRA Team and Timeframe

10. Each PRA Team includes a Water Resource Engineer, a Sociologist, a Women in Development Specialist, an Agriculturist and a Fisheries Specialist cum Environmentalist. A team leader from among these members will be selected.

11. PRA is a quick appraisal activity. Yet, time required to conduct PRA of subproject depends on its size and complexity of planned interventions. For simple subprojects, like drainage and tidal irrigation subprojects involving only re-excavation of khals and having usual sizes with 3-5 villages, may require 2-3 days field work. But, subprojects involving gated structures for water regulation present complex water management issues and if subproject area is big say involving 10 villages, may need 7-8 days field work.

12. Considering an equal number of days for data processing and report preparation, total time required for conducting PRA of subprojects may vary from *1-week* for simpler subprojects to *2-week* for bigger and complex subprojects.

1.5 PRA Sampling Method and Coverage

13. To expect a wide participation and support for a proposed subproject, it is necessary that there must be thorough discussion with potential beneficiaries with dissemination of information about the infrastructure to be built, their functions to address the problems

including limitations and about the benefits and advantages that is expected as the result of the subproject as widely as possible.

14. Therefore, in order to expect wide participation of the beneficiaries in the subproject matters, besides *Talks/Interactions* with local leading persons and *Transect Walk* through the subproject area, emphasis should be given to hold *FGD* and S*tructured/Semi-structured Interviews* with target groups in *all subproject villages*. If, however, number of villages in the subproject is exceptionally large, say more than 10, or many small scattered homesteads exist in the area, smaller villages or homestead clusters may be grouped together to workable number of villages for conducting PRA and also for other subsequent issues to come.

1.6 Main Components of PRA and Tasks of Team Members

1.6.1 Engineering Component

15. A Water Resource Engineer (WRE) having experience in conducting PRA will be the PRA Team member responsible for the Engineering Component. He will concentrate in assessing the physical situation and engineering aspect of a proposed subproject. However data and information obtained for use in PRA will be only qualitative in nature. The WRE will provide support and assistance to all members of the Team in engineering and mapping matters.

16. The WRE facilitates the conduct of *"Timeline"* with help from key informants / participants. There will be two *"Timelines"* summarizing (i) history of important water resources development events in and nearby the subproject area, and (ii) development / evolving of the current water resource related problems/constraints for which the subproject is being considered. .

17. Together with other members of PRA Team and local participating people, the WRE will undertake *"Transect Walk*" and develop a physical / resource map of the subproject area by putting information obtained by visual examination and by collecting from transect participants on a Google map of the subproject with reconnaissance information carried from Dhaka for the purpose. The WRE's task will mainly be to check and validate available data-information on water resources, engineering and physical features. The followings and any others the WRE may think necessary should be noted / marked / drawn on the physical map:

- Subproject boundary given by reconnaissance team. Any modification to that boundary suggested by the *Transect Walk* participants or others in course of the PRA exercise.
- All water resources/physical features (rivers, khals, beels, dighis, villages, market, etc.). The features visible in the map (Google map) will be identified on ground and their names written on map. Smaller features that are not visible in the Google map being used should be drawn approximately with name..
- All structures affecting water (roads, embankments, sluices, regulators, culverts etc.) both existing and proposed (indicate if a new proposal during PRA).
- Flooding and drainage paths with flow directions using different color arrows (blue for flooding, green for drainage). F → ← D

- Area and Spread of flooding/inundation to be shown by colored bounding lines for mean, 1:10-yr and 1:20-yr floods based on discussion with participants.

18. ***Form G3-A(WR)*** given in ***Exhibit G3-A*** of this Document presents the format for writing observations and data gathered by the Water Resource Engineer. In the narrative report, the Water Resource Engineer will explain the things below:. :

- History of water related development activities and the current water related problems should be described in a timeline. Specify if alignment of khal is still defined / visible. See sample in the following table:

A. Time Line for Water Resource Development Activity

Sl.	Features Waterbody/Struc	Year Established/ Constructed	By Whom?	Status
1.	Khals			
	a. Jungla Khal	Unknown but it has been existing since 1900	Government	Fully silted up and alignment no longer defined. Major portions used for seedbed preparation. The downstream part being cultivated.
	b. Kumari Khal	1978	BWDB	About 500 meters upstream is silted up but alignment is visible.
2.	Culvert	1978	UP	Broken. No longer functional

B. Time Line for Water Related Problems

Sl.	Water Related Problems	20 Year Before	10 Year Before	Now (2017)	Reason
1	**Flood**	No flood in pre-monsoon time, only in monsoon. .	Rain flood gradually increasing (pre-monsn)	Problem now is severe, every year event. Drainage is slow..	Khals inside and also in outside has silted up. Culvert built in 2010 is with small length.
2.	Culvert			Built in 2010 Span less than khal top width.	Broken. No longer functional

- Mention also in the history of water related activities if this subproject area is within any BWDB project or if there is any BWDB intervention in the past and in the future in the proposed subproject area.
- After the history of water related activities and problems, briefly discuss the proposed subproject development concept or plan (as proposed during reconnaissance survey), specifying the type of subproject and the works/structures proposed for construction.

In case of water retention/conservation projects, mention any issue of *sharing the khal/beel water* by different users.

- Also present what the local stakeholders have proposed if these differ from the reconnaissance survey proposal. Check for possible conflict of opinion as to the need for the structures, location of the structures, and/or khal alignment.
- In presenting the expected impacts of the proposed subproject, closely relate these to the proposed development plan for the subproject in order to show clearly how the various impacts will be attained. **Example**: If the proposed subproject is implemented, it will result in quick removal of floodwater from Rupati beel and the crops in the adjoining fields will be free from water logging resulting in increased crop production. The re-excavation of the Shakaria khal will allow storage of water during dry season and this water could be used for cultivating paddy and "robi" crops in areas on both sides of the khal."

19. Participants/Stakeholders to be involved in the Time Line and Transect Walk will preferably have the following eligibilities:

- Farmers, persons who have lived long, say more than 20 years, in the subproject area and are conversant with causes and effects of current water resource related problems.
- Local leaders who are knowledgeable about past interventions on water resources development in the area

20. Names and signatures of those involved in PRA activities specific to this component should be given as shown in ***Form G3-A (WR).***

1.6.2 Agriculture Component

21. An Agriculturist having experience in conducting PRA will be the PRA Team member responsible for the Agriculture Component. Proposed subprojects usually aim at overcoming bottlenecks in agricultural production. PRA should be able to clearly point out what the water-related agricultural problems are and how the local people want to overcome these. The focus is therefore on qualitative information, rather than on quantitative data. In this regard, the Agriculturist meets with representative farmers of all the villages covered by the subproject to find out how water, be it too much or too little, affects crop production. Each of the main crops is discussed to identify water-related constraints and possible solutions.

22. **Participants and PRA Methods and Tools for Agriculture Information:** The Agriculturist/Agronomist will conduct focus group discussions and some semi-structured interviews with the men and women farmers to find out how water, be it too much or too little, affects crop production, what are the main crops, what are the water-related constraints and solutions, and possible impacts of the proposed subproject on crop production. Matrix and Problem Ranking will be utilized in the identification of constraints and solutions. This should be initiated before completion of FGD session with the women and men farmer-participants. The Agriculturist should see to it that he is able to have discussions with small, marginal, medium and rich farmers in the subproject area.

23. ***Form G3-B (Agri)*** given in ***Exhibit G3-B*** of this Document presents the format for writing observations and data gathered by the Agriculturist. In the narrative part of the report, the following should be written:

- Land types and major cropping patterns to be reflected in the agriculture map (see below). Cropping patterns should include variety (local, hyv) and planting method (broadcast, transplanted).
- Areas having flood related crop production limitations
- Areas having water logging related crop production limitations
- Areas having drought related crop production limitations
- Expected impact of the proposed subproject (example: reduced crop damage, changed cropping patterns, cropped area, yields, etc.). The impacts should be quantified in terms of percentage of area, kilograms, percent of farmers who will benefit from which village. Explain how expected impacts will be attained. If this has been mentioned in engineering aspect, then just refer to that section here and do not repeat what had been mentioned already.
- A separate **agriculture map** should be prepared using Google map of the subproject area with reconnaissance level interventions shown. Earlier, this Google map should be prepared at Dhaka for the Agriculturist which he would carry for field work.
- The areas under various crops and the areas classified as waterlogged, flooded, irrigated, etc are to be shown in the agriculture map.

24. Names and signatures of those involved in PRA activities specific to this component should be given as shown in ***Form G3-B (Agri).***

1.6.3 Fisheries Component

25. The Fisheries Component and Environment Component will be addressed by a common Fisheries-cum-Environmental Specialist. Thus a Fisheries-cum-Environmental Specialist having experience in conducting PRA will be the PRA Team member responsible for the Fisheries Component. The task of the Fisheries-cum-Environment Specialist is to find out from people (men and women) involved (full and part time) in fishing what the local capture fisheries situation is and how it can be improved. Proposed subprojects often have a negative impact on capture (open-water) fisheries and therefore on the poorer sections of society for whom the common resource is important for their protein intake and sometimes cash income. The PRA report should indicate what the present capture and culture fisheries production is and how these might be affected by the proposed subproject.

26. The Fisheries cum Environmental Specialist will indicate the followings on the fishery map of the subproject prepared by using a Google map. Earlier, the Google map of the subproject should be prepared at Dhaka for the Fisheries cum Environmental Specialist which he would carry for field work.

- Seasonal and perennial water bodies
- Location of fishing communities
- Fish migration routes

27. In the narrative section, the following information should be mentioned:

- Fisheries resource base, distinguishing between seasonal and perennial water bodies estimating their number and size and quantifying present fish production, distinguishing between capture, culture, fresh water and salt water fish and prawns. Indicate ownership and management status of major water bodies (example: khas or privately owned, cultivated or not, under individual or group management etc.).

- Fishing communities specifying types of fisher families estimating number for each type. Indicate how many households are depending on fishing as their main livelihood
- Involvement of women in fisheries activities
- Expected impact of the proposed subproject on fisheries

28. The possible mitigation measures to compensate for the possible negative impacts should be mentioned. Apart from the views/suggestions of the local people or affected people themselves, the following list could be discussed with them:

- adopting fish friendly operation of structure gates.
- planned fish cultivation in the subproject water bodies.
- extension support for fish culture (training, documentation, etc.).

29. **Participants and PRA Methods and Tools for Fisheries Information:** FGD and Semi-structured Interviews will be conducted with men and women fishers (genuine/ethnic and subsistence); genuine fish farmers; stock holders from all subproject area villages to gather fisheries information.

30. ***Form G3-C (Fish)*** given in ***Exhibit G3-C*** presents the format for writing observations and data gathered on fishery aspect. Names and signatures of those involved in PRA activities specific to this component should be provided in ***Form G3-C***.

1.6.4 Environmental Component

31. The Fisheries-cum-Environmental Specialist will be the PRA Team member responsible for the Environmental Component. The following usual negative effects should be kept in mind:

- people living between a proposed embankment and the river will experience more intense and standing flood conditions,
- people living upstream from regulator who may experience additional flooding if the regulator is closed
- landless and fisher households will be affected if fish production is reduced because a structure prevents fish eggs and/or fingerlings from entering the subproject area from the river
- some plants/wildlife species may be threatened / endangered by the subproject
- forest resources and natural or planted vegetation (e.g. planting and cutting of trees) add to either profit or loss due to the subproject

32. ***Form G3-D (Env)*** given in ***Exhibit G3-D*** presents the format for writing observations and data gathered on environmental issues/concerns. In the narrative section of the report, the following should be written:

- Historical sites, conserved wetland/forest that might be threatened

- Water bodies that may be affected
- Land Acquisition issue, which should identify and quantify those who will be affected and what their reactions are towards the subproject. It should include any possible mitigation measures. Explore issue in-depth and check for people who will lose their income that may be brought about the re-excavation of khals like those who have been using portions of the khals for seedbed preparation and cultivation, residence, and others.
- Description of navigation specifying how many boats ply the area, how many boatmen/trawler drivers
- Villages/areas vulnerable to flooding (within and outside the project boundary). Identify and quantify.
- Use of chemicals and fertilizers.
- Expected impact of proposed subproject, description of project affected people (e.g. landowners who will lose land, boatmen who will not be able to ply their boats, fisher folks who will not be able to capture fish, others) and mitigating measures.

33. The possible mitigation measures to compensate any of the possible impacts should be mentioned. Apart from the views/suggestions of the local people or affected people themselves, the following list could be discussed with them:

- raising the homesteads where additional flooding is expected
- providing boat passes in regulators where navigation of many boats is hindered
- making a road where navigation is no longer possible
- stocking of a beel if a fish migration route is blocked
- design sill level in structures so that a beel cannot be completely drained
- keeping gates of regulators built in migration routes open at equal or nearly equal WLs at appropriate times for recruitment of fish eggs and fries.
- Resettlement of people who lose their homesteads due to construction of an embankment.

34. The **resource/physical map** (Google map based) of the subproject will show highlighted by colored circles or ovals drawn, the locations where people will be displaced due to construction of embankment or any other structure. Also, the areas (inside or outside of subproject) which might be negatively affected due to implementation of the subproject will be indicated in the map by color or shading.

35. **Participants and PRA Methods and Tools for Environmental Information:** FGD should be held at environmentally sensitive/important sites whenever needed in order to have a better investigation of some environmental concerns/issues. All villages of the subproject area should be studied. If this has not been followed, information in respect of other villages should be collected before drawing any conclusion on environmental feasibility. The names of villages and *moujas* studied should be indicated in ***Form G3-D (Env)*** to clarify where the information applies.

36. A sample of potential project affected people (PAP) should be taken to ensure that their recommendations and views are included in the report. Key informants from villages outside the subproject area who may be negatively affected should be interviewed. Concerned key informants from staff of relevant government agencies should also be interviewed.

37. Names and signatures of those involved in PRA activities specific to this component should be given as shown in ***Form G3-D.***

1.6.5 Social and Women Aspect Component

38. The Sociologist and Women in Development (WID) Specialist together meet, separate of the other tam members, with the farmers, fishers, landless, boatmen, women, indigenous groups (if there is any) and other stakeholders in the selected villages. She/he tries to find out what each of these stakeholders groups thinks about the local water resources; what their biggest problems are and the possible ways to overcome them.

39. ***Form G3-E (Soc)*** and ***Form G3-F(Women)*** given in ***Exhibit G3-E*** and ***Exhibit G3-F*** present the format for writing observations and data gathered on social and women issues/concerns. In the narrative section of the report, the following should be written:

- Type, number and percentage of stakeholders groups (indicate percentage land owned/operated)
- Major problems and ranking and proposed solutions by men and women stakeholders to be presented in a table/matrix form
- Reactions of men and women stakeholders about the proposed subproject and recommendations, if any (to be presented in a table/matrix form)
- Expected impact of proposed subproject on various social classes and occupational groups
- History of cooperation among local people
- Social conflicts, if any
- Major problems and needs of the indigenous people and their views about the proposed subproject and their recommendations, if any
- Existing groups/organizations (formal/informal; men's or women's groups) and services
- Women Aspects: demographic data; non-water related problems and needs, major activities and workload, and mobility status

40. This section will also deal with information regarding the landless and destitute men and women inside the subproject area: their number, present occupation, their experience and interest in engaging in earthwork employment. It will also deal with information regarding any indigenous group/s (if there are): their number, location of households, and source of income/livelihood. Separate FGDs and interviews with indigenous groups (men and women) should be conducted concerning: a) their water resource constraints; b) other needs and problems; c) their views and recommendations on how to address these; and d) their views on the possible impacts (negative and positive) of the proposed subproject and their opinion on the mitigation measures. Information should also be gathered on the level of participation of indigenous groups in economic and community activities.

41. Other information to be gathered concerns the identification of major social conflicts and presence of very influential people controlling management of resources and decision making within the subproject area (if any). The Sociologist should also gather information on the history of cooperation among the local people in the subproject area. S/he should check if the local people had initiated any program/project using their own resources or if they have contributed their resources to any government/private projects or programs implemented in the area. She should gather information also on existing groups/organizations (formal or informal) in the area.

42. The Sociologist and the WID Specialist will show on the social/resource map of the subproject (Google map based), which was prepared earlier and carried to site for field work, the location of villages, union, where the various stakeholder groups (occupational groups, social groups/classes, landless and poor people, indigenous peoples, project affected people, etc.) live, and location of institutions/ organizations like the UP office, health clinic, mosque, school, etc.

43. In the social map, the Sociologist should indicate the negative social effects of the proposed subproject, if any. The following should be kept in mind:

- people living on an existing embankment who have to move off, if and when it is heightened/broadened
- people (farmers, landless, etc) who may no longer easily cross a previously passable *khal* after it is re-excavated
- people living downstream from a water retention structure who may experience water shortage in the dry season
- landless and fishers' households who will be affected if fish production is reduced because flooding/water logging is reduced
- boatmen and businessmen who will be affected if *khals* are closed with regulators
- people affected by transport cost increase if *khals* are closed with regulators
- women who will have to walk farther for washing/bathing, watering the homestead garden, etc. if surface water inside the subproject area is reduced
- type and approximate area of land to be acquired/lost as well as the number of households likely to be affected.

44. **Participants and PRA Methods and Tools for Social and Women Aspects**: FGD should be held at all villages of the subproject area as defined in Section 3.3. The WID Specialist will be responsible in ensuring women's involvement in all the PRA activities. She will be conducting separate FGDs and interviews with women from different socio-economic classes and occupational groups concerning water resource constraints, needs and problems, their views and recommendations on how to address these and their views on the possible impacts (negative and positive) of the proposed subproject and their opinion on the mitigation measures. She will also gather information on the level of participation of women in economic and community activities, their main activities or preoccupation, mobility status and their major concerns.

45. Names and signatures of those involved in PRA activities specific to this component should be given as shown in ***Form G3-E*** and ***Form G3-F.***

1.6.6 Overall Conclusion of PRA Team

46. ***Form G3-G (Overall)*** presents the format for the overall conclusions of the PRA Team on key components of the PRA study. In the narrative report, the answers and findings to each question in the format should be written. On the questions: *Is there broad popular support for the proposed subproject and is there any opposition?* Identify and quantify who support and who oppose. Specify the type of stakeholder group/s, number and/or percentage and the reasons for supporting and opposing the proposed subproject. In addition, the PRA team should give a brief analysis and recommendations about the findings of the PRA study.

47. PRA Team should present briefly their own analysis and recommendations as to the social, environmental and institutional viability of the proposed subprojects and what they think of the proposed development concept by the local people considering their water resource constraints and problems in a separate sheet attached to ***Form G3-G.***

1.7 The PRA Implementation Process

48. The overall process for implementing PRA in SSWRD subprojects is presented in ***Table G3-III.1*** that integrates all components and activities under them as discussed earlier. The matrix describes the process, the corresponding activities to be conducted, the data/information to be gathered, the methods and techniques in initiating the activities and the expected outputs of each activity.

49. The PRA process for SSWRD subprojects involves eight (8) steps from planning to the submission of the PRA report (see ***Figure G3-III.1***). The heart of the whole PRA process can be found in Steps 3 and 4, which involve the actual conduct of PRA activities, data gathering and methods to be used (see ***Figure G3-III.2***). During the fieldwork period, the PRA Team should live full time at the subproject area so as to be able to fit in the activities with the availability of the people. FGD and Semi-structured Interviews can be done more ideally during late afternoons and evenings when local people have completed their major works. Transect and mapping can be done early in the morning or when local people are taking their break during the day from their work at the farm and elsewhere. ***Figure G3-III.3*** presents the steps involved in conducting the feedback and debriefing sessions that end field works.

Table G3-0.1: PRA IMPLEMENTATION PROCESS IN SSWRD SUBPROJECTS

PRA PROCESS	ACTIVITIES & DATA TO BE GATHERED	PRA METHODS AND TOOLS / TECHNIQUES	OUTPUTS
1. Collection of subproject map (Google map based) and discussion of reconnaissance findings	1. Collect subproject map from and discuss with LGED/PMO reconnaissance findings		1.Collected subproject map and gathered reconnaissance findings
2. Discussion of PRA objectives, activities and requirements with District and Upazila level LGED officials and Union Parishad Chairman and members	2.a PRA Team meets with Executive Engineer and Upazila Engineer to discuss PRA objectives, activities and support needed by PRA Team 2.b PRA Team meets UZ Chairman,UP Chairman and Members to discuss PRA objectives, activities		2.a LGED officials and PRA Team finalized arrangements for the implementation of PRA activities 2.b UZ Chairman,UP Chairman and members made aware of PRA objectives and activities
3. Conduct initial visit of the area and preliminary social investigation and inventory of subproject boundary, villages, population, local water resources and present use by the whole PRA Team	3.a Identify all villages covered by the proposed subproject and stakeholders groups: potential beneficiaries (categorized into farmers, fisher folks, others); affected people or those who might be adversely affected/ impacted; local groups/ institutions who can affect the outcome of the intervention; vulnerable groups living within the subproject boundary (poor, marginal, destitute, landless, etc.); influential people; and other key informants 3.b. Inventory of all local water resources and present use.	• Stakeholder Analysis through Individual talks and interactions with local leaders, key informants • Transect • Resource/Physical mapping	3.a Established rapport with the local people 3.b List of stakeholder groups and estimated number in the subproject area (tabulation and map) 3.c Tabulation and map of existing water resources in the subproject area and corresponding present usage.
4. Facilitate Self Analysis by the people in the subproject area about their situation as well as basic description of the type of community and the interest groups. (To be initiated individually by the PRA Team members/experts using Forms G3-A to G3-G as their data gathering guide)	4.a. Get views and opinion of the people about the existing water resources facilities and structures. Surface their problems and needs on water resource use and management and other issues: • perceptions on water related issues and constraints in relation to domestic, agricultural, fisheries, transport,	4.a.i FGD and Semi-structured Individual Interviews 4.a.ii. Matrix ranking for constraints/ problems/issues 4.a.iii Preference ranking on solutions, recommendations	4.a. Narrative report on views/ perceptions of each stakeholder group on: • water related issues and constraints (including their needs and aspirations) in relation to domestic, agricultural, fisheries,

PRA PROCESS	ACTIVITIES & DATA TO BE GATHERED	PRA METHODS AND TOOLS / TECHNIQUES	OUTPUTS
	environmental, other usage (needs and aspirations) • perceptions on solutions and recommendations to resolve issues and constraints identified. • perceptions on positive and negative impact of proposed subproject on various stakeholder groups. • Perception of their responsibilities towards the proposed subproject 4.b. Gather information on the following: • landless and destitute men and women/households • history of water related interventions • land types and use • water bodies and fishery data • agricultural/fishery production data • environmental issues (flooding, water logging) • social and women aspects	4.a.iv Social Mapping 4. b.i. Conduct trend line, time line, seasonal diagram and production flowchart 4.b. ii Indicate in the social map areas which will be negatively affected by the proposed subproject and landless/destitute people 4.b. iii Indicate in the fishery map: water bodies/ ponds; "ghers" for prawn cultivation. The flood and waterlog affected areas; and water shortage areas to be reflected in agriculture map. Ponds/ water bodies to be affected by proposed subproject to be reflected in the physical map	transport, environmental, other usage • solutions/recommendations to resolve issues and constraints identified • positive and negative impact of proposed subproject to them 4. b. Completed trend line, time line. Seasonal diagram, production flowchart, social map and resource/physical map
5.1 Determine if there is any opposition to the proposed subproject and if so quantify the opposition. Also identify options for changing proposed subproject to make it more widely accepted or what mitigation measures can be taken to minimize residual opposition. (To be determined and discussed by the whole PRA Team based on all data gathered. (See Form G3-G)	5.1a. Assess outputs of activity 4.a and 4.b 5.1b. If there is any opposition quantify by reviewing data under 3.a output. 5.1c. Validate data in 5.1a and 5.1b and identify options through a discussion with the opposing groups and concerned technical staff/ engineering consulting firm.	(Should be inferred from findings / outputs in item 4. a. and 4.b. Additional FGDs/ interviews with other stakeholder group/people may be required for identifying mitigation measures).	5.1a. List of any opposition (individuals and or groups) and estimated number 5.1b. Options or mitigation measures to minimize residual opposition presented in table form and/or map.
5.2 Determine likely environmental impacts of the proposed subproject, if any of those are negative, what design changes can be made to minimize them and what mitigation measures can be taken concerning residual negative impacts. (Determined by whole PRA Team	5.2a. Evaluate outputs of 4.a and 4.b and identify environmental impacts, if any. 5.2b. Discuss with local institution e.g. affected people, UP, LGED, and other key stakeholder groups on (i) change in design, (ii) miyigation measures	(Should be inferred from findings/ outputs in items 4.a and 4.b)	5.2a. Description of identified environmental impact. 5.2b. Proposed design changes to minimize negative impact. 5.2c. Mitigation measures.

PRA PROCESS	ACTIVITIES & DATA TO BE GATHERED	PRA METHODS AND TOOLS / TECHNIQUES	OUTPUTS
based on data gathered.(See Form G3-G).			
5.3.To determine if there is a broad, popular support for the proposed subproject (To be determined by the whole PRA Team based on all data gathered. (See Form G3-G).	5.3 Assess outputs of activity 4.a and 4.b.		Matrix on extent of support for the proposed subproject by key stakeholder groups
5.4 Determine willingness of potential beneficiaries to: a) Pay 3% of all earthworks and 1.5% of all structural work before LGED starts construction. b) Form WMCA and take full responsibility for O&M. c) Assist in land acquisition. (to be determined and discussed by the whole PRA Team based on all data gathered (See Form G3-G).	5.4a. Assess outputs of activity 3 & 4. 5.4b. May need to gather more information to be able to really gauge willingness: • History of cooperation in the area: check if they have undertaken any projects/ programs using their own resources or if they have contributed anything in any govt. projects/programs of the area • Land acquisition experience in area • Any existing groups (informal and formal) in the area	5.4a. Infer from findings / outputs in items 3 & 4 5.4b. Conduct additional FGD and interviews with potential beneficiaries, key informants	5.4 Percentage of beneficiaries willing to: a) Pay 3% of all earthworks and 1.5% of all structural work before construction. b) Form WMCA and take full responsibility for O&M. c) Assist in land acquisition.
5.5 Come up with overall conclusions and draft report (See Form G3-G).	5.5 Consolidate and analyze outputs of nos. 3-5.4		5.5 PRA draft report on findings
6. Feedback session/s with the stakeholders on PRA findings	6. Conduct group meetings with key stakeholder groups and/or public meeting with majority of stakeholders who participated in PRA activities to present and discuss major findings of the PRA	6.a. Large Meetings/ Assembly meeting 6.b. Presentation of enlarged version of maps prepared, matrices and diagrams	6.a. PRA findings confirmed/ validated by the stakeholders 6.b.Majority of stakeholders approved or agreed with the PRA Team about PRA findings
7. Debriefing session with LGED field officials and staff, local government officials, key staff from relevant government agencies and NGOs	7. Conduct meetings with the LGED Executive Engineer, Upazila Engineer and staff and also with UP members and key staff from relevant government agencies and NGOS to present and discuss major findings of the PRA	7. Presentation of PRA findings and discussions	7.a. PRA findings confirmed/ validated by UZ Parishad, partner organizations, LGED officials and staff and government/NGO people of Uz level 7.b.Upazila Engineer and Executive Engineer agreed with PRA Team about PRA findings
8. Write final report on PRA findings and submit to the Project Director.			8. PRA Report submitted

FIGURE G3-III.1: FLOWCHART OF PRA PROCESS IN SSWRD SUBPROJECTS

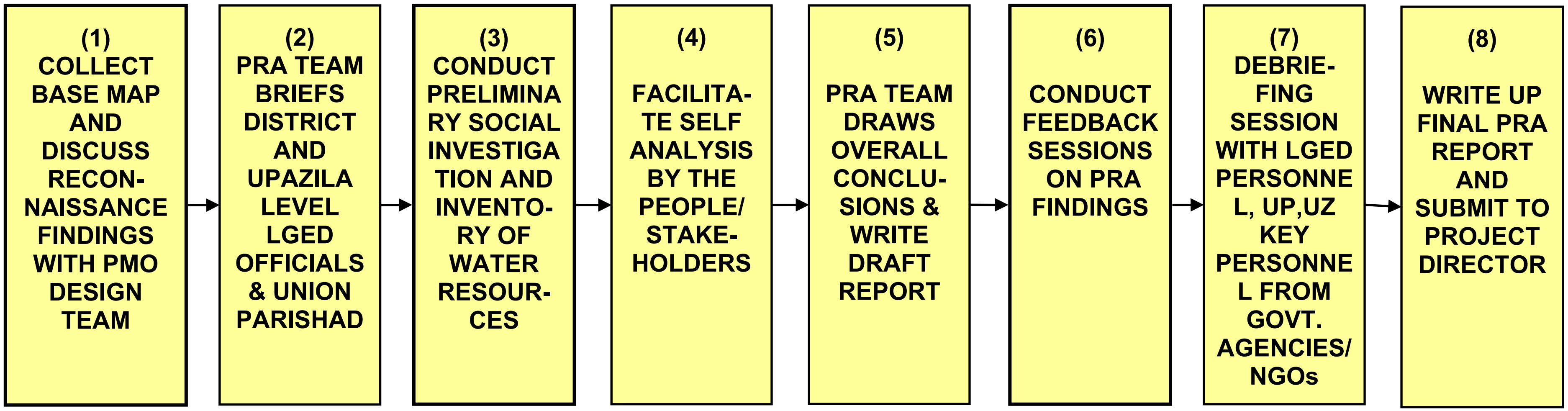


FIGURE G3-III.2: FLOWCHART OF PRA FIELDWORK PROCESS (1 week) IN SSWRD SUBPROJECTS

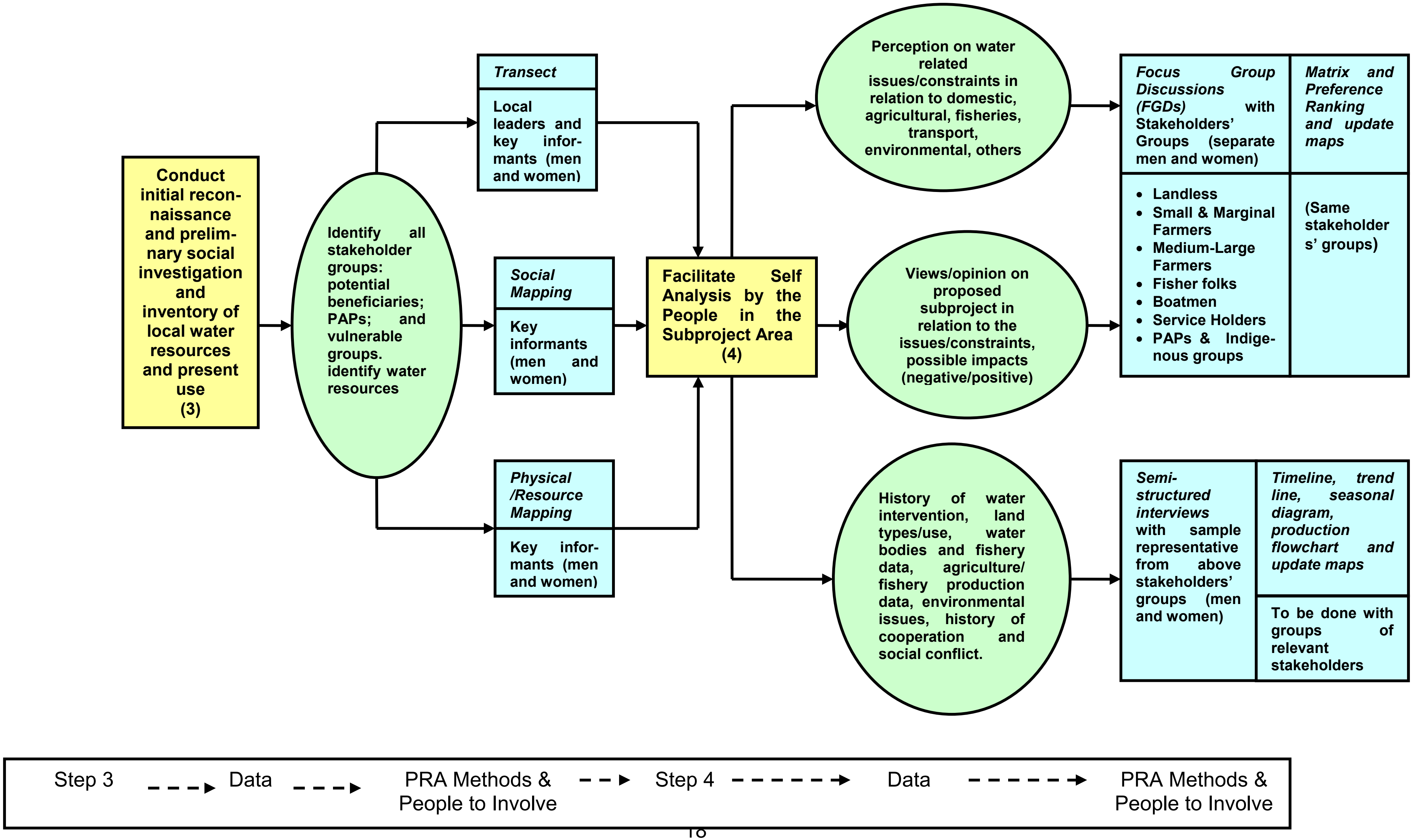
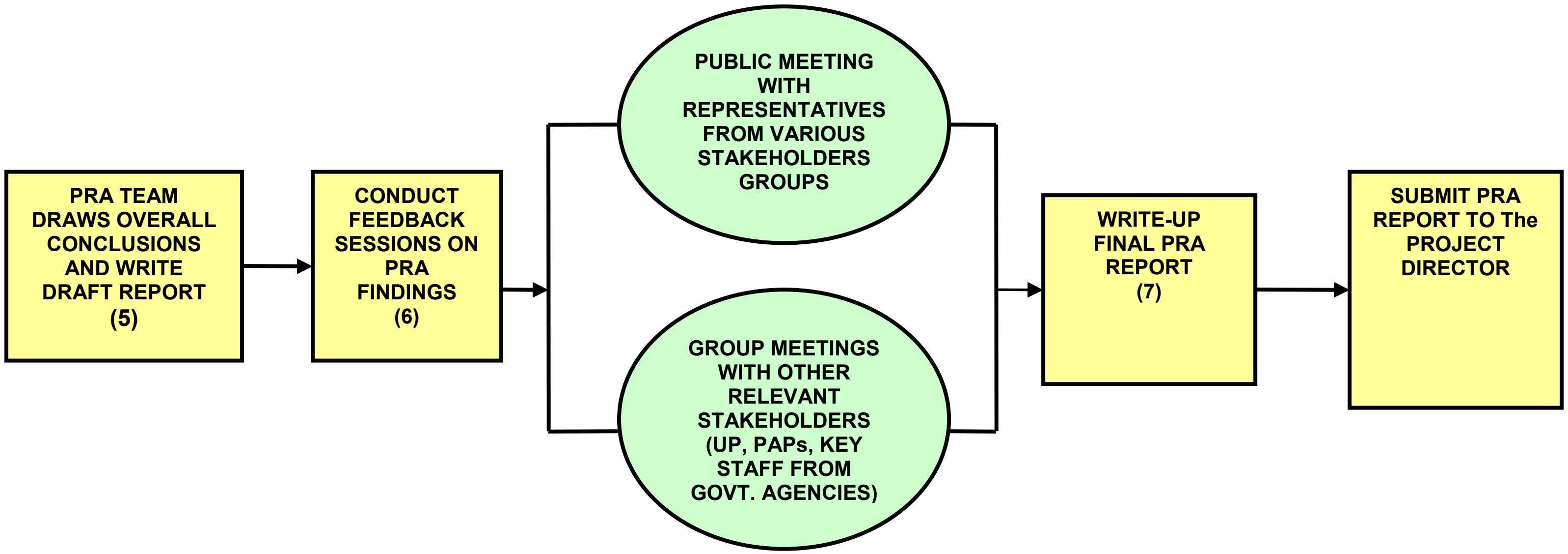


FIGURE G3-III.3: FLOWCHART OF PRA REPORTING & FEED-BACK PROCESS (1 week) IN SUBPROJECTS



1.8 Basic Principles and Rules in Conducting PRA

50. The PRA Teams must observe the following principles and rules in the process of conducting PRA work in the proposed subprojects assigned to them:

- Make your objectives and activities clear to relevant officials, local leaders, and other stakeholders. Ensure that they fully understand these and also their role in the PRA.
- Establish rapport with the local people/stakeholders and gain their confidence. Help them understand their role in the PRA.
- Do not raise any expectations or make any promises
- You are a facilitator, facilitating investigation, analysis, and learning by the local people themselves.
- Seek out representatives from all stakeholders' groups of various occupations, social status and gender. Involve both men and women. Do not rush and overlook other stakeholders especially the poor and disadvantaged.
- Do not be biased and never interpret the data. Write-up and present the information as you have gathered it specifically on the stakeholders; proposed solutions to their water related problems and impacts of proposed subproject on social, agricultural, fishery and other environmental aspects.
- Gather all information indicated in the PRA Guidelines as comprehensively as possible.
- Work as a team.

1.9 Undertaking Selected PRA Tools

1.9.1 Time Line or Historical Mapping

51. **Objective** of the Tool is to find out significant water resource development interventions in the subproject area.

52. **Steps** to be followed in applying the Tool and achieve the objective are:

a. Discuss with the participating stakeholders the purpose of the activity. Start by asking about the significant water resource development events they could remember that have been initiated which benefited or affected them or their community/area. The interventions may take the form of water resource structures/facilities such as regulator, khal that may or may not be located within the proposed subproject area.

b. Take note of the year when the intervention was initiated and who initiated it. Ask questions that would draw out significant water resource development events in the community. Example of questions, are as follows:

   - When was the first water resource system/structure constructed which benefited or affected their community? In which year(s) were these built? What were the structures constructed, where are these located and who built these?

- Aside from this water resource system/structure, were there other water resource development interventions in the area e.g. fishponds? Who initiated the assistance and what year(s) these were built?
- For each water resource structure/facility, what is the present condition and usage?

c. Plot the events on a timeline (yearly basis)

Year	Water Development Intervention/Structure/Facility	Who Built?	Status/Usage

d. Summarize the discussion.

1.9.2 Reconnaissance / Walk Through and Resource / Physical Mapping

53. **Objective** of the Tool is to enable the participants to collect information like land use, existing physical infrastructure facilities and other resources of the subproject area through direct observation and discussion while walking and draw a resource/physical map after the walk.

54. **Steps** to be followed in applying the Tool and achieve the objective are:

a. The team may divide the whole subproject area among them and organize a group of stakeholders who will undergo the walk through with the team. They may divide it based on the number of villages. It is important that each group discusses and agrees on the approximate route to be taken.

b. The group will then walk and observe from one end of the route to another end taking notes of/documenting the following data:

- rivers, khals, beels, ponds and other water bodies
- all structures and facilities affecting water (roads, embankments, gates, bridges, etc.) and other facilities e.g. schools, clinics, markets, etc.
- settlements (villages, unions and households)
- inundated, flooded, water logged, and irrigated areas
- wetlands, forest, natural or planted vegetation, if any

c. After the walk through, each group will choose an appropriate place and medium for drawing the physical/resource map. They may choose from the following:

- ground (using sticks, stones, sawdust, etc)
- floor or flat surface (using chalk, stones, sticks)
- poster paper (using pens, colored chalks or crayons)

d. Work on one item at a time like finishing the land resources first before water resources.

e. Observe how things are taking place. If some things are left out/forgotten, ask the group members about it. Encourage corrections and/or additions.

f. The team will re-draw the whole map for the subproject area on paper if it was drawn on the ground or the floor.

1.9.3 Social Mapping

55. **Objective** of the Tool is that at the end of the activity the participants will be able to show information about the social structure of the subproject area, about the local stakeholders' groups and potential project affected people, location of homesteads, different streets/paras, institutions (schools, mosques, clinics, etc.),

56. **Steps** to be followed in applying the Tool and achieve the objective are:

a. Explain the purpose of the activity. Using the outline of the physical/resource map explain what data are needed to be shown on the map, as follows:

- location of farming and fishing households, landless households and other occupational groups
- location of institutions, organizations/groups
- potential project affected groups (e.g. households to be affected if fish production is reduced, land/areas for possible acquisition, etc.)

b. Choose an appropriate place and medium like:

- ground (using sticks, stones, sawdust, etc)
- floor or flat surface (using chalk, stones, sticks)
- poster paper (using pens, colored chalks or crayons)

c. Copy the map on paper, especially if it was done on the ground or on the floor.

1.9.4 Focus Group Discussion (FGD)

57. **Objective** of the Tool is that at the end of the activity the participants will be able to discuss a number of water related topics e.g. history of water related interventions, fishery aspects, environmental issues/impacts, problems/issues and possible solutions to the issues identified, etc.

58. **Practical Guidelines** to follow in conducting FGD are as below:

a. It should be held with a small group of people who share common interests, concerns, occupations, social class, and other characteristics. Examples: small to medium women or men-farmers, genuine men or women fisher folks, etc.

b. Keep the group small. Although it is possible to have as few as four or as many as 12 participants, the 7-10 range is generally the most successful.

c. There should be a facilitator- the person who guides the discussion, and in addition, another member of the team should be present to take notes on the discussion.

d. Make sure the members of the focus group know what are expected of them during the session. Orienting the participants about the objectives of the discussion will enable them to search their memories for the recall of perceptions and experiences relevant to the topics or issues to be discussed.

e. Be familiar with the guide questions/topics or issue for discussion.

f. Avoid marathon sessions. The length of the FGD depends largely on the number of topics/issues to be discussed and the size of the group. But it is generally advisable to keep the session within a period of 1-2 hours to avoid physical strain or exhaustion among the participants

1.9.5 Semi-Structured Interviews

59. **Objective:** This is a method that allows for a natural free-flowing conversation and does not involve a formal questionnaire, but instead makes use of a flexible interview guide or checklist of topics or issues to help ensure that the interviews stay focused on the relevant issues/topics. It can be used to probe on certain issues/topics with individuals or with members of a household. At the end of this activity, information on a checklist of topics/issues had been gathered in detail.

60. **Practical Guidelines** to follow in conducting Semi-Structured Interviews are as below:

a. Identify and list the issues/topics which you will gather using this method. Think also of ways on how to probe for details, like coming up with probing questions.

b. Identify and list down the individuals/key informants or households you will involve in this activity based on the information to be gathered.

c. Be familiar with the checklist of topics or issues for discussion to avoid looking at it from to time to time during the interview that may distract the informants and the process.

d. Avoid marathon sessions. The length of the semi-structured depends largely on the number of topics/issues to be discussed. But it is generally advisable to keep the session within a period of one hour for individual interviews and no longer than 2 hours for household interviews to avoid physical strain or exhaustion among the participants.

1.10 Final PRA Report: Submission and Approval

61. When the fieldwork is completed, the findings of the PRA are summarized in a Draft Final Report using the specified standard Table of Contents (see ***Exhibit G3-H***). The report should give comprehensive and reliable information, which would allow a proper assessment of the social and environmental feasibility of the proposed subproject.

62. When the PRA Team has completed its Draft Final Report, it will be submitted to the PMO. The PMO-Project Consultants will review the report and, if any revision/modification is considered necessary, the PRA Team will do that and re-submit the Final PRA Report. The Final PRA Report will, upon recommendation from the PMO-Project Consultants, be approved by the IWRMU (P&D Section), LGED.

63. Following approval of the Final PRA Report by IWRMU, LGED, PMO will instruct the Consultant Firm to proceed with Feasibility Study and IEE/EIA of the subproject.

SUPERVISION AND MONITORING OF PRA ACTIVITY

64. After each day of fieldwork, the team members will hold a meeting to crosscheck findings/information gathered. This is crucial as it is one of the important methods for ensuring correct and reliable information. Quite often, the team identifies information or areas that will need further checking, which is then done by varying the people interviewed, the location of the interview or the tools used. This technique is known as “triangulation” and is one of the major ways in which quality of information is ensured.

65. The IWRMU (P&D Section) and Project Consultants will be closely supervising and monitoring the PRA activity through LGED field offices which will be strengthened by placing necessary project staff. They will undertake field supervision. All submitted PRA reports will be studied and evaluated by the PMO- Project Consultants Team. Observations and recommendations for PRA improvement will be immediately forwarded to concerned PRA Team Leader / Team members and management of concerned Firm if necessary and these will be consolidated and written-up for use in follow-up training with the PRA teams.

66. Poor performance by a team member or the PRA team as a whole will be discussed immediately with management of the Firm concerned for proper action.

67. Regular review meetings/courses with the Team Leaders and/or Team members will be initiated to discuss progress of work and issues that need to be addressed. In addition, the Team members may be requested for meetings time to time to discuss comments and suggestions for improvement and/or completion of specific report submitted, if and when necessary.

EXHIBITS

EXHIBIT G3-A: FORM G3-A (WR)

Report on PRA Engineering Findings

Proposed Subproject: …………………………………………………………………………….……..

District: ………… Upazila: ………… Union: ………………Villages: …...………………………..

*[The Water Resources Engineer will ensure (a) obtaining all information necessary, may be beyond the structure of this Form, to make the engineering report comprehensive, and (b) obtaining information from all villages (small contiguous scattered homesteads can be grouped like a village) inside / outside subproject area, according to the outline given in **Section 3.3** of the Document **G3 Participatory Rural Appraisal of Subprojects.** Use back of the Form if space is necessary]*

1. Describe the subproject area and people – names of villages with populations, number of households including benefitted households and gross and benefit areas by marking on the subproject/physical map.
   Notes:………………………………………………………………………………………
   ………………………………………………………………………………………………..
2. Explain concept plans of original subproject proposal and of the reconnaissance team and describe stakeholder opinions including additions/changes/dropping of interventions, if any.
   Notes:………………………………………………………………………………………
   ………………………………………………………………………………………………..
3. Describe the history of water related interventions (hydraulic structures, khal re-excavations, embankment, roads, etc.) Particularly mention details of BWDB interventions inside and outside (vicinity) of subproject area.
   Notes:………………………………………………………………………………………
   ………………………………………………………………………………………………..
4. Indicate on the map (subproject/physical map) using arrows the directions of flood flows and drainage flows.
   Notes:………………………………………………………………………………………
   ………………………………………………………………………………………………..
5. Indicate on the map (subproject/physical map) by shading, flood inundated areas and waterlogged areas, and in the report itself give dates and depth of inundation.
   Notes:………………………………………………………………………………………
   ………………………………………………………………………………………………..
6. How often is the area flooded (once every 1,2,3,4,5 or more years), what is the source of the flooding, depth of flooding and what is the highest flood level (local mark)?
   Notes:………………………………………………………………………………………
   ………………………………………………………………………………………………..
7. In case of a proposed water conservation project, check if there is a potential water sharing issue between upstream/downstream areas/users..
   Notes:………………………………………………………………………………………
   ………………………………………………………………………………………………..
8. If the proposed subproject is implemented, what will be the impacts on the water environment?
   Notes:………………………………………………………………………………………
   ………………………………………………………………………………………………..

Exhibit G3-A

Stakeholders Involved in PRA Activities (Engineering)

Sl. No.	Name	Village	Gender	Occupation	Signature	Date
Activity-1: (Transect Walk/FGD/Interview/Others)			Location-1 of Activity (place/village): …………………………………			
			Location-2 of Activity (place/village): …………………………………			
Activity-2 (Transect Walk/FGD/Interview/Others)			Location-1 of Activity (place/village): …………………………………			
			Location-2 of Activity (place/village): …………………………………			

EXHIBIT G3-B: FORM G3-B (AGRI)

Report on PRA Agriculture Findings

Proposed Subproject: ……

District: ……………… Upazila: ………… ……… Union: ……………………… Villages: ....

*[The Agriculturist will ensure (a) obtaining all information necessary, may be beyond the structure of this Form, to make the agriculture report comprehensively representing the whole subproject area, and (b) obtaining information from all the concerned villages (2 or more small villages may be grouped) inside subproject area, according to the outline given in **Section III D (2)** of the Document **G3 PRA of SSWRDP Subprojects.** Use back of the Form if space is necessary]*

1. Land Types

Land Types	Area (hectare)	Major Crops			Major Limitations to Crop Production (Late planting, crop damage, use of local variety, low yield, low productivity, etc.)	Average Cost of Land (Tk/ha)
		Kharif 1	Kharif 2	Rabi		
Drainage free						
Flood free						
<u>Irrigated</u>: Full Supplement						
<u>Flooded</u>: Shallow Moderate Deep Very Deep						
Poor drainage						
Drought						
Unirrigated						

2. Flood Related Crop Production Limitations

Flood Characteristics (circle types)	Flash flood/ Seasonal flood/ Local rainfall Shallow/ Moderately deep/ Deep/Very deep
Average number of floods per year	
Period of floods; (month –to - month)	
Yield loss per crop	Name of Crop ___________________ loss: _________ kg/ha or % Name of Crop ___________________ loss: _________ kg/ha or %
Farmers' suggestions on how to protect crop from flood damage	

3. Water Logging Related Crop Production Limitation

Drainage pattern (circle applicable one)	Slow / Delayed / Late Pre-monsoon / Monsoon / Post-monsoon
Type of land where water logging occurs (circle applicable one)	High / Medium High / Medium Low / Low / Very Low
Period of water logging; from-to (month)	
Yield loss per crop	Name of Crop _________________ loss: ___________ kg/ha or % Name of Crop _________________ loss: ___________ kg/ha or %
Farmers' suggestions for improvement *(Categorise suggestions coming from highland, medium land, low land and farmers)*	

4. Drought Related Crop Production Limitations

Characteristics of drought	Extensive / Short / Before rainy season / After rainy season / Before dry season / After dry season
Period of drought (months/season)	
Type of land affected by drought	High / Medium High / Medium Low / Low / Very Low
Area of land affected by drought (ha)	
Yield loss per crop	Name of Crop ______________ loss: ___________ kg/ha or % Name of Crop ______________ loss: ___________ kg/ha or %
Farmers' suggestions on how to protect crop from drought	

5. Expected Impact of Subproject on Crop Production

Reduce crop damage (name of crop and area)	
Increase in area under modern variety (name of crop and area)	
Increase in crop area (name of crop and area)	
Change in cropping patterns (specify cropping patterns)	
Increase in crop yield (name of crop and yield increase in percent)	
Others	
No impact	

Exhibit G3-B

Stakeholders Involved in PRA Activities (Agriculture)

Sl. No.	Name	Village	Gender	Occupation	Signature	Date
Activity-1: (Transect Walk/FGD/Interview/Others)			Location-1 of Activity (place/village): ……………………………………………….			
			Location-2 of Activity (place/village): …………………………………………………….			
Activity-2: (Transect Walk/FGD/Interview/Others)			Location-1 of Activity (place/village): ……………………………………………….			
			Location-2 of Activity (place/village): …………………………………………………….			
Activity-3: (Transect Walk/FGD/Interview/Others)			Location-1 of Activity (place/village): ……………………………………………….			
			Location-2 of Activity (place/village): …………………………………………………….			

EXHIBIT G3-C: FORM G3-C (FISH)

Report on PRA Fisheries Findings

Proposed Subproject: ………

District: ……………… Upazila: ………… ……… Union: ……………………… Villages: ....

*[The Fisheries Specialist will ensure (a) obtaining all information necessary, may be beyond the structure of this Form, to make the agriculture report comprehensively representing the whole subproject area, and (b) obtaining information from all the concerned villages (2 or more small villages may be grouped) inside subproject area, according to the outline given in **Section III D (3)** of the Document **G3 PRA of SSWRDP Subprojects.** Use back of the Form if space is necessary]*

1. Fisheries Resource Base and Production

Type of Water Body	Total Area (Hectare)	Khas Area (Hectare)	Tidal Effect (Yes/No)	Annual Production (Kg)			
				Fish	Galda	Bagda	Total
A. Seasonal Water Body (0.5 m water for 4 months)							
☐ Floodplain Ricefields							
☐ Pond, Dighi, Ditch							
☐ Khal							
☐ Beel							
☐ Borrow pit							
Sub-Total							
B. Perennial Water Body (0.8 m water year round)							
☐ Pond, Dighi, Ditch							
☐ Khal							
☐ Beel							
☐ Baor							

☐ River, Haor							
Sub-Total							
Total (Sub-total A + B)							

2. **Fish Migration Routes** (for in and out migration of fish to and from the subproject area. indicate on the map)

Name of the Channel/Khal	Period of Major Migration					
	Early Monsoon		Middle Monsoon		Late Monsoon	
	In	Out	In	Out	In	Out
a.						
b.						
c.						

3. **Fishing Communities**

Type of Household (HH)	Total HHs	Female Headed HHs
a. Genuine/Ethnic Fisher		
b. Subsistence Fisher/ Part time Fisher		
c. Genuine Fish Farmer		
d. Subsistence Fish Farmer/ Part time Fish Farmer		

4. **Involvement of women in fisheries activities**

Fisheries Activities	Number
Feeding fish	
Pond culture	
Fish nursery	

Others:	
•	
•	
•	

5. **Expected Impact of Proposed Subproject Interventions on Fisheries** (*Male and female responses to be segregated if significantly different*)

Expected Impact	Suggested Mitigating Measures
Reduction of fish habitat (area, depth of water, period of inundation)	
Reduction in the entry of brood fish and fish seeds	
Reduction in fish production	
Reduction in the inflow of water	
Reduction in community consumption of fish	
Deterioration of livelihood condition of fisher folks	
Others:	
•	
•	
•	

Exhibit G3-C

Stakeholders Involved in PRA Activities (Fisheries)

Sl. No.	Name	Village	Gender	Occupation	Signature	Date
Activity-1: (Transect Walk/FGD/Interview/Others)			Location-1 of Activity (place/village): …………………………………………………			
			Location-2 of Activity (place/village): …………………………………………………			
Activity-2: (Transect Walk/FGD/Interview/Others)			Location-1 of Activity (place/village): …………………………………………………			
			Location-2 of Activity (place/village): …………………………………………………			

EXHIBIT G3-D: FORM G-3-D (ENV)

Report on PRA Environmental Findings

Proposed Subproject: ________________________ Union(s): __________________ Upazila: ___________ District:__________
Villages/Moujas (Study Areas): ____

[The Enironment Specialist will ensure (a) obtaining all information necessary, may be beyond the structure of this Form, to make the agriculture report comprehensively representing the whole subproject area, and (b) obtaining information from all the concerned villages (2 or more small villages may be grouped) inside subproject area, according to the outline given in ***Section III D (4)*** *of the Document* ***G3 PRA of SSWRDP Subprojects.*** *Use back of the Form if space is necessary]*

1. Is there any conserved wetland like Tanguar Haor or conserved forest like Sundarban in the proposed subproject area? If so, give details and show location on the map.
   ……
   ……

2. Is there any historical/archaeological site, which may be threatened or may have to be demolished for subproject construction? If so, indicate in the map and give details.
   ……
   ……..

3. Indicate on the map and give names of the water bodies which may be drained partially or completely if the proposed subproject is implemented

Water bodies not affected by proposed subproject	
Water bodies partially drained by proposed subproject	
Water bodies completely drained by proposed subproject	

4. Land Acquisition Issue and/or Agricultural Land Loss. Mention here the type and approximate area of land to be acquired/lost as well as the number of households likely to be affected, if any. Also mention mitigation demand by affected households.

Type and Approximate Area of Land (in hectare)	Number of Affected Households	Mitigation Demands from Affected Households

5. Indicate on the map and give names and the number of boats passing through khals/rivers/channels, which may be closed with a structure if the subproject is implemented.

Average number and types of boats passing proposed structure site per day

Site/Khal Name	Pre-monsoon	Monsoon	Post-monsoon

6. Indicate on the map and provide names of villages/areas outside the subproject boundary, which may experience higher risk of flooding if the subproject is implemented.

……

…….

7. Types and amount of chemical fertilizer and pesticides presently used by farmers

Crop	Name of Fertilizer and Pesticide	Amount Used per Acre

8. Will the subproject construction require destruction of natural or planted vegetation? If so, give detail.
……

9. Give the approximate percentage of people in favor and/or against the proposed subproject …………………………………

10. Expected environmental impacts and possible mitigation measures if proposed subproject is implemented

Type of Intervention	Expected Impacts and Affected People		Possible Mitigation Measures
	Positive	Negative	
Khal re-excavation			
Construction of WRS, Sluices, Regulators			
Embankments constn.			
Other interventions			

11. Summary Table of Project Affected People (PAP)

Sl.	Type of Stakeholder Group Affected	Number of PAPs	Negative Impacts	Mitigation Measures
1.				
2.				

Note 1: If new impact issues other than those described above are identified during field visits and discussions with sub-project beneficiaries, affected groups and other stakeholders, these issues are to be recorded in separate sheets along with mitigation options suggested by them.

Note 2: If any environmental impact has serious adverse effects as per assessment of the beneficiaries, affected groups and other stakeholders, the PRA Team should recommend a detailed field investigation and should indicate this in its overall conclusions.

Stakeholders Involved in PRA Activities (Environment)

Sl. No.	Name	Village	Gender	Occupation	Signature	Date
Activity-1: (Transect Walk/FGD/Interview/Others)			Location-1 of Activity (place/village): …………………………………………………			
			Location-2 of Activity (place/village): …………………………………………………			
Activity-2: (Transect Walk/FGD/Interview/Others)			Location-1 of Activity (place/village): …………………………………………………			
			Location-2 of Activity (place/village): …………………………………………………			
Activity-3: (Transect Walk/FGD/Interview/Others)			Location-1 of Activity (place/village): …………………………………………………			

EXHIBIT G3-E: FORM G3-E (SOC)

Report on PRA Social Findings

Proposed Subproject: ________________________ Union(s): __________________ Upazila: __________ District:_________
Villages/Moujas (Study Areas): ____
Name and Designation of Surveyor(s):……………………………………………………………………… Date of Survey: …………………..

[The Sociologist will ensure (a) obtaining all information necessary, may be beyond the structure of this Form, to make the agriculture report comprehensively representing the whole subproject area, and (b) obtaining information from all the concerned villages (2 or more small villages may be grouped) inside subproject area, according to the outline given in ***Section III D (5)*** *of the Document* ***G3 PRA of SSWRDP Subprojects.*** *Use back of the Form if space is necessary]*

Table 5.1.1(a): Inventory of Villages

No.	Village Name	Union	No. Households	Total Population	Date(s) Visited
Villages inside the subproject area					
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					
Villages outside the subproject area					
1.					
2.					
3.					
4.					
5.					
6.					

Table 5.1.1 (b): Farm Size Distribution and Household Occupation of Villages Inside Subproject

Village Names		1.	2.	3.	Totals
5.2.1	People interviewed (groups)	Number of Males:__ Number Females:__ Total:_____	Number of Males:__ Number Females:__ Total:_____	Number of Males:__ Number Females:__ Total:_____	Number of Males:__ Number Females:__ Total:______
5.2.2	Total number of HH in village				
5.2.3	In this village, number of a) Households entirely depending on agricultural production for income (Farm) b) Households with farm and other occupations (mixed Farm/non-Farm) c) Households entirely dependent on non-farm occupations (Non-Farm)				
5.2.4	a) Is most of the land owned by a few households? b) What (estimated) percentage of land is operated by landless sharecropper, marginal & small owner?				
5.2.5	Who owns / lease water bodies in side subproject, if there is/are any?				

Village Names		1.		2.		3.		Totals	
	Farm Landholdings	No.	%	No.	%	No.	%	No.	%
5.2.6	Landless/functionally landless: < 0.2 ha (< 50 decimal)								
5.2.7	Marginal farmer: 0.2 – 0.5 ha (50 to 125 decimal)								
5.2.8	Small-holder: 0.5 – 1 ha (126 to 250 decimal)								
5.2.9	Medium-size holder: 1 - 2 ha (251 to 500 decimal)								
5.2.10	Large-size holder: > 2 ha (more than 501 decimal)								
	Farmers: Total								
	Primary Occupation / Income Source of HH	No.	%	No.	%	No.	%	No.	%
5.2.11	Daily-paid Agricultural Labor								
5.2.12	Other daily-paid work: Laborers, Household Maids, Earth Workers								
5.2.13	Traditional Fisher (fishing in rivers or beels etc.)								
5.2.14	Agricultural Farming								
5.2.15	Poultry, fisheries, dairy								
5.2.16	Medium-Large Business, Trade, Transport, Boat owners								
5.2.17	Small-scale Business, Trade								
5.2.18	Transport (Rickshaw/Van puller), Boatmen								
5.2.19	Others (In Service, Retired, Foreign Remittances)								
5.2.20	Unemployed								

Village Names		1.		2.		3.		Totals	
	Primary Occupations: Total								
5.2.21	What is the average agricultural day labour wage in peak period ?	Male…….. Fem………		Male….. Fem……..		Male……..Fem…….			
5.2.22	What is the average agricultural day labour wage in lean period?	Male…….. Fem………		Male….. Fem……..		Male……..Fem…….			

	In/Out Migration	No.	% of total	No.	%	No.	%	No.	%
5.2.23	How many men migrate-**out** for work during some part of the year?								
5.2.24	How many men migrate-**in** for work during some part of the year?								
5.2.25	Do any women migrate-out for work?								

	Household Economic Status Information				
5.2.26	How many households depend entirely on agricultural/day labor for income?				
5.2.27	How many poor women in this village are earning income or seeking work?				
5.2.28	How many poor female-headed households are there in the village?				
5.2.29	What is the normal payment for a woman doing household labor?	Amount: Per (day/week/month):	Amount: Per (day/week/month):	Amount: Per (day/week/month):	Amount: Per (day/week/month):
5.2.30	What is the normal payment for a woman doing earth works?	Amount: Per (day/week/month):	Amount: Per (day/week/month):	Amount: Per (day/week/month):	Amount: Per (day/week/month):

Village Name		1.		2.		3.		Total	
		Number	%	**Number**	**%**	**Number**	**%**	**Number**	**%**
5.2.31	How many households under poverty line income are there in this village? [Poverty line income = Tk........../.......	Number:		Number:		Number:		Number:	
5.2.32	How many of these poor households send their children to school?								

Table 5.1.2(a): Problems and Solutions Identified by Stakeholders (Male)

Stakeholder Group	**No. of Individuals Consulted**	**Stakeholders' Response/Comments**	
		Present Problems (highest and second highest priority)	**Proposed Solutions (for each problem mentioned)**
Landless (operating less than 0.5 acres). Livelihood mainly depends on manual labor.			
Small and Marginal Farmers (operating <2.5 acres)			
Medium-Large Farmers (operating 2.5 or more acres)			
Fishers and Boatmen			
Service holders and others			

Table 5.1.2(b): Problems and Solutions Identified by Stakeholders (Female)

Stakeholder Group	No. of Individuals Consulted	Stakeholders' Response/Comments	
		Present Problems (highest and second highest priority)	**Proposed Solutions (for each problem mentioned)**
Landless (operating less than 0.5 acres) Livelihood mainly depends on manual labor.			
Small and Marginal Farmers (operating <2.5 acres)			
Medium-Large Farmers (operating 2.5 or more acres)			
Fishers and boatmen			
Service Holders & Others			

Table 5.1.2(c): Expected impact and reaction to the proposed subproject by stakeholders

Stakeholder Group	No. of Individuals Consulted	Male Response	Female Response
Landless (operating less than 0.5 acres) Livelihood mainly depends on manual labor.			
Small and Marginal Farmers (operating <2.5 acres)			
Medium-Large Farmers (operating 2.5 or more acres)			
Fishers and Boatmen			
Service holders and Others			

Table 5.1.3(a): Problems and Solutions Identified by Indigenous People

Indigenous Groups	No. of Individuals Consulted	Stakeholders' Response/Comments	
		Present Problems (highest and second highest priority)	Proposed Solutions (for each problem mentioned)

Table 5.1.3(b): Expected impact and reaction to the proposed subproject by Indigenous People

Indigenous Groups	No. of Individuals Consulted	Male Response	Female Response

Table 5.1.4: History of cooperation among the people in the subproject area:. Whether or not they have implemented any project/program (e.g. water resource, health and sanitation, etc.) using mainly their own resources. Or if they have contributed their resources (money, labor) to any government/private projects or programs. Give details

Table 5.1.5: Major social conflicts in the area (within last 3 years)

Nature of Conflict (describe)	People/Groups Involved	Describe how it was resolved	Not yet resolved
a.			
b.			

EXHIBIT G3-F: FORM G3-F (WOM)

Report on PRA Women Aspects Findings

Proposed Subproject: ________________________ Union(s): __________________ Upazila: __________ District:_________

Villages/Moujas (Study Areas): ____

[The GAD Specialist will ensure (a) obtaining all information necessary, may be beyond the structure of this Form, to make the agriculture report comprehensively representing the whole subproject area, and (b) obtaining information from all the concerned villages (2 or more small villages may be grouped) inside subproject area, according to the outline given in ***Section III D (6)*** *of the Document* ***G3 PRA of SSWRDP Subprojects.*** *Use back of the Form if space is necessary]*

Table 5.2.1: Non-Water Related Problems and Solutions Identified by Women

Women (Based on land ownership)	**Population**		**No. of Individuals Consulted**	**Stakeholders' Response/Comments**	
	No.	%		**Present Problems**	**Proposed Solutions (for each problem mentioned)**
Poor and landless and destitute					
Marginal and small					
Middle					
Big/Large					
TOTAL					

Number and Percentage of Women Headed Households: ______________________

Table 5.2.2: Activities and Workload and Source of Livelihood

Table 5.2.3: Mobility Status

Stakeholders Involved in PRA Activities (Social & Women)

Sl. No.	Name	Village	Gender	Occupation	Signature	Date
Activity-1: (Transect Walk/FGD/Interview/Others)			Location-1 of Activity (place/village): ………………………………………………..			
			Location-2 of Activity (place/village): ………………………………………………..			
Activity-2: (Transect Walk/FGD/Interview/Others)			Location-1 of Activity (place/village): ………………………………………………..			
			Location-2 of Activity (place/village): ………………………………………………..			
Activity-3: (Transect Walk/FGD/Interview/Others)			Location-1 of Activity (place/village): ………………………………………………..			

EXHIBIT G3-G: FORM (PRA TEAM)

Report on Overall Conclusion of PRA Team

Proposed Subproject: ________________________ Union(s): _________________ Upazila: ___________ District: ___________

1. Is there broad, popular support for the proposed subproject? (Quantify in percentage)
   ………
   ………

2. Is there any opposition to the proposed subproject, and if so, by whom, why and how many (number and %) people are against it?
   ………
   ………

3. Is the proposed subproject technically feasible? ……………………………………………………………………………………

4. What are the likely environmental impacts and what possible measures can be taken to mitigate negative impacts?
   ………
   ………

5. Are the beneficiaries willing to pay the first year's operation and maintenance cost (3% of earthwork, 1.5% of structures) before start of construction, form a Water Management Association, assist in land acquisition activity, and take full responsibility for operation and maintenance?
   ………

Date: ____________________

Names and Signature of PRA Team Members

____________________ ____________________ ____________________ ____________________ ____________________
(PRA Team Leader) (…………………………..) (……………………………) (………………………..) (…………………………)

EXHIBIT G3-H: FORM (TOC OF PRA REPORT)

TABLE OF CONTENTS OF PRA REPORT

* One page for Executive Summary with one paragraph summarizing each of the 6 chapters. One page for Introduction to include when work order was issued, when team actually started PRA work, when debriefing session with stakeholders, XEN and UE was conducted and the PRA methods and tools used for the study.

5.1.9 Description of existing organizations/groups 5.1.10 Indigenous Peoples/Groups	
5.2. Women Aspect 5.2.1 Demographic Data 5.2.2 Non-Water Related Problems and Needs 5.2.3 Activities, Workload and Source of Livelihood 5.2.4 Mobility Status	1-2
6.a PRA Team's Overall Conclusions 6.1 Is there broad popular support for the proposed subproject? 6.2 Is there any opposition to the proposed subproject 6.3 Is the proposed subproject socially feasible? 6.4 Are there negative environmental impacts and if so, how can they be mitigated? 6.5 Are the beneficiaries willing to form into a Water Management Cooperative Association, pay O&M contribution, assist in land acquisition and completely assume O&M responsibility? 6.b PRA Team's Analysis and Recommendations	1-2
Appendices (filled-out forms) As available	
Maps (physical/subproject map, resource map, social map, fishery and agricultural map	5

===

Attachment II-10

Guidelines for Small Scale Water Resources Development Project

G4 Feasibility Study of Subproject

Local Government Engineering Department

Local Government Division
Ministry of Local Government, Rural Development and Cooperatives
Government of the People's Republic of Bangladesh

Guidelines for

Small Scale Water Resources Development Project

G4 Feasibility Study of Subproject

October 2017

TABLE OF CONTENTS

Document Architecture of the New Set of Guidelines for SSWRD Project

[Small Scale Water Resources Development (SSWRD) means, from physical points of view, implementing appropriate water management subprojects of small sizes, not exceeding 1000 hectare benefit area by the current definition, to resolve existing water management constraints to agriculture that in turn enhance rural employment leading to reduction of rural poverty. Implementation of SSWR subprojects involve long process from proposal of a subproject from Local Government bodies (Union Parishad and Upazila Parishad) to its final selection, study of feasibility from different considerations (social, environmental, technical, economical), preparing detail design and costing, constructing required physical works to standard quality and finally its operation and maintenance by its beneficiaries. The process has multiple facets too. It needs to be comprehensively beneficiaries' and other stakeholders' participatory, acceptable to people of widely varying social and socio-economic conditions, friendly to the surrounding environment, etc. Thus, Guidelines for SSWR Development is, of necessity, complex.

The long and complex process has been divided into major distinguishable steps and separate Guidelines for works and activities involved in those major steps have been developed. Environmental study applies to the subproject as whole and is of different nature. So, Guidelines for Environmental Assessment is made a separate document. Following this principle, the Ten (10) Guidelines with Alpha-numeric ID Numbers and Names as below constitute the Documentation of Guidelines for SSWR Development.

This list will appear in all the individual Guideline Documents with highlight of the current Document name for the user to refer when necessary]

The List of New Set of Guidelines for SSWRD Project

G1	Policy and Development Process
G2	Identification of Subprojects
G3	Participatory Rural Appraisal of Subproject
G4	Feasibility Study of Subproject
G5	Environmental Assessment of Subproject
G6	Detail Design of Subproject Structure
G7	Construction of Subproject Structure
G8	Operation and Maintenance
G9	Monitoring and Evaluation
G10	Integrated Rural Development Plan between SSWR and Rural Road/Market

AMENDMENT AND UPGRADATION RECORDS

This document "**Guidelines for SSWR Development: G4 Feasibility Study of Subprojects"** has been issued following amendments and up-gradations as outlined below:

Revision	Description	Date
	Guidelines for the Participatory Process in Small-scale Water Resources Development, initially developed for ADB-supported SSWRDSP (1995-2002) guided feasibility study and design of SSWR subprojects of the two ADB-supported Projects - SSWRDSP (1995-2002) and SSWRDSP-2 (2002-2009).	April 1999 March 2006
A	The above Guidelines document of ADB Project was updated and adapted as "Planning and Design Guidelines: Methodology and Common Subproject Components (updated 2009)" for feasibility study and design of the JICA-supported SSWRDP (2009-20015). The ADB-supported PSSWRDSP (2010-2017) also used a similar Guidelines document. .	May 2009
B	SSWR Development Strategy, Processes and Support (draft) – proposed introduction of variations to development process for three categories of subprojects : (i) without water flow regulation; (ii) with water flow regulation; and (iii) performance enhancement.	December 2013
C	The SSWR Development Strategy, Processes and Support (draft) document was revised and upgraded following consultation with relevant professional specialists and the Detailed Subproject Development Process was firmed up in a series of meetings in IWRM Unit chaired by Addl CE (IWRM), LGED in Nov-Dec, 2014. Provisions of the upgraded Subproject Development Process were used in the ongoing JICA-assisted SSWRDP (2009-2015) but the document Planning and Design Guidelines (2009) was not updated for being towards the end of the project period.	January 2015
D	This "**Guidelines for SSWR Development: G4 Feasibility Study of Subprojects**" is the ***Fourth*** Document of the Series of Guidelines for SSWR Development finalized and approved by a Working Group of LGED Professionals with proven experience in SSWR development with assistance from Specialist WR Development Consultants under a JICA-LGED Technical Co-operation Project. The Document builds on the guidelines for preparing feasibility study contained in the "Subproject Planning and Design Guidelines (May 2009)" (excluding the *Detail Engineering Design* part for which a separate document has been prepared) and the "SSWR Development Strategy, Processes and Support (revised draft, January 2015)" together with incorporation of improved methods and techniques and lessons learned over the time.	August 2017

GLOSSARY

Aman	Rice grown during the wet season (Kharif), and harvested late (Nov-December). Yields: (i) Broadcast, deep water 1.5t/ha; (ii) Transplanted, local variety 2.2t/ha; (iii) Transplanted, high yielding variety, 3.25t/ha
Aus	Rice grown during the wet season (Kharif), and harvested early (July-August). Yields: (i) Broadcast 1.25t/ha; (ii) Transplanted, high yielding variety, 2.5t/ha
Beel	Saucer shaped low-lying area with pond of static water as opposed to moving water in rivers and canals.
Boro	Irrigated rice grown in the early dry season (Rabi). Transplanted in December-January and harvested in April-May. Yield: Transplanted, high yielding variety, 4.25t/ha
District	Second administrative unit of the government comprising 6-9 Upazilas. There are 64 districts in Bangladesh.
Haor	Haor is a wetland ecosystem in the north eastern part of Bangladesh. Physically a bowl or saucer shaped shallow depression, also known as a back-swamp
Integrated Water Resources Management Unit	Unit comprising two sections: (i) planning & design, and (ii) operation & maintenance, with a mandate to guide LGED's activities in the water sector with specific responsibility to assist in enunciation of policies, formulation of strategies and plans, preparation of new projects, inter-agency coordination and with external agencies, undertake studies and to provide long term support to the completed projects
Khal	Natural or man-made water channel (canal)
Kharif	Wet (monsoon) season
Local Stakeholder	Local Stakeholders are inhabitants of an area directly or indirectly affected by water management, be it as beneficiaries or as "project affected people".
Project Affected People	People negatively impacted by investment in water management projects and / or subprojects or by the manner in which water regulating infrastructure is managed.
Project Consultants	Project implementation consultants working with the PMO
Project Management Office	A unit comprising LGED staff appointed to manage implementation of a Project
Rabi	Dry / winter cropping season (November to March)
Stakeholder Groups	Stakeholder groups are collections of individuals who have similar interests concerning water. Among others, such stakeholder groups are men and women, farmers (low, medium low, medium high and high land farmers), fishers, boatmen, landless, elected representatives, LGED employees, BWDB employees, employees of other government departments, contractors, consultants, and development partners.
Union	Subdivision of Upazila and the lowest governance institution in the country. There are 4,889 Unions in Bangladesh.
Union Parishad	Local government institution at Union level. The Union Parishad consists of an elected council & chairman, and is the oldest government institution in Bangladesh
Upazila	Administrative unit, sub-division of District and lowest administrative tier of the government. In all, there are 482 Upazilas in Bangladesh.
Upazila Parishad	2nd tier of local government institution at Upazila. According to the Upazila Parishad Act 2009, Upazila Parishad consists one elected Chairman and two Vice-chairmen, Chairmen of UPs and Mayor of Municipality within each Upazila including representatives from line agencies with an Upazila Nirbhai Officer as the Secretary. The election of the Upazila Parishad was held on 22 January 2009. Upazila Parishad runs the local administration.

ABBREVIATIONS AND ACRONYMS

ADB	Asian Development Bank
AE	Assistant Engineer
BWDB	Bangladesh Water Development Board
CA	Community Assistant (Project Based – Subproject Level)
CO	Community Organizer
CPO	Community Participation Officer (Project based, District level)
CS	Construction Supervisor (Project Based – Upazila Level)
DAE	Department of Agricultural Extension
DDM	Detailed Design Meeting
DLIAPEC	District Level Inter-Agency Project Evaluation Committee
DOC	Department of Cooperatives
DOF	Department of Fisheries
DWRA	District Water Resources Assessment
EIA	Environmental Impact Assessment
EMP	Environmental Mitigation Plan
FMC	First Management Committee (of WMCA)
FSDD	Feasibility Study and Detailed Design
GoB	Government of Bangladesh
IEE	Initial Environmental Examination
JBIC	Japan Bank for International Cooperation
JICA	Japan International Cooperation Agency
ICM	Integrated Crop Management
IWRMU	Integrated Water Resources Management Unit (of LGED)
LCS	Labour Contracting Society
LGED	Local Government Engineering Department
MC	Management Committee (of WMCA)
MEP	Member Education Program
MIS	Management Information System
MLGRDC	Ministry of Local Government, Rural Development and Cooperatives
NGO	Non-Governmental Organization
O&M	Operation and Maintenance
PAP	Project Affected Person
PE	Performance Enhancement
PEA	Performance Enhancement Appraisal
PM	Planning Meeting
PMO	Project Management Office
PRA	Participatory Rural Appraisal
QC	Quality Control
SAE	Sub-Assistant Engineer
SAPROF	Special Assistance for Project Formulation
SP	Subproject
SSWR	Small Scale Water Resources
SSW-1	SSWR Development Project Phase I (ADB), 1996-2002
SSW-2	SSWR Development Project Phase II (ADB), 2002-2009
SSW-3	SSWR Development Project (JBIC), 2009-2016
SSW-4	Participatory SSWR Project (ADB) 2010-2017
TA	Technical Assistance
UDCC	Union Development Coordination Committee
UE	Upazila Engineer
UP	Union Parishad (local council)
UzP	Upazila Parishad
WMCA	Water Management Cooperative Association
XEN	Executive Engineer (usually used in LGED)

Farm, Land and Subproject Categories

FARM CATEGORIES

Land Holding (ac)	Land Holding (ha)	Farm Category
<0.51	< 0.21	Landless
0.51 – 1.00	0.21 - 0.40	Marginal Farmer
1.01 – 2.49	0.41 – 1.00	Small Farmer
2.50 – 7.49	1.01 – 3.03	Medium Farmer
>7.50	>3.03	Large Farmer

LAND CATEGORIES

Depth of Average Monsoon Flooding (m)	Depth of Average Monsoon Flooding (ft)	Land Category
<0.3	<1.0	Highland
0.3-0.9	1.0-3.0	Medium Highland
0.9-1.8	3.0-5.9	Medium Lowland
>1.8	>5.9	Lowland

SUBPROJECT CATEGORIES AND TYPES WITH USUAL WORKS AND OBJECTIVES

Category		Type		Typical Works with Objectives
I	Simple (without Regulation of Water Flow)	DR	Drainage	Re-excavate drainage *khals* to increase capacity of drainage systems to benefit agriculture as well as fisheries and local navigation
		TI	Tidal Irrigation	Re-excavate existing *khals* to enhance tidal flux (volume and propagation) in the *khals* in dry season to benefit irrigated agriculture in fresh water tidal areas as well as fisheries and local navigation (also increases drainage capacity)
II	Complex (with Regulation of Water Flow using gated or other kind of structures)	FM	Flood Management	Rehabilitate and construct embankments and/or sluices/regulators to reduce extent and duration of flooding of farmland inside the subproject
		FMD	Flood Management and Drainage	Rehabilitate and construct embankments, sluices/ regulators and re-excavate *khals* to reduce extent and duration of flooding of farmland and increase drainage capacity of khal system of the subproject
		FMDTI	Flood Management, Drainage and Tidal Irrigation	Rehabilitate and construct embankments, sluices/ regulators and re-excavate *khals* to reduce extent and duration of flooding of farmland, increase drainage capacity and tidal flow capacity of khal system of the subproject. Sluices/regulators of these subprojects will have arrangements of automatic flow of drainage and tidal inflow at the gates.
		WC	Water Conservation	Develop water retention capacity of existing *haors*, *beels* and *khals* to increase availability of surface water for irrigation in dry season by installing gated water retention structures (also *Rubber Dams* at appropriate sites) and by re-excavating *khals* and suitable water bodies
		FMDWC	Flood Management, Drainage and Water Conservation	Combination of works involved in FMD and WC type of subprojects outlined above
		CAD	Command Area Development	Development of existing irrigation schemes by providing better water distribution systems over the command area and, as agreed, pumping facilities. Works may include: improved canal network, lining of canals, installation of buried pipelines, installation of control structures, construction of pump

Category		Type		Typical Works with Objectives
				house, etc.
		DRCAD	Drainage and Command Area Development	Development of existing irrigation schemes by providing better water distribution systems including drainage improvement measures for the command area and, as may be agreed, pumping facilities. Works may include: improved canal network, lining of canals, installation of buried pipelines, installation of control structures, construction of pump house, headwater tanks, regulators/sluices in drainage khals, etc..
		FMDCAD	Flood Management, Drainage and Command Area Development	Development of existing irrigation schemes by providing better water distribution systems together with flood management and drainage improvement facilities forr the command area and, as may be agreed, pumping facilities. Works may include: improved canal network, lining of canals, installation of buried pipelines, installation of control structures, construction of pump house, headwater tanks, etc and construction / rehabilitation of embankments, sluices /regulators in drainage khals, etc..
III	Performance Enhancement	Any Type of Existing Subprojects		Any of the above described works for existing (developed and handed over) subprojects for which additional works are desirable to consolidate planed benefits / result in additional benefits

I. INTRODUCTION

1.1 Background

1. This Document ***"G4 Feasibility Study of Subprojects"***, the *fourth* document in the series that describe the Guidelines for SSWR Development, outlines the procedure, methodology and criteria of feasibility analyses including environmental examination and assessment and institutionalization of local stakeholders' participation in SSWRD subprojects. It builds on previous versions of the document but incorporates up-to-date experiences and lessons learned from implementation of four SSWRD projects over the last 20 years.

2. The document is meant to address the following principal objectives in feasibility study of SSWRD subprojects:

(1) Document the feasibility study and IEE/EIA process of each subproject comprehensively;
(2) Increase efficiency of conducting feasibility study of a large number of subprojects by streamlining the methodology of use of all the system elements; and
(3) Produce feasibility study and IEE/EIA reports in standardized useable sizes.

3. Appraisal of a SSWRD subproject following this guidelines will be documented by the two outputs as below: :

a. ***Feasibility Study and IEE/EIA Report:*** This report will be distributed to the respective LGED District Executive Engineers and, as may be necessary to Development Partner agencies. The report follows a standardized format containing analyses in *five disciplines* - Engineering, Agriculture, Fisheries, Socio-economic, and Environment in separate *Sections* supported by an ***Engineering Annex*** and the required number of ***Exhibits*** containing detail technical analyses and the primary and secondary data collected.

b. ***Two Annexes:*** The PRA and Environmental Assessment are two separate studies to be done for the subproject following Guidelines ***G3: Participatory Rural Appraisal of Subprojects*** and ***G5: Environmental Assessment of Subprojects*** respectively. Feasibility analyses of the subproject will draw upon these studies and make references to them and therefore Reports of these two studies will form two ***Annexes*** of the Feasibility Report and will be attached to it.

4. Participatory Rural Appraisal (PRA) of a reconnaissance "passed" subproject, a brief farmer and local stakeholder level study, will be done separately by the contracted FSDD firm or, if specifically required by the related development partner agency, by an independent firm/NGO. PRA of every individual subproject will be done following a separate Guidelines Document **G3: Participatory Rural Appraisal of Subprojects**. The PRA study will provide comprehensive data and information on social and socio-economic aspects of the subproject along with decision on whether the subproject has social acceptability and beneficiaries are willing to form a beneficiaries' participatory association and bear responsibility of O&M of the subproject including cost sharing.

5. The PRA though conducted as a prerequisite as to whether or not the subproject will be taken up for an extensive feasibility study, the feasibility study will use data and information, particularly on social and socio-economic aspects, from the PRA study and

often make reference to it for details. The PRA report will therefore be attached to the FS Report as ***Annex-II***.

6. The SSWRD subprojects involve rehabilitation and upgrading of existing water management systems of local dimensions (subproject areas are less than 1000 ha) meant to remove or mitigate existing constraints to agricultural production. These subprojects are judged in the ‘B Category’ (Orange) according to Bangladesh Environment Conservation Rules, 1997. For these subprojects, IEE would suffice in most cases. However, in subprojects where IEE will indicate a significant residual environmental impact, a detail EIA will be conducted.

7. Environmental Assessments of every individual SSWRD subproject will be done following a separate Guidelines Document **G5: Environmental Assessment of Subprojects**. This feasibility study guidelines will discuss environmental analysis of the subproject – IEE/EIA including EMP to mitigate any residual impact, in ***Section 3.7*** by drawing upon the above Environmental Assessment study and make reference to it for detail information. The Environmental Assessment Report of the subproject will be attached to the FS Report as ***Annex-III***.

II. PRE-FEASIBILITY STUDY AND DLIAPEC CLEARANCE

2.1 Background

8. The flow chart of the subproject development process show that the formal process for institutionalization of beneficiaries' participation starts only after the subproject is cleared at the district level by a statutory District Level Inter-Agency Project Evaluation Committee (DLIAPEC) regarding duplication or overlapping with projects/programs of other agencies. However, the Executive Engineer, LGED can present the subproject to the DLIAPEC only when the subproject has taken a concrete shape in respect of location and area, development concept, planning of physical infrastructure/interventions, economic and other viability indices, etc. Accordingly, the previous development processes required to hold the DLIAPEC review of the subproject with the final Feasibility Report completed.

9. But this entailed a too short time for the WMCA to be formed, registered and made capable to sign Implementation Agreement (IA) to start the tendering process though preparation of detail design and drawings were completed quite earlier. The tendering process had to wait until WMCA could sign the IA. This was resulting in a host of works in the last year of the project, sometimes necessitating extension of project period.

10. On the other hand, a relatively longer period – the time when feasibility study of the subproject was being done, remained without any activity for WMCA development. It was noted that if the DLIAPEC review can be held earlier – sometime at the start of feasibility study activities, the entire time required for feasibility study can be available for WMCA development activities i.e. the institutional process will get a desired longer time . In fact, the PMO-Project Consultants of the last two SSWR projects (JICA-1 and ADB-3) had used this slot by holding the DLIAPEC review with an interim report called *Planning Concept Report.*

11. The subproject development process adopted in this *SSWR Development Guidelines Documentation* has therefore included conducting a quick prefeasibility analysis of the subproject and prepare a brief but comprehensive Pre-Feasibility Study Report to hold the DLIAPEC review before commencing the main feasibility study that takes time for field survey, detail data collection, conducting analyses of the different Annexes and synthesizing the Feasibility Report.

2.2 Pre-Feasibility Study and Report

12. **Step 8(a) - Field Investigation by FS Consultants:** With a subproject "passing" in PRA, the contracted FSDD firm will undertake an exhaustive field investigation of the subproject by a multidisciplinary consultant team of five specialists (water resources engineer (team leader), agriculturist, fisheries specialist, sociologist and environmentalist). More details on preparatory and on-field activities of the multidisciplinary team are given in the appended ***Exhibit G4-A***.

13. The team will be provided with copies of Form 1, Form 2 and Form 3 of the subproject identification stage along with the Subproject Map prepared during pre-screening that will give them the basic problem and the nature of relief/remedy that local stakeholders have desired and the considerations/criteria on which IWRMU-PMO has allowed the subproject to proceed The Reconnaissance Report including the maps prepared by the reconnaissance team and PRA Report will not be provided to the team at this stage so that the team can develop their own independent observations and opinions. Duration of the field investigation visit may be 2-4 days depending on size and complexity of the subproject.

14. Local LGED staff – UE/SAE from Upazila Engineer's Office and/or Assistant Engineer/Community Participation Officer (project staff) from District LGED Office will participate in the field visit program as observer from LGED and facilitate the activities.

15. The multidisciplinary team will visit the subproject boundary, talk to local people and justify the boundary including any alteration, both inclusion and exclusion, they consider appropriate. The team will visit significant locations in the subproject area to understand and assess the problems that is to be addressed with all its causes and consequences, observe and take note of the conditions of all relevant physical features and interventions proposed by local stakeholders (Form 1 and Form 2), note the appropriateness and adequacy of the interventions proposed and discuss with local people about functioning of the interventions and any alternatives, etc the team considers better. Through this visit using the Subproject Map, the team will develop an on-field planning of interventions and infrastructures that will be necessary to address problems of the subproject area. The team will also make a comprehensive list of all physical works required in the subproject with tentative quantities – number, lengths and tentative sections for required khal re-excavations; number, lengths, tentative level and sections of embankments; number, location, type and size (number of vents) of hydraulic and other kind of structures.

16. The agriculture specialist in the field investigation team during visit to different locations will discuss local people about the impact of subproject on agriculture and assess possible annual benefit by noting – the area where crop suffers damage due to the water management problem (mark the area on the map with the help of information like village/mouza and the crop field visible on the imagery map), frequency of crop damage and extent of damage corresponding to different frequencies, crops grown and damage by crops with usual yields, cost of cultivation, etc. All the collected data should collate to a reasonable estimate of the average annual agricultural benefit of the subproject.

17. The fisheries and other specialists in the field investigation team will likewise visit the subproject area at the different points, talk to people, develop their understanding of the problem at the subproject and collect relevant data/information to assess impacts and viability of the subproject.

18. The field investigation team will have, after completion of field works, a debriefing discussion with the Executive Engineer, LGED and other District level project staff about the overall activities and findings at the subproject site.

19. **Index Map, Physical Works and Cost of Subproject:** After the field investigation and preliminary data collection, the team will consolidate planning of the subproject and prepare a subproject ***Index Map in Google Imagery*** showing all physical features – roads, khals, rivers, water bodies, homesteads, crop fields, etc based on the previous *Subproject Map* and all the planned subproject infrastructure – excavation / re-excavation of khals, re-construction / construction of embankments, regulators / sluices / water retention structures, other structures (if any) as per the detail field investigation.

20. Land elevation characteristics of subproject areas are obtained from the 4 inch to 1 mile (1:15,840) Water Development Maps (1965) that are available for nearly the whole country with contours of 1.00 ft (300mm) intervals. As these maps are quite old, alignments/locations of rivers, khals and water bodies differ from the present situation as given by Google Imagery. Elevations of low lands also have undergone changes. However, ***another Index Map*** of the subproject is to be prepared using the 4 inch to 1 mile scale contour maps by transferring the subproject boundary and alignments of khals and rivers from the Google Image based Index Map. The area-elevation-storage characteristics of the subproject area are established by measuring areas under various elevation contours using this **Index Map**. As accurate digital elevation models (DEM) will become readily available, land types (by flooding depths) would be quickly determined without the need for field topographic survey.

21. The list of all planned works is finalized with their tentative quantities and costs. Thus the total subproject cost based on a preliminary estimate will be obtained. The approximate annual O&M cost can also be estimated using a standard basis (the current basis is 1.5% of cost of structures and 3% of the cost of earthworks). A copy of the Index Map will be made in A1 size for presentation in the Planning Meeting.

22. **Benefit and Socio-Environmental Impact:** The only tangible benefit of SSWRD subprojects is from agriculture. The Agriculturist of the FS field investigation team will collate and consolidate data and information collected from the field investigation and asses the tentative net lands that will be benefitted due to the subproject by nature of the benefit (improved drainage, protected from flood, supplied with irrigation water) and name of the benefitted crops with tentative areas, production and net financial returns from them which will sum up to the total benefit of the subproject. Location of the net benefit area will be shown in the subproject Index Map.

23. SSWRD subprojects generally reduce open water capture fisheries. However, improved water management and added support and attention to the fisheries sector activities, particularly in culture fisheries, have impacted an increased fisheries production in many subprojects. The Fisheries Specialist of the field investigation team will, considering the features and conditions at the subproject and the interventions planned for water management, analyze data and information collected from the field visit and come to a pragmatic estimate of the subproject's impact on fisheries, either positive or negative.

24. The Sociologist and Environmentalist of the field investigation team, likewise, will analyze field conditions and all the data/information obtained from field by observations and discussions with local people and consolidate the issues with respective responses / impacts. There will, however, be summary observations on the social acceptance and environmental viability of the subproject.

25. **Draft Pre-Feasibility Study Report:** The FS Consultants and Specialists participating in the field investigation will discuss, after their return from field, their investigation and observations with PMO-Project Consultants and conduct the follow up subproject planning, cost and benefit assessment and viability analysis activities (paragraphs 18-21) in close consultation with the Project Consultants as part of the quality check measures. By collating and consolidating all these outputs of the field investigation, the FS Consultants will prepare a draft Prefeasibility Report for use in the Planning Meeting.

26. The Prefeasibility Report will be concise and follow the contents as outlined in ***Exhibit G4-B*** appended to this document.

27. **Step 8(b) - Planning Meeting:** The engineering works planned for the subproject have largely been decided through discussions with local people in previous steps – proposal, reconnaissance, PRA and the field investigation by the FS Consultants. However, the subproject planning is to be discussed with beneficiaries representing the whole subproject area and be agreed upon, if necessary with modifications emanating from the meeting. This is done in a Planning Meeting of the subproject participated by a wide section of beneficiaries and other local stakeholders.

28. The Planning Meetings will be organized and held by the District Executive Engineer, LGED through a wide publicity in the subproject area. Project staff at District and Upazila will assist LGED staff in making the meetings successful. The venue of the meetings will be at a place nearly central to the subproject area and having good access from all areas of the subproject. Date and time of the meetings should also be decided considering scope of rural people to attend – excluding big market days, avoiding peak work times of days, etc.

29. The organizers will take special efforts to ensure participants from all parts of the subproject area, from all groups of stakeholders – landless and small farmers to big farmers, communities of professional fishermen and boatmen, leaders and respected persons from all involved villages, etc.

30. The Executive Engineer, LGED of the District will attend the Planning Meetings as these are public meetings called in his name. His presence will enhance participation and effectiveness of the meetings. Besides, Planning Meetings will be attended by all District and Upazila level LGED-staff related with water sector activities, all District and Upazila level project staff, and representatives from IWRM Unit and PMO-Project Consultants.

31. As Planning Meetings are open general public meetings, a respected person present will be made President of the meeting. He will preside over the meeting and sign its minutes. The FS Consultants will engage two eligible persons to prepare participant's list, keep records of the meeting and prepare minutes of the meeting. The Executive Engineer, LGED and PMO-Project Consultant representative will facilitate the meeting.

32. The FS Consultants will present the subproject planning in the meeting using a big (A1) size Index Map showing all the proposed works of the subproject. He will describe the works planned with their locations and functions with the expected benefit from them. All participants will be requested to participate in constructive review of the subproject planning. Alternatives and other suggestions emanating from the participants will be duly discussed and if agreed unanimously will be accepted.

33. Besides engineering planning of the physical works of the subproject, The Planning Meeting will also discuss the project requirements that (i) the beneficiaries from all over the subproject area will form a WMCA under the Co-operative Law by being member of it and undertake responsibility of operation, maintenance and management of the subproject through an elected Management Committee of the WMCA after the subproject is constructed, and (ii) the beneficiaries together will make an upfront contribution (currently equal to 1.5% of the cost of structures and 3% of the cost of earthworks) to the O&M fund of the subproject as a pre-condition for commencing construction works. The collected fund will be kept as fixed deposit in a Bank under joint signature of the WMCA Chairman and Secretary and the Executive Engineer of LGED. There will be a separate operating O&M account of the WMCA where the profit from the Fixed Deposit Account will be transferred and new collected O&M fund will be deposited. All costs of O&M activities will be paid through this operating O&M account. The main fixed deposit fund will remain in fixed deposit continuously. The meeting needs to have a unanimous support to the two issues.

34. At the end of the meeting, the summarized decisions of the meeting will be read out to the participants, incorporated in the minutes of the meeting and signed and issued by the President of the Planning Meeting.

35. **Step 8(c)- Pre-feasibility Study Report:** After the beneficiaries have agreed with the subproject planning in the Planning Meeting, the FS Consultants will update the subproject Index Map and finalize the Prefeasibility Report in consultation with the Project Consultants by incorporating modifications, if any, emanating from the Planning Meeting. The Minutes of the Planning Meeting will be annexed to the Prefeasibility Report.

2.3 DLIAPEC Clearance

36. **Step 9- DLIAPEC Clearance:** As the FS firm submits final Prefeasibility Report, the PMO will send it to the District Executive Engineer, LGED with instruction to hold the DLIAPEC meeting on the subproject. The Executive Engineer will present and explain the subproject plan in the meeting, request the members to examine if there is any duplication or

overlapping of the subproject with projects and programs of their Departments/Agencies and ask for clearance of the subproject for implementation. The DLIAPEC will discuss the subproject and accord the clearance if no overlapping/duplication is noted. If however any duplication/overlapping is found, the meeting will suggest remedial measures, include it in the minutes and give a clearance conditional to the remedial measure. The FS Consultant will revise the subproject planning to incorporate the remedial suggestion. The matter may be resolved through bilateral discussion between the field level officials of the concerned departments and the District Executive Engineer, LGED and/or PMO-Project Consultants and the concerned Department with the revised subproject plan or a second DLIAPEC meeting may be held.

III. FEASIBILITY STUDY

3.1 The Study Components

37. The objective of a feasibility study is to assess that the proposed subproject is technically, economically, socially and environmentally viable. In SSWRD subprojects, this is done through analyses under five component disciplines – **Engineering, Agriculture, Fisheries, Social** and **Environmental.**

38. The procedures of analyses under the respective disciplines including required data and criteria to be followed are described in respective subheads below. These detail analyses and the expected changes following the subproject intervention will be summarized in the component wise ***Annexes*** that will be attached to the feasibility report.

3.2 Engineering Analysis

3.2.1 Introduction

39. The purpose of engineering analysis is to establish the optimal physical interventions needed to support the subproject development concept in general, and to ascertain hydrological changes needed within the subproject area to improve conditions for agricultural production. This can be achieved only when the analysis are based on latest relevant data and information.

40. The engineering analysis should be carried out for all subprojects following a standard general format. The main feasibility report of subprojects will contain general information with salient data/information and justification of the proposed development works summarized from analyses and results thereof from the attached ***Annexes.***

41. Of the usual subprojects implemented under SSWRD projects, CAD subprojects are of uniquely different type – characteristically different from other types (DR, TI, FM, WC) of subprojects. For example, the above four types of subprojects are related to pre-monsoon and monsoon season water regimes i.e. flooding and drainage and therefore design parameters and criteria for these subprojects focus on issues like maximum rainfall, drainage rate, extent of crop damage due to submergence in flood water, design of works like khal re-excavation, embankment development, construction of structures in khals/rivers, etc. On the other hand, for CAD subprojects that are fully irrigation subprojects are related with design and development of irrigation system for supply and distribution of water for irrigation of crops in the dry season. Accordingly, Engineering Annexes of the two subproject groups are made separate:

- **Annex G4-IA: Engineering Annex** for the subprojects (Dr, TI, FMD, WC) where analyses relate to pre-monsoon and monsoon water regimes; and
- **Annex G4-IB: Engineering Annex (CAD)** for CAD subprojects where analyses relate to assessment of irrigation water requirement and irrigation system design and development.

42. The Engineering Annexes will generally provide the following information:

Figure 1: **Index Map** of subprojects showing subproject boundaries, khals, beels, existing and proposed infrastructure and ground level contours converted to meter units from contours in feet shown on 4 inch to 1 mile topographic maps. Index Maps are prepared by using existing reference maps in which infrastructure planned under the subproject and, when possible, their impacts are shown. The basic

reference map for this is the 4 inch to 1 mile topographic map available for the whole country. But the maps are very old - surveyed and prepared during late1950s to mid 1960s and therefore courses of rivers and khals and also alignment of roads, etc have undergone significant changes. Many smaller khals and water bodies have lost their existence and some new have developed. Regarding land elevations, it is believed that changes in high to medium low lands may not be significant while ground levels in lowlands may have increased to some extent due to sedimentation. Under the situation, two Index Maps have been used. The *first* one, identified as ***Figure 1A: Index Map (Google Image)*** is based on Google Image of the subproject area and shows current position of physical features including rivers, khals, water bodies, roads, bridges, homesteads, crop fields, places, etc. The subproject boundary, all planned physical works and impact area boundaries, etc are shown on the Google Image map using AutoCAD. Areas can also be measured from this map. The *second* one, identified as ***Figure 1B: Index Map (Topography)*** is based on the available 4 inch to 1 mile topographic map. Important features of the subproject area like subproject area, catchment area and benefit area boundaries, alignment of rivers, khals, important roads, locations of water bodies are copied on this map from the Google image map. This map will be used mainly to establish the area – elevation – storage relationship of the subproject area by measuring areas under different land elevations following the contour lines within the subproject boundary (refer ***Annex G4-IA, Appendix G4-IA.B, Section B2.A1***)

[For CAD subprojects, additional schematic layouts detailing the irrigation systems (buried pipelines, canals) will be needed]

Figure 2: Base Map of subproject showing location of the subproject in LGED Upazila Base Map of scale 1:50,000. This map presents location of the subproject in a wider surrounding in the Upazila in relation to communication systems, markets, important towns and places, etc.

Figure 3: Regional Map showing location of the subproject in relation with major rivers and khals, main roads and towns, existing BWDB projects (if applicable) and hydrometric stations used in the analysis. As the basis for preparation of Regional Map, topographic map of 1:250,000 scale or hydrological network map may be used.

- Subproject Name and ID Number
- Subproject Location: District; Upazila; Union
- Subproject Areas: catchment area, gross subproject area, net benefited area, command area (for CAD subprojects)
- Area-Elevation-Storage relationship (table and graph)
- Land class analysis (based on flood depth)
- Hydro - Climatic data with statistical analysis
- Hydrological and Hydraulic design of proposed works (khal, embankment, hydraulic structures).
- Basic Drawings of the proposed works

3.2.2 Important Definitions Relevant to SSWRD Subprojects

43. **Water Resources Development Subproject:** A Hydrological Unit within a defined catchment including all existing and planned infrastructure designed for improving water management to improve soil-water relationship for increase of agricultural production.

44. For SSWRD subprojects, net benefited area of a single subproject is limited to 1,000 hectares. SSWRD subprojects must be technically viable, economically feasible, environmentally sound and socially acceptable and must comply with all the specified criteria of the Project under which they are implemented.

45. **Subproject Catchment Area:** Catchment area (also called drainage area, catchment basin or watershed area) is an area enclosed by high elevation points/line that is attributed to a specific low outflow point in the basin through which all rainwater runoff drains out from that basin.

46. A specific subproject catchment is separated from adjacent catchments (basins) by a divide line formed by natural topography of elevated land (successive hills and ridges) or artificial, man-made topography (elevated roads and/or flood embankments, homestead platforms) which can be traced on a topographic map by joining successive highest elevation points in a closed loop starting and ending at the outflow point.

47. Runoff from rain falling over a single catchment drains through the outflow point – a structure or section of a khal or land valley. In the context of SSWR development, two types of catchments can be identified in flat topography areas: dry season catchment and monsoon season catchment. Monsoon season flood may overtop dry season divide boundaries and merge several dry season catchments into one common wet season catchment, which also may have several outflow points or outlets.

48. When demarcating a subproject catchment area, the planner should remember that catchment boundary (divide line) runs through highest points of hills and ridges but it should never cross valleys, land depressions, beels, baors, haors, channels, khals and rivers.

49. In flat topography, there might be channels or small khals connected with other channels periodically draining to the outside of the subproject catchment. These are called double outlet channels with direction of flow depending on water levels in the adjoining basins. In this case the planner should examine the channel in the field, ask local people about direction of flow and water levels at which the flow changes direction. The channel in question should be surveyed. Based on the shape of the profile and the information on water flow direction and time, the planner can decide about the location of the catchment divide line, and leave it as it is or have it closed at the divide line.

50. Subproject Catchment Area is the base parameter used for hydrological and engineering design of subproject infrastructure – size and sections of hydraulic structures and khals.

51. Incorrectly demarcated catchment boundary may lead to design of a subproject, which is not a *hydrological unit / sub-unit* and as such covers only a part of or encroaches on neighbouring catchments. This will result in design of a subproject with (i) too small catchment area, or (ii) too large catchment area.

52. Subproject designed with <u>too small catchment area</u> will have undersized channels and structures to convey the actual drainage discharge As a result, post subproject conditions will worsen due to (1) increased drainage congestion and higher internal flood inside the subproject boundary, and (2) accumulation of flood and water logging outside the subproject embankments constructed across the actual subproject basin. Local people will have no choice but to cut embankments at both upstream and downstream end of the subproject, to relieve water accumulated outside embankment and drainage congestion inside the subproject. In such case the undersized structures will be prone to early damage and additional structure(s) will need to be constructed. Also additional embankments along the correct boundary may have to be constructed.

53. Subproject designed with too large catchment area will have excess capacity channels and structures, which results in an accelerated silting of channels due to reduced flow velocity. Also, the subproject construction will require higher capital investment cost and consequently larger beneficiaries' contribution for O&M.

54. **Subproject Gross Benefitted Area:** Gross Benefited Area is the gross area, cultivable and non-cultivable, that is affected by poor drainage, flood or drought, from which these problems should be removed or mitigated after the subproject implementation.

55. Depending on type of subproject, the gross benefited area may comprise a part or whole of the subproject catchment and it includes highland, homesteads, roads and water bodies if present within its boundary. Elevation of the design flood, extent of water logging and elevation or distance to which water can be made available from the storage for irrigation, define the boundary of gross benefitted area.

56. The subproject gross benefited area dominates the *Institutional and Social aspects* of the subproject. It is the base data used for identification of the subproject beneficiaries – farmers whose lands are within the subproject gross benefited area. It is therefore very important that the gross benefited area boundary is correctly demarcated in the field and defined on the Subproject Index Map.

57. The implications of incorrectly demarcated gross benefited area will result in WMCA membership including people who will not be getting any benefit from the subproject but will be demanded to make financial contribution to the subproject.

58. **Subproject Net Benefited Area:** Subproject net benefited area is the area of cultivable land within the subproject gross benefited area. It is calculated by subtracting the area under water bodies, homesteads and infrastructure from the subproject gross benefited area.

59. The subproject net benefited area comprises cultivable land within the subproject that is subjected to improved conditions for agricultural production or land positively affected by the subproject intervention. In other words, all the post-subproject changes in agriculture take place only within the net benefited area.

60. It is the base information used in agricultural planning and determination of the expected subproject benefits.

61. The implications of incorrectly demarcated net benefited area will result in false claims of subproject benefits and/or implementation of non-feasible subprojects.

62. **Subproject Boundary:** Subproject boundary is the outer limit of the area physically affected by the subproject interventions. Depending on land topography, subproject location and subproject type, subproject boundary may be represented by the boundary line of catchment area or by the boundary line of subproject gross benefited area. Usually, in subprojects with sloping topography, catchment boundary coincides with gross benefited area boundary in the lower basin while in the upper basin catchment boundary is farther away outside the gross benefited area boundary.

63. In Flood Management and Drainage subprojects located in coastal area and covering whole polders, and located in floodplains of big rivers with entire subproject area inundated (excluding homesteads), the subproject boundary coincides with the subproject catchment boundary.

64. In Flood Management subprojects located in haor areas of greater Sylhet and Mymensingh Districts with entire subproject area inundated (excluding homesteads) the subproject boundary coincides with the subproject catchment boundary.

65. In Flood Management and Drainage subprojects located in non-tidal area having sloping basins which are flooded only in lower part, subproject boundary coincides with the subproject gross benefited area boundary.

66. In Water Conservation subprojects located in hilly areas or having sloping basins the subproject boundary coincides with the subproject gross benefited area boundary.

67. In Command Area Development subprojects the subproject boundary coincides with the subproject gross benefited area boundary. It may be within a single catchment or it may extend over parts of more than one catchment. This can be so because the most practical alignment of irrigation canals is over divide lines in higher lands.

3.2.3 Engineering Works Required for Different Subprojects

68. The engineering interventions required in a water development subproject depend on the existing problems in the subproject area. The problems, however, may vary according to topography, hydro-geological conditions, and land use of a particular subproject area. SSWRD projects are generally with the primary objective of increasing agricultural production through improved water management but they cut across fisheries sector and therefore are significant for fisheries also.

69. Taking into account the prevailing water management problems and the requirements identified in the course of implementing the previous SSWRD projects, new subprojects for SSWR development are grouped into five basic types which are again divided into two categories. The categories and types of SSWR subprojects with objectives and physical works usually required are listed at the beginning of this Document. However, the categories and types of new subprojects along with the set of physical works that might be needed for the respective type of subprojects are given below for easy reference.

Category-I: Simple Subprojects (without flow regulation)

- ***Drainage improvement:*** Re-excavate drainage channels to increase capacity of drainage systems to benefit agriculture as well as fisheries and local navigation.
- ***Tidal irrigation:*** Re-excavate existing tidal channels to increase availability of dry season tidal fresh water both in quantity and propagation deeper inland for irrigation.

Category-II: Complex Subprojects (with flow regulation)

- ***Flood management:*** Rehabilitate / construct embankments and/or sluices/ regulators to reduce extent and duration of flooding of farmland.
- ***Water conservation:*** Develop water retention capacity of existing haors, beels, and channels to increase availability of irrigation water by installing water retention structures and/or by re-excavating the bed of water bodies and channels.
- ***Command area development:*** Improve existing irrigation schemes by providing better water distribution systems (improved canal network, lining of canals, installing buried concrete or PVC pipelines, installing head water tanks and/or distribution control structures, etc.) to extend irrigated areas.

70. In case of combination of problems and benefits, the five basic types may lead to ten common types of subprojects. Physical works that may be required for the combined type subprojects will also be combination of work requirements of the basic types and can be drawn from the above listing. More details of the characteristic problems and infrastructure

needs of the various types of subprojects are given in ***Exhibit G4-C*** appended to this Document.

71. **Planning of Water Conservation Type:** When planning the water conservation type subproject, it should be considered that the channel in the area normally assumes a role of not only irrigation but also drainage. In case the channel is long, e.g. more than a few kilometres, more than one water retention structures (WRSs) will be necessary. Therefore, in this case firstly the channel should be designed for the drainage, and then the retention level will be determined and followed by the number of WRS taking into consideration of the land availability etc. and then finally the sill level of each WRS will be determined. The basic flow of the consideration is shown as below. Also the comparative observation on WS type subproject planning about two extreme cases is shown below, which suggests careful consideration on pros and cons.

- ❖ Step-1: Collect basic data of the subproject area such as land elevation, bed level and alignment of channel.
- ❖ Setp-2: Estimate Drainage rate and maximum drainage discharge.
- ❖ Setp-3: Determine the channel dimension such as bed level and width of channel taking into consideration of land availability. Deeper bed level will require wider lands than shallow one.
- ❖ Step-4: Determine the most appropriate water retention level and structure allocation for WRSs in a comprehensive manner such as economic viability, O&M easiness and environmental changes. Economic comparison should include the cost of land acquisitions.
- ❖ Step-5: Sill level of WRS determined in line with channel bed level required for drainage.

Comparative Observation on WC type Subproject Planning

Case	Advantage	Disadvantage
Case-A Retention level: High Nos of WRS: Less	- Cost-effective as the number of structures is less. - O&M may be easier in less number.	- In case retention level is higher than the ground level, the dike to retain water should be newly constructed together with the wider range of lands. - O&M may be harder due to big structure. - The Outlet structure to drain out water from paddy will be also necessary since the dike may impede the drainage. As drainage will be restricted through outlets instead of direct inflow like before, drainage will be delayed. Concentration of drainage through the outlets may eventually develop erosion and small khals causing loss to croplands.
Case-B Retention level: Low Nos of WRS: Many	- Normally no need to newly construct retention dike. - O&M may be easier due to small.	- The construction cost of WRSs may be increased. - O&M may become relatively complexed due to many numbers of structures.

3.2.4 Data Requirement for Engineering Analysis of Subprojects

72. **Preliminary Data for Prefeasibility Study:** Engineering Analysis and for that matter requirement of engineering data commences when the subproject is found to have, by PRA study, popular support and no significant social opposition or environmental adverse impact. Field investigation and prefeasibility analysis are the initial activities and these need mainly secondary data (maps, WL) at the preparatory stage. Primary data collected by the investigating team professionals from field level at the subprojects are approximate but adequate for prefeasibility analysis. Details of these preliminary data requirement and

obtaining them are discussed in ***Section 2.2*** of this Document and the appended ***Exhibit G4-A***.

73. **Detail Data Requirement for Feasibility Analysis:** As the feasibility study investment for the subproject is justified by the prefeasibility study and the DLIAPEC clears the subproject for *no duplication or overlapping with works of other agencies*, the first activity for conducting detail engineering analysis is collection of required primary data from field through engineering survey. Some data (survey and subsoil data of structure sites) will be required only during detail engineering design of structures. These will be collected later after structure sites are finalized. Hydro-meteorological data for relevant stations are collected during prefeasibility study. However, any remaining of these data should be collected at this stage. Following is a listing of data generally required for feasibility level design of proposed physical works of SSWR subprojects.

i. Hydrological Data

- Name and ID Number of WL station(s) that influence water regime
- Daily WL Data (raw or with analysis) of at least current 20 years of above station
- Surveyed max HFL at subproject (from flood marks) highest in 20 years
- Surveyed average Monsoon Flood Level at subproject area

ii. Meteorological Data

- Name and ID Number of nearest weather station
- Name and ID Number of nearest Rainfall station, if different
- Daily Rainfall Data of the above Rainfall /weather stations
- Data of Evaporation, Temperatures, Daylight Hours and Wind Speed (for CAD subprojects)
-

iii. BM and TBM for Survey Works

- Location, ID Number, Distance from subproject and RL (mPWD) of nearest SOB BM Pillar
- Location and RL (mPWD) of established TBM at subproject site for survey of subproject works

iv. Survey Works

- Detail procedures for conducting engineering survey for SSWRD subprojects are given in **Exhibit G4-D** appended to this document
- Surveyed cross-sections at 100 m intervals of existing/new embankments to be re-sectioned/constructed, khals to be re-excavated, irrigation canals to be constructed, buried pipelines to be installed
- Surveyed long sections of the embankments, khals, irrigation canals, buried pipelines those are surveyed.
- Spot GL survey of specified low area of subproject to check possible raised present GL against GL in topographic maps
- Plane Table survey of site of new structure if structure site is exactly known (this survey is needed during detail design and so should be waited until the site is finalized)

v. Survey of Existing Structures to be Modified/Rehabilitated

- Sketch Plan and Elevation Drawings of existing structures that will be modified or rehabilitated with all dimensions

- Surveyed RL of top, invert, upstream and downstream floors and other points as may be considered necessary of the above sketched structures
-

vi. Subsoil Data (required for Detail Design of structures)

- Subsoil Investigation for Box Type Sluice/Regulator/WRS (minimum 3 Bore Holes 20 m deep are to be executed; for pipe sluices and culverts subsoil data is not required)
- SPT Values at every 1.5m for full depths of all Bore Holes
- Unconfined Compressive Strength (q_u) of cohesive/clayey soils in the Bore Holes whenever encountered (undisturbed soil samples must be collected from each layer of cohesive/clayey soils encountered and tested in laboratory for q_u)

74. The above is a general data requirement. Depending on the subproject type some data may be omitted and/or other data may need to be included.

3.2.5 Hydrological Analyses Relevant to Subproject Study

a. DR, TI, FMD, WC Subprojects

75. **Area-Elevation-Storage Characteristics of Subprojects:** The relationship between land elevation and corresponding area of land under it and the volume of water that can be held in storage on this land area provides a valuable hydro-topographical tool for analysis of various impacts of the subproject. The relationship is established by using the 4 inch to 1 mile scale (1:15840) topographical maps with land elevation contour lines at 1-foot (0.3 m) intervals. These maps, though old – prepared during late-1950s to mid-1960s, are available for all areas of the country except for Hill Tract areas. Areas between successive contour lines, within the subproject boundary (*refer also to Section 3.2.1, Index Map*) are measured and a cumulative Area vs Elevation data from lowest land elevation to higher is prepared in a tabular form. To this table, a column for volume of water that would be held in storage at the consecutive elevation steps can be added. Thus a tabular data of Area-Elevation-Storage characteristics of the subproject area is established which can be used by the Spreadsheet Design Programs. Also graphs can be plotted using the data for visual analysis and study. Example data and curves of Area-Elevation-Storage relationship is shown in the ***Engineering Annex, Appendix G4-IA.B, Section B2.A1*** for reference.

76. **Design Basin WL and Drainage Rate of Subproject:** Design Drainage Rate is the rate expressed in millimetres per day at which the runoff generated from design storm rainfall over the entire subproject catchment area (may be more than subproject area) has to be drained out so that inundation damage to crops grown in the net benefited area remains within the acceptable limit - up to 5% of the net benefited area. That is to say, as the design storm runoff is drained at a certain drainage rate, the maximum water level in the subproject area should be such that criteria for crop damage is not exceeded i.e. no more than 5% of the benefited area remains submerged for more than three days with depth of water more than 0.3 meter. This water level in the subproject area is termed as the Design Basin Water Level because it satisfies the acceptable crop damage criteria.

77. The design Drainage Rate is determined, to meet the above acceptable crop damage conditions, by applying the design 5-day 10-year storm onto the subproject catchment area (basin) and carrying out a iterative water balance (or flood routing) calculation with a time step of one day. The calculation is carried out using the MS Excel Spreadsheet Program “DRate Analysis” using the design storm rainfall and the basin area-elevation-storage data.

The program calculation is run by typing in a “trial drainage rate value” and observing the “number of days in the column for full damage day”. If the number of days is just 3, the trial drainage rate is the Design Drainage Rate and the maximum value in the WL_{Basin} column is the Design Basin Water Level. Example calculation of Drainage Rate and Design Basin WL analysis using the Spreadsheet Program “DRate Analysis” is shown in ***Engineering Annex Appendix G4-IA.B, Section B2.B*** for reference.

78. **Land Types and Changes in Land Types under Subprojects:** Land type or land class as is related to agriculture and, for that matter, to agricultural water management is defined based on flood phase (depth of water) of lands as below:

Highland	F0	0-0.3m depth of water on land
Medium highland	F1	0.3-0.9m depth of water on land
Medium lowland	F2	0.9-1.8m depth of water on land
Lowland	F3	>1.8m depth of water on land

79. Full Flood Management subprojects impact agriculture by lowering water depth in the subproject area such that lands from deeper flood phase changes to shallower flood phase whereby area and cropping of shallow flood phase lands increase. Therefore, assessing amount of land changing flood phase i.e. land type change occurring due to the subproject is an essential analysis in impact assessment of Full Flood Management subprojects. Partial Flood Management subprojects and Drainage Improvement subprojects protect crops from pre-monsoon floods and improves cropping by reducing subproject WL but do not change land types as the impacts do not persist over the whole monsoon season and also on long terms. Water Conservation and CAD subprojects are dry season subprojects having no interference with monsoon waters and so do not make any land type change impact.

80. Spreadsheet Program in MS Excel has been developed that works with the tabulated Area vs Elevation data of a subproject and gives areas of different land types under a given WL in the subproject according to the above flood phase definition. Accordingly, by using pre-subproject and post subproject WLs, two sets of land types are calculated and the difference between post-subproject and pre-subproject land type figures indicate the land type change due to the subproject. Example calculation of land type analysis and change in land types are shown in ***Engineering Annex Appendix G4-IA.B, Section B2.A2*** for reference

b. CAD Subprojects

81. **RCC and PVC Pipes: Comparative Cost Effectiveness:** Buried pipelines for irrigation in command area development (CAD) subprojects were, previously, made using RCC pipes, sizes of which range from 300mm to 900 mm internal diameters. Since 2011, unplasticized PVC (uPVC) pipes are being used for nominal diameter requirements of up to 600 mm, as these pipe sizes are being produced locally, and for higher pipe diameters up to 900 mm, use of RCC pipes is continued as uPVC pipes of these higher diameters are not yet available with adequate technical requirements and cost effectiveness.

82. Though cost of uPVC pipes are higher than RCC pipes, the reasons for preferring uPVC pipes are (i) lengthy on-site manufacture of a huge number of RCC pipes with much difficulty in quality control is avoided; (ii) uPVC pipes are light and handling, placement, jointing are both easier and quicker; and (iii) number of joints i.e leaking possibilities reduce significantly as lengths of pipe units are longer and joints of uPVC pipes are much more leak resistant.

83. Capital cost of CAD subprojects under SSWRD projects using buried uPVC pipes are assessed to be typically BDT 60,000 to 100,000 per hectare irrigated area with 60-65 % of

the cost due to the pipes only. However, the apparent high cost should not be construed as "not cost effective" because cost effectiveness relates also to a few other things like (i) subproject being able to provide full irrigation to the whole area, not requiring to leave some part for the system out of service due to frequent/major leaks in pipe system, (ii) not only capital (construction) cost but the total cost including costs of pumping water, system operation (distribution management) and maintenance (leak repair, etc) of the system, etc.

84. The last completed project, SSWRD (JICA) -1, implemented 07 CAD subprojects with uPVC buried pipes, for the first time in larger areas, and 01 CAD subproject with RCC pipes. Previous SSWRD projects implemented several CAD subprojects with only RCC buried pipes. The uPVC buried pipe CAD subprojects are performing for 02 years now and have not indicated a single problem in the buried pipe system whereas the subproject with RCC pipe has already left a part of the area out of service temporarily due to the problem of leaking joints. For the previous CAD subprojects with RCC pipes, serious problems have been reported in all of them – some of them having gone out of service. Though it is too early to form an opinion, observations of this short period gives positive indication of cost effectiveness of uPVC buried pipe CAD subprojects.

85. **System Layout and Index Map of Subproject:** Layout planning of a CAD subproject is best done by using Google earth imagery of the subproject area, may be on a printed hard copy or working on-line using a GIS program. Google earth imagery gives ground elevation to an accuracy of 1.00 m which would be adequate for planning purpose. Subproject boundary should first be delineated by physical boundary, irrigable land, etc and considering that carrying water to more than about 2.50 km is not desirable from economic point of view. Natural drainage paths within the area are identified and then ridge ground alignments are identified to locate the irrigation pipelines.

86. The net command area, excluding the non-irrigable areas like homesteads, beels, etc is divided into more or less equal size "rotation units" of 80-130 ha areas. Rotation units in a subproject may be about 06 at the maximum from the view point of system management. Each rotation unit will be supplied by a separate pipeline. Branches spurring from these lines will have riser outlets. Each outlet will have 10-15 ha of land called an "irrigator unit". The whole command area will be provided with, as far as possible, equitable riser outlets. One rule of thumb is that risers should be spaced 200-500 m along the pipeline and no land should be more than 200-400 m from an outlet. Locations of header tank, other flow control structures and all outlet points are to be clearly shown in the layout plan. With this exercise of layout of pipelines and dividing the command area into rotation units and irrigator units, a draft statement of rotation and irrigator units and associated information will be prepared.

87. At this stage, stakeholders' agreement will be sought and having an approved basic layout of the irrigation system, the subproject Index map will be prepared and engineering surveys for sites of header tank and flow control structures and alignment of pipelines will be undertaken. The **Index Map,** with updates that may be needed as detail design of the system is progressed and completed, will be included in feasibility report in ***G4-IB Engineering Annex (CAD), Appendix G4-IB.C1*** (see example map in the attached Appendix)***.*** Also, based on the stakeholders agreed layout of pipelines, a schematic layout of skeletal pipelines with relevant data of all the pipe reaches between nodes are prepared. Diameter of pipes at this stage as shown in this schematic drawing is calculated from the area of land to be served by the pipe at the point, the average (3-month) duty of irrigation water and a desired moderate velocity in the pipe at 0.70 – 0.80 m/s. The schematic layout of pipe system with hydraulic data will be given in ***G4-IB Engineering Annex (CAD), Appendix G4-IB.C2*** of the feasibility report (see example map in the attached Appendix)***.***

88. **Crop Water Requirement, Irrigation Duty and Pipe Size:** Calculation of crop water requirement is quite complex. Details on the parameters, assumptions and limitations, different cropping scenarios, etc and the FAO approach of calculation are given in Guidelines Document **G6: Detail Design of Subproject Structures**, ***Exhibit G6-L: Criteria and Design of PVC Buried Pipe Irrigation Subprojects.***

89. The Exhibit provides crop water requirements and irrigation requirements of 13 districts of the country for different cropping scenarios. For SSWRD irrigation (CAD) subprojects, data of these 13 districts are considered adequate. Subprojects in any district will adopt data of one of these 13 districts (mostly the adjacent districts will govern) that is considered most appropriate for the hydro-climatic and agricultural condition of the subproject. Crop water and irrigation water requirements of the applicable reference district will be provided in the feasibility report in ***Engineering Annex (CAD), AppendixG4-IB.A, Table A3.***

90. An "irrigation Duty" (irrigation requirement at field level expressed in mm/day or l/s/ha) is to be adopted for a subproject depending on cropping pattern (percent land under a crop) of the subproject area and water requirement of the crop at the place that is dependent on factors like the crop and its growing stage (crop coefficient), type of soil (percolation and moisture holding capacity), crop coverage of land, evaporation and transpiration, etc. Two Duties will be used – *usual* Duty or *three-month* Duty (uniform Duty for three months of the crop period) for sizing the pipes and *peak* Duty or *one-month* Duty (Duty for the one month period of high water demand) to design height of the header tank and stand pipe. For the peak one month, pipes will flow with a higher velocity to convey more discharge as per the higher Duty.

91. The pipe lines are then divided into reaches separated by nodal points on the basis that pipe sizes should reduce as the command area of the pipe reach reduces. With the command area of a pipe reach so determined and knowing the irrigation duty, discharge required at the reach is calculated. Thus, a tabulation of command area-discharge-pipe diameter of all the reaches of pipes in all the pipe lines is drawn up. In calculating preliminary pipe size, a moderate flow velocity in the pipes as 0.7 to 0.8 m/s will be maintained for all the reaches and all pipe sizes. The system layout and calculations will lead to a tabulation of data on rotation units and irrigator units in the subproject including related other data like rotation discharges, flow control structures required etc. These, a summary data and information of the subproject, are provided in ***G4-IB Engineering Annex (CAD), Appendix G4-IB.B, Tables B3*** and ***B4***. Feasibility study Consultants will provide calculations of concerned subprojects and include the Appendices in the feasibility report appropriately. A skeletal layout of pipe system with the above calculated parameters will be given in a schematic diagram in ***G4-IB Engineering Anex (CAD), Appendix G4-IB.C2.***

3.2.6 Anticipated Impacts of Different Types of Subprojects

a. Drainage Improvement Subprojects

92. Drainage improvement works are designed to remove excess water from an area, and/or to reduce time required to drain that water. This is usually achieved by re-excavating existing drainage khals whose capacities have been reduced for being silted up or being encroached upon. Sometimes, excavation of new khal may also be required. Drainage improvement subprojects have impacts on agriculture and fisheries.

i. Impact on Agriculture

93. Possible agricultural benefits that can be derived from improved drainage are:

- Increased production of pulses and oilseeds in the Rabi season since crops can be planted earlier.
- Increased area under short duration crops (mustard, pulses, potatoes) between hyv Aman and hyv Boro.
- Reduced crop damage in Kharif I (pre-monsoon) and in Kharif II (monsoon) seasons.
- Additional land available for cropping where shallow swamplands (beels) are drained.

ii. Impact on Fisheries

94. Impacts of drainage improvement works on fisheries are as below:

- Reduced production of open water fisheries, both capture and cultivated, in the subproject area due to reduction of habitat,
- Re-excavation of drainage khals increase their depths of the khals and may increase water storage and thereby may improve fisheries habitat. However, impact of this on production is likely to be insignificant.

b. Tidal Irrigation Subprojects

95. Tidal Irrigation subprojects are limited for the areas where tidal water is fresh and suitable for irrigation. These subprojects are designed to re-excavate silted up tidal khals to increase availability of tidal water in the khals for irrigation use. Re-excavation increases flux of tidal water in the khals and also extends propagation of water more inland so that more area comes under irrigation. Tidal khals may be independent with branches that spread water up to certain points along their lengths or may form interconnected network when the whole khal system area gets water. The re-excavation may also benefit drainage. These subprojects have impact on both agriculture and fisheries.

i. Impact on Agriculture

96. Tidal irrigation subprojects, by way of increasing availability of water for irrigation, increases cultivation of Rabi crops – pulses, oil seeds, water melons and irrigated hyv Boro rice crops in extended areas.

ii. Impact on Fisheries

97. Re-excavation of tidal khals enhance fisheries habitat and increases open water capture fisheries.

c. Flood Management Subprojects

i Full and Partial Flood Management (FM) Subprojects for Areas of Different Water Regimes

98. Flood is usually related with monsoon season but in some areas, in the context of crops grown, flood during pre-monsoon season is critically important. Also flood regime, either monsoon or pre-monsoon, is different in different areas. Accordingly, two kinds of Flood Management subprojects are used based water regime and/or season.

99. **Full Flood Management Subproject:** Full FM subprojects use high embankments designed to protect Aus and Aman rice crops of the subproject area from monsoon floods. These subprojects are suitable for relatively shallow flooded areas and areas along flashy rivers. Also, in tidal areas where protection from saline water is required, full flood management subprojects are to be used.

100. Full Flood Management subprojects are generally not possible in deeply flooded areas because there is no drainage from the subproject area during the whole monsoon season (June-October) and accumulation of all rainfall during these months builds water such that cultivation is not possible. Under these conditions pump drainage is required for effective full flood management. Pump drainage is expensive, complex and not appropriate under SSWR development.

101. **Partial Flood Management Subprojects:** In deeply flooded areas like the Haors of greater Sylhet and Mymensingh and lower flood plains of big rivers, protecting HYV Boro rice crop from pre-monsoon floods is only important. In these areas and for this purpose, submersible embankments are used that protect subproject areas from pre-monsoon floods only and, as harvesting is done safely, get submerged as monsoon water builds high. These are called Partial FM subprojects.

ii. Impact on Agriculture

102. The Full Flood Management subprojects have two-fold positive impact on agricultural production: (a) Damage to crops due to flood is reduced, and (b) Land types changes as a result of reduced flood depth. Reduction in flood depth is assessed by the difference between the present (pre-subproject) and future (post-subproject) water levels.

103. The Partial Flood Management subprojects impact agricultural production by (a) saving 'nearly mature' to 'ready to harvest' crops from damage by submergence due to flash flood in outside rivers, and (b) reducing inside water depth. However, these subprojects cannot cause any land type change because there is no change in monsoon water level due to the subproject.

104. Present crop damage due to flood is estimated based on the crops grown in the area of the subproject that lies below the (a) 1:10-year pre-monsoon flood level for partial FM subprojects, and (b) 1:10-year monsoon flood level for full FM subprojects. These areas are calculated by using the water levels and the area-elevation–storage relationship data of the subproject document.

105. Estimation of land type change in full FM subproject is done by computing the (a) present (pre-subproject) land types of the subproject area considering 1:10-year HFL and (b) post-subproject land types by considering the design Monsoon Basin WL of the subproject, and taking the difference between post-project and pre-project values of respective land types. An example of involved calculations using the Spreadsheet Design Program is shown in ***Annex G4-IA: Engineering Annex, Appendix G4-IA.B, Section B2.A2*** (see also paragraphs on *Area-Elevation-Storage* and *Land Types Changes* above).

106. The pre-project and post-project WLs at the subproject that are criteria for agricultural analysis by seasons – pre-monsoon and post-monsoon and by subproject type – partial or full flood management are shown in ***Table III-1*** below.

Table III-1: Pre-Subproject and Post-Subproject WLs for Agricultural Analysis

Item	Pre-Project WL	Post-Project WL		
	Description	Description	Approximate Estimate	Detail Analysis
Pre-Monsoon Flood Protection with Submersible Embankments in Haor Areas (Land Type will not change)				
Pre-Monsoon Design	1:10-year May HFL in outfall river (at SPsite)	Design Basin WL generated by pre-monsn	May [(Mean Max WL +	Basin Water Level determined from routing of the Pre-Monsoon Design

Item	Pre-Project WL	Post-Project WL		
	Description	Description	Approximate Estimate	Detail Analysis
Flood Level		Design Storm (5-day, 1:10-yr storm rainfall)	Mean Min WL)/2+0.3]	Storm using a Drainage Rate that correspond to project acceptable crop damage criteria.
Pre-Monsoon Flood Protection with Submersible Embankments in Other Areas (Land Type will not change)				
Pre-Monsoon Design Flood Level	1:10-year Jun HFL in outfall river (at SPsite)	Design Basin WL generated by pre-monsn Design Storm (5-day, 1:10-yr storm rainfall)	Freshwater Tidal Areas Jun [(Mean Max WL + Mean Min WL)/2+0.3] Non-Tidal Areas: June Mean WL + 0.3m	Basin Water Level determined from routing of the Pre-Monsoon Design Storm using a Drainage Rate that correspond to project accepted crop damage criteria.
Monsoon Flood Protection with High Embankments (Land Type will change according to Post-Project Basin Water Level)				
Monsoon Season Design Flood Level	1:10-yr Annual HFL in outfall river (at SPsite)	Design Basin WL_generated by monsoon Design Storm (5-day, 1:10-yr storm rainfall)	Tidal Areas: Jul-Aug[(Mean Max WL + Mean Min WL)/2+0.3] Non-Tidal Areas: July- August Mean WL+ 0.3 m	1. Outfall river WL permits drainage: Basin Water Level determined from routing of Monsoon Design Storm using a Drainage Rate that correspond to project accepted crop damage criteria. 2.Outfall WL does not permit drainage: Basin Water Level determined from monthly Water Balance analysis. (ref: Para 88).

Notes: 1. The "Approximate Estimate" of post-project Basin WL may be used at prefeasibility analysis.
2. Basin WL determined by "Detail Analysis" should be used in feasibility analysis.

107. The design Monsoon Basin WL of a subproject is most appropriately estimated by a flood routing analysis for the monsoon months, June to October. This requires 1 in 10 year daily rainfall inside the protected area and 1 in 10 year daily water levels of the outfall river for the whole period – June to October. The flood routing analysis is then done as a water balance calculation exercise with the simple relationship – *'day inflow less evapo-transpiration'* minus *'day outflow' equals* '*change in basin storage'*. In practice, however, water levels of a particular year of which the max WL is equal or closely equal to the computed 1 in 10 year HFL value are taken. Similarly, daily rainfall data of the particular year of which the total rainfall equals or nearly equals to the computed 1 in 10 year annual rainfall are taken. The computation can be done using a Excel Spreadsheet Program.

108. To reduce computational works, an approximate flood routing analysis may be done by using 10-day steps of analysis instead of the daily and using average 10-daily WL and rainfall values.

109. When outside water level is high allowing no drainage, monsoon basin water level for full FM subprojects may be determined by accumulating total rainfalls of June to October months less by evapo-transpiration during this period and converting this depth of runoff from the whole subproject area into volume [(total rainfall less total evapo-transpiration in

mm) x (drainage area of subproject in hectares)] of water in storage in the basin that gives the basin water level when applied on the area-elevation-storage data of the subproject..

110. Though full FM subprojects usually cause change in land type, it may be at times that land type change is not significant. It is usually considered that if difference between pre-subproject and post subproject water levels is 0.3 m or less, the subproject is considered to produce no land type change. However, the high embankment subprojects under such condition will also benefit the subproject area by protecting crops from higher than average monsoon floods (1in 5 year, 1in 8 year, etc) under proper flood management by closing and opening gates with rising and falling outside water levels (this is one mode of fish friendly gate operation in FM subprojects).

111. Estimate of crop damage due to floods made from areas inundated under the criteria WLs may be in error due to incorrect estimation of flood levels and/or subproject ground topography. To avoid such error, the calculated crop damage due to flood should be cross checked by using primary agriculture data collected from field (refer ***3.3 Agricultural Analysis*** in this document).

iii. Impact on Fisheries

112. While reduced flood level resulting from Flood Management subprojects has positive impact on agriculture, it has negative impact on fisheries. However, the bases for estimating the impacts are different. While the flood protection *agricultural benefit* estimates include protected land defined by 1:10-year flood level, which is derived from extreme-short duration peaks that damage crops, the *fisheries damage* refers to flood plain area that is used by migrating fishes as grazing ground for longer time during flood season.

113. For seasonally flooded land to be considered as fish grazing ground it has to remain inundated for a reasonable period of time. To eliminate any short duration inundated land, the floodplain fisheries have been defined as land that is inundated by annual average flood to more than 0.90 m depth, which corresponds to agricultural land types F2 and F3. The criteria for estimating changes in flood plain areas due to subproject intervention are given in ***Table III-2*** below.

Table III-2: Pre-Subproject and Post-Subproject WLs for Fisheries Analysis

Item	**Pre-Subproject Habitat**	**Post-Subproject Habitat**		
	Description	**Description**	**Approx Estimate**	**Detail Analysis**
Partial Flood Management Subprojects with Submersible Embankments (monsoon flood plain area will not change)				
Present Floodplain Fish Habitat	Depth of flooding from average monsoon HFL (1:2.33-yr Annual HFL) more than 0.90 m. [present area of F2 +F3 lands]	Depth of flooding from average monsoon HFL (1:2.33-yr Annual HFL) more than 0.90 m. [present area of F2 +F3 lands]	No change	Determine impact of disruption of fish migration in April - June on annual fish production from field data.
Full Flood Management Subprojects with High Embankments (Flood plain fish grazing area will change according to effective basin water level)				

Present Floodplain Fish Habitat	Depth of flooding from average monsoon HFL (1:2.33-yr Annual HFL) more than 0.90 m. [present area of F2 +F3 lands]	Depth of flooding from Design Basin WL more than 0.90 m. [post-subproject area of F2 +F3 lands]	Change	Calculated from Area-Elevation-Storage relation corresponding to WL= Design Basin WL – 0..9m [Post subproject area of F2 + F3 lands]

d. Water Conservation Subprojects (including Rubber Dam Subprojects)

i Impact on Agriculture

114. It is assumed that all water retained by a hydraulic structure is available for irrigation of HYV Boro rice crop within the area of influence of the water body – khal or Beel. The benefited area is evaluated by determining the amount of land that can be irrigated by the available water considering the required depth of irrigation water application at the subproject.

115. Irrigation may be done by gravity and/or lifting water by LLPs or other means. Assuming that water from the khal including branch khals, if any, or Beel can be taken up to about 250m by earthen field channels and to some more distance, say 350m, by using lay-flat hose pipes, the width of command area would be 500 – 700 m considering both sides of the khal or Beel. This strip of command area is assumed to extend along the length of the khal and branch khals up to the point where bed level of the khal equals the maximum water retention level. This area may be defined as the gross command area whereas the net command/benefited area will be determined from water availability consideration.

116. For Rubber Dam subprojects, storage water volume is usually larger and organized irrigation schemes are set along the river by pump owners who lift and distribute water to farmers' plots under their own management and collect project specified service fees from farmers on irrigated land area basis. Here, irrigation water can be taken further inside compared to individual farmers efforts. Accordingly, benefitted area may simply be calculated based on available quantity of water, including return flow from irrigation fields, and crop water requirement.

117. Beside what water was initially stored and available from the dry season flow of the khal/chhara, return flow from irrigation fields (irrigated either by water from this storage or by groundwater) in the catchment area contributes to the storage. An estimate of possible irrigation return flow may be made using a thumb assumption of 15-20 percent of applied water.

118. In some areas, Aman rice crop suffers from long rainless periods, up to about three weeks, causing drought stress on the crop at its flowering stage. Water Conservation subprojects can support supplementary irrigation to Aman crop in such conditions.

119. In addition to providing water for dry season irrigation, water conservation subprojects increase residual moisture available within the soil profile. This can facilitate cultivation of early rabi crops, though for the purpose of the impact analysis, this benefit is difficult to quantify and thus not factored into the overall benefit analysis.

ii. Impact on Fisheries

120. Usually, gated water retention structures and Rubber Dams with low inverts at bed levels of khals/rivers are built in water conservation subprojects. Fixed weirs of elevated sills are also constructed in some subprojects, though rarely because of their inherent characteristic of obstructing monsoon drainage and causing higher flood level in the upstream. The weirs overflow for drainage and remain submerged under monsoon water.

121. The gated water retention structures and Rubber Dams remain fully open during pre-monsoon and monsoon and as such have practically no impact on monsoon habitat and migration/movement of fisheries. These subprojects, on the other hand, improve post-monsoon to dry season habitat of fisheries in khals/rivers and beels for a few months through storage of water for irrigation. Impact on fisheries production due to this has not been significant. However, there is significant potential of fisheries production in Rubber Dam reservoirs, compared to other water retention structures, as the reservoirs are usually bigger.

122. The elevated sill weirs obstruct pre-monsoon to early monsoon migration/movement of fishes and thus have some adverse impact. However, the migration/movement opens up in monsoon as the dams get submerged and, in post-monsoon to dry season, habitats in the khals and beels improve.

e. Command Area Development (CAD) Subprojects

i. Impact on Agriculture

123. The command area development subprojects include rehabilitation of existing and construction of new / additional infrastructure for water distribution within irrigation systems. The direct impact of CAD subprojects is reflected by additional cultivable area brought under irrigated agriculture and/or improved water availability for timely irrigation that improves yield.

124. The indirect impacts of CAD subprojects are increased efficiency in use of irrigation water and improved water management, which result in reduced cost of crop production.

ii. Impact on Fisheries

125. CAD subprojects usually have no impact, either positive or negative, on fisheries. However, in dry areas, some people are seen to excavate ponds for fish culture based on drawing water to their ponds from the irrigation system. The impact is not seen as significant.

3.2.7 Determination of Subproject Benefited Areas for Different Subprojects

a. Drainage Improvement Subprojects

126. To determine the benefited area of a drainage improvement subproject it is necessary to establish (i) pre-subproject area affected by inadequate drainage and (ii) post-subproject area that remains affected by inadequate drainage (if any). The pre-subproject boundary of affected area should be demarcated on the subproject Index Map and measured. Water level corresponding to this pre-subproject affected area can be established from land elevation contour values along the periphery line of this area. The post subproject level below which lands cannot be drained would be given by design bed level of the drainage khal or sill level of regulator, if any, used to retain water in the khal or low water level of outfall river or khal that limits drainage. The boundary corresponding to this level can be drawn on the subproject Index Map with contour lines and measured. The difference between these two measurements gives the subproject’s benefited area. In case of drainage of lowlands, the area reclaimed from the uncultivable lowland may increase the benefited area. In case of new drainage khal excavation, the benefited area should include loss of cultivable land taken by the channel.

127. With the pre-subproject and post-subproject drainage affected water levels known, the area-elevation-storage relationship of the subproject can be used to calculate land types under both the water levels and the differences between land type figures give the benefitted areas by land types.

b. Tidal Irrigation Subprojects

128. Khals re-excavated for enhancement of tidal water availability for irrigation use may be independent single khal or with tributary branches. In such conditions, length of khal coming fresh under water supply determines the benefitted area with a strip width of 500-700 meters along the length of the khals. This length can be known from field information to what point water was reaching under pre-project time and from design condition to what point water will reach after re-excavation a per design. Tide cycle is approximately of 12 hours of which for six hours water in the khal will be in rising and for the next six hours water level remains in falling. It is complex to calculate how much water is available from a khal supplied by tides as it is related with re-excavated bed level of khal and LTL that is variable with time – days over the months and years. It can however be assumed in general that if the re-excavation provide about 500 mm depth of water below the LTL at the beginning of the khal, it may supply adequate water for irrigation of command area under it. The benefited area estimated as above will hold even some pumps go idle during low tides. Where the re-excavated khals form close network, the whole subproject area may be considered as the post project benefit area while the pre-project area would be noted from field information.

129. The benefited areas as outlined above if demarcated on the subproject Index Map and the range of land elevations in which the benefited area belongs is known from contour values, the land type distribution of the benefited area can be known.

c. Flood Management Subprojects

130. The 1:10-year pre-subproject annual flood level defines the upper limit of benefited area of full flood protection subprojects, while the design Basin Water Level defines the lower limit of benefited area. Difference between the two areas within the subproject boundary gives the subproject gross benefited area. This area may include cultivable land, homesteads, roads and other lands that are negatively affected by flood.

131. The subproject net benefited area refers to cultivable land and it should include only the cultivable land within the demarcated gross benefited area of a subproject.

132. The Subproject Index Map with land elevation contours and topographical futures of the area should be used for demarcation and measurement of benefited areas.

133. The above two water levels – the 1:10-year HFL and the design Basin WL if worked with the area-elevation relationship of the subproject area will provide land types under each WL and the difference will give the benefitted area by land types.

d. Water Conservation Subprojects

134. Water conservation subprojects develop water storage capacity in baors, beels and/or existing khals /rivers to increase availability of irrigation water by installing water retention or regulator structures or Rubber Dams to regulate outflow from and conserve water inside the subproject.

135. Water conservation subprojects are designed for irrigation by gravity or using LLPs. The extent of benefited area on either sides of the storage channel depends on the distance water can be conveyed by the system adopted by farmers - gravity channels, LLPs, etc. Assuming that water from the khal or Beel can be taken up to about 300-400 m by earthen

field channels (actual distance may differ), the width of command area will be 600- 800 m both sides of the khal or Beel. The meeting point of the design water retention level with the design bed elevation of the khal defines the longitudinal limit (distance) of the benefited area. Command areas of water conservation subprojects are defined by these widths and lengths.

136. However, net irrigated area under the subproject will depend on available quantity of water in the storage (including perennial flow from upstream) and irrigation water requirement (including supplementation from other sources like groundwater) in the command area lands.

137. The benefited areas as outlined above if demarcated on the subproject Index Map and the range of land elevations in which the benefited area belongs is known from contour values, the land type distribution of the benefited area can be known.

e. Command Area Development Subprojects

138. If a CAD subproject involves rehabilitation of a whole existing irrigation system the benefited area will include the whole subproject irrigated area. Most of the SSWR CAD subprojects are of this type. In case the subproject is only for expanding existing command area by constructing additional irrigation canals, etc the benefited area will be the only new or additional irrigated area.

139. Other cases may include rehabilitation of different components of the irrigation system like pumping station, main canals, secondary canals or cross drainage and other infrastructure. In such case the benefited area that will be considered for the work will depend on how much of the net subproject irrigated area is affected by the proposed works.

140. Net irrigated area of a CAD subproject (whole irrigation system) will depend on quantity of water available from the pump and irrigation water requirement of crops grown in the command area.

3.3 Agricultural Analysis

3.3.1 Introduction

141. The purpose of agricultural analysis in feasibility study of subprojects is to estimate the impacts of subproject on agriculture, that is, the difference between “present” and “future with-subproject” agriculture inside the subproject area. The impact, expressed in terms of increase in agricultural production that is finally converted into economic return from the subproject, is required to justify investment in the subproject. Cropping pattern in the present and future with-subproject conditions are assumed to be identical.

3.3.2 Data Requirement and Collection

142. The Agriculturist of FS Consultant Firm assisted by field surveyors, as required, will collect primary agricultural data for each subproject. Any project staff in agriculture at district level, if available, will monitor the field activities.

143. Data will be collected by using the standardized Field Survey Forms for Agricultural Data and Information given in ***Exhibit G4-E, Tables G4-E.1 through G4-E.6*** appended to this document. Project Consultants - PMO will organize short orientation course to explain the data collection forms and the procedure to follow in conducting the survey. Supplementary information, particularly, on future plans for the area should be collected from the office of Upazila Agricultural Extension Officer.

144. Primary data should be collected in three ways and cross checked in the field between sources as much as possible. Collection methods to be used are:

- farmer interviews,
- direct visual observation of subproject agriculture, and
- discussions with Sub-Assistant Agriculture Officers working in the subproject area at Union levels. .

145. Farmer interviews, following the standard Field Survey Forms will be taken in group discussions at different sites within the subproject area. The interviews will determine:

- present land utilization
- present crop patterns on various land types
- percent of area under each crop pattern
- extent of crop damage due to flooding in different seasons, drought, and pest
- date and area of crop damage
- yield levels under normal and damaged conditions
- percent of crop area under different methods of irrigation
- crop planting and harvesting dates
- application rates of fertilizers and manure
- labor and draught power use
- constraints to agricultural production
- suggestions as to the nature of the interventions required to resolve the constraints
- views on possible impacts of the proposed subproject infrastructure.

146. Three main secondary sources shall be used to augment and cross-check the collected field data:

Upazila Land and Soil Use Guide, Soil Resources Development Institute / Ministry of Agriculture 1991. Guides exist for all the project area Upazilas. Each guide includes an upazila map at a scale of 1:50,000 and provides information on soil associations, soil series, cultivated land type, present land use, limitation to crop production, opportunities for development, crop yield level, and type and status of soil.

District Reconnaissance Soil Survey, Department of Soil Survey (now SRDI), 1970s. This is a series of district guides. Each guide includes a map at scale of 1:125,000 and provides the same information as the upazila guide, though at a coarser resolution.

Agro-Ecological Regions of Bangladesh*, Report 2*, Land Resource Appraisal of Bangladesh, 1988 (UNDP report DBD/8/035). Includes a map at a scale of 1:750,000 and provides information on physiography, agroecological zones and sub-zones, drainage and physical properties of the soils.

147. In addition, Index Map of subprojects in Google image and in 4 inch to 1 mile topographic maps with contours will be used.

148. Findings of earlier studies / reports – Reconnaissance and PRA will be duly used in this analysis.

3.3.3 Agricultural Impact Analysis

149. The objectives and methods used for determining agricultural impacts of flood management, drainage and irrigation subprojects are:

- Establish crop patterns and production on each land type found within the subproject area.

- Determine the area on which flood damage occurs under present subproject conditions.
- Determine the changes in area under each land type based on new flood levels or on the provision of drainage improvement or irrigation corresponding to type of subprojects (refer: Sub-section 3.2.6, Para on benefitted land types).
- Predict changes in production levels by assuming that those cropping patterns presently found on a given land type would be found over the new area of that land type under post-project conditions. Yields are assumed to remain unchanged unless there is flood damage prior to the provision of the infrastructure. In this event, undamaged pre-project yields should be used in the post-project condition.
- In cases where supplementary irrigation is provided for the kharif II crops (mainly transplanted Aman), under pre-subproject (droughty) conditions, reduced yields should be used. With the provision of supplementary irrigation, normal yields are predicted.
- Where supplementary irrigation is provided concurrently with flood management and/or improved drainage, the post-project crop patterns on a given land type are a combination of pre-project crop patterns on the two or more land types from which the post-subproject land type is derived.
- In cases where winter season (Boro) irrigation is made available, irrigated crops, usually Boro hyv rice or Wheat should be incorporated into the crop pattern in accordance with the volume of irrigation water made available.

150. Crop budgets prepared for standard crops cultivated in SSWR subproject areas under conditions of “without” and “with” water management are given in the appended ***Exhibit G4-G: Economic Analysis, Table G4-G.7*** as reference. The crop budgets are based on (i) yield data and input use rates including labour and draught power standardized for each crop based on field survey data after verification with data from secondary sources such as Bangladesh Bureau of Statistics, (ii) farm gate prices of internationally traded commodities calculated using World Bank price forecast of July, 2016 and (iii) prices (2017) of local agricultural input and output products given by Department of Agricultural Marketing. However, as these are market sensitive data, each project will prepare a fresh crop budget for use in feasibility analysis of its subprojects. Further, it may be necessary to update project crop budget if component prices change significantly during project period.

3.4 Fisheries Analysis

3.4.1 Introduction

151. Purpose of fisheries analysis in feasibility study of subprojects is to estimate the impact of proposed subproject on fisheries; specifically, the difference between “present” and “future-with subproject” conditions. Because of limitations of generally available data, the state of fisheries in the “future-without subproject” is assumed to be the same as the “present”. This approach, in many areas should lead to fairly conservative estimates of fisheries impacts since in much of the region fish production has been declining, probably due to habitat loss from infrastructure development (including water resources) and over-fishing.

3.4.2 Data Requirement and Collection

152. Fisheries Specialist of the FS Consultant Firm will collect primary fisheries data. Any project staff on fisheries specialization, if available at the field level, will coordinate and monitor the data collection activities. Data should be collected using the standardized forms

for Fisheries Field Survey and Data Collection given in the appended **Exhibit G4-F**. Sources for primary data and information on fisheries in the subproject area and surroundings include:

- Group discussions with village leaders, representatives of Union Parishad, fishermen, and farmers.
- Direct visual observations of subproject fishery resources.
- Discussions with Department of Fisheries (DOF) officials working in the subproject area.

153. Secondary data are required to validate the primary data collected from the field and these should be obtained from the following sources:

- Fisheries Information Bulletin, Volume 3, No 1 Water Area Statistics of Bangladesh, Fisheries Resource Survey System, Department of Fisheries
- Fish Catch Statistics of Bangladesh, Department of Fisheries
- Fisheries Studies and Pilot Project, FAP 17, Final Report

154. To assess impact of a SSWRD subproject in the fisheries sector, the required data and information should include:

- List of open water fisheries inside and around subproject area;
- Area, condition and location of fisheries habitat inside the subproject
- Present area of culture fisheries and permanent open water fisheries inside the subproject area
- Estimated fish production in the identified fisheries
- Demarcation of present floodplain fisheries boundaries and fish migration routes/points shown on subproject planning maps (4” to 1 mile topo map and Google image)
- Dates of fish migration through the identified routes
- Fish marketing centers in the area
- Reaction of fishing community to the proposed works.

3.4.3 Analysis of Fisheries Impact

155. The fisheries impact analysis will comprise:

a. An assessment of subproject negative fisheries impacts, considering the "worst case" scenario, in terms of:

   - Habitat extent (floodplain area, seasonal and permanent water body areas in hectares) and duration (number of months flooded) estimated on the basis of pre- and post-subproject land types
   - Habitat quality (blockage of fish movement by embankments, closures, and water management structures, interruption (intermittent or permanent) of fish movement by proposed infrastructure)
   - Fish production, employment in fishing, and subsistence fisher nutrition

b. An assessment of potential positive impacts inherent in the basic subproject design such as improvements in habitat quality related to re-excavation of drainage khals; increased (compensatory) employment of landless laborers in agriculture

c. An assessment of the feasibility and potential impacts of any relevant add-on mitigating and compensating measures such as modifying structure designs and operating practices to minimize open water fisheries damage and measures to promote aquaculture.

d. An assessment of net fisheries impacts (subproject negative impacts + subproject positive impacts + add-on mitigation/compensation impacts).

156. The subproject impact on fisheries is a combination of impact due to changes in habitat area and changes due to reduction in catch per ha of habitat. Both of these are incorporated in the model for economic analysis of the subprojects.

157. Nominal quantification of pre- and post-subproject habitat extent (for various habitat types) is possible based on hydrological analysis of land type changes for FM subprojects. Drainage, tidal irrigation and water conservation subprojects will not have any land type change. Tidal irrigation and water conservation subprojects add some dry season habitat in khals.

158. Where better data is unavailable, fish catch on floodplains (land presently flooded throughout monsoon season, which corresponds to the area of F2 + F3 lands) can be assumed to be 50 kg/ha, and in permanent water bodies 220 kg/ha. In general, without mitigation measures, it can be assumed that flood management infrastructures reduce these values by 50%.

159. In case of drainage improvement by excavating and/or re-excavating drainage channels without any structure across the channel, post-subproject fish catch should be assumed to be equal to pre-subproject catch.

160. Fisheries budgets should be prepared separately for floodplain and perennial water bodies on the basis of per hectare habitat and the quantities and costs/prices used should be based on data from Department of Fisheries.

161. For floodplain fisheries, it can be assumed that:

- The pre-subproject level of effort is 30 person-days per hectare and it is expected to drop to 20 person-days per hectare under the with subproject scenario, mainly due to reduced fish yield. Nevertheless, it can be recognized that numerous variables affect the level of effort such as effective fishing days per year and depth of water body;
- Average fishing wage is assumed to be Tk 70 per person-day, which is comparable to farm labor (used in the financial analysis);
- No hired labor is used; all fishers are subsistence type and therefore labor value can be considered at zero, for the financial analysis;
- Gear and craft cost estimated at 10 and 5 per cent of catch value under pre-subproject conditions. This cost will be reduced by 50 per cent under post-subproject conditions;
- There will be no lease fee for floodplain fisheries; and
- There will be no costs associated with guarding the fishery.

162. For perennial water bodies, it is assumed that:

- Level of effort is 50 person-days per hectare (40 pd/ha with subproject);
- Average fishing wage is assumed to be Tk 70 per person-day, which is comparable to farm labor (used in the financial analysis);

- The perennial water bodies are generally leased to wealthier members of the community who do not provide their own labor and therefore all labor would be hired;
- Gear and craft cost was estimated at 20 and 10 per cent of catch value under pre-and post-subproject conditions;
- Lease fees per hectare under pre-subproject conditions are averaged to Tk 1000 per hectare of water body. The current fees should be reduced by 50 per cent in the post-subproject conditions (in proportion to the reduction of the catch); and
- Fees to guard the fishery should be included.

3.5 Social Analysis

3.5.1 Introduction

163. The overall objective of social assessment of subprojects is to assess whether a proposed subproject is *socially sound and institutionally viable*. This can be determined by assessing how broad-based is local public support for the subproject and if people agree to get organized in an association for the management of local water resources. And these will be judged by applying the following socio-institutional criteria on the various data and condition existing in the subproject area:

- More than 40% of the subproject benefited area is operated by landless share croppers and marginal or small farmers owning less than 1.0 ha of land.
- Local people must support the proposed subproject on the grounds that the subproject will benefit them.
- The beneficiaries must be willing to form a Water Management Co-operative Association (WMCA).
- Conditions for a feasible WMCA exist (no major social conflicts; affected area, number of beneficiaries and affected people, villages and Unions limited to a manageable size; community is not dominated by influential few individuals with different interests).

  The key persons (potential beneficiaries attending group discussion/interview) must commit themselves to paying before implementation 1.5% of the cost of structure and 3% of the cost of earthworks (5% for submersible embankment) toward annual O&M expenses.

3.5.2 Data Requirement and Collection

164. Data used in the analysis will be primary data collected from field. However, the field data will be checked with secondary data of the Bangladesh Bureau of Statistics (BBS) which would be available readily with Union Parishads and Upazila Statistical Offices. Extensive social and socio-economic data will be collected by the PRA study. FS Consultant will use data and information on social, socio-economic and women aspects from PRA report which forms ***Annex II*** of the Feasibility Report of the subproject. However, the FS Consultant will review those data before use and may undertake sample checks of the data using secondary sources and also at the field, if necessary.

3.5.3 Definition of Poverty Level

165. A poverty line will be drawn for the beneficiaries of the subproject by using the *Household Income Criteria*. The household income currently used in defining poverty line is Tk. 634 per person per month. As this is dependent on inflation rate, etc, the figure needs to be appropriately redefined for individual projects. In terms of family size, the household incomes are as below:

- less than Tk 1,900/- per month for a family of 3
- less than Tk 2,536/- per month for a family of 4
- less than Tk 3,170/- per month for a family of 5, etc.
-

166. In case of difficulties in obtaining reliable information about household income, the following criteria may be used to define the poverty level:

- Households cultivating own or leased land less than 0.2 ha,
- Landless person working as farm laborer or non-farm worker, and
- Household engaged in small fishing or petty business or service.

3.5.4 Analysis for Social and Socio-Economic Assessment

167. The analysis involves compilation and verification of field data to ensure that subproject criteria are being met and to ensure that there are possible solutions to local disagreements, if any. Where the required socio-institutional viability criteria given in ***Section 3.5.1: Introduction*** above is not met, or resolving of local disagreement is not possible, the subproject should be recommended for deferral.

168. The selection criteria concerning benefited land operation by landless to small farmers should be applied in its stated form. That is, only those proposed subprojects in which more than 40 per cent of benefited area is operated by landless sharecroppers, and/or marginal or small farmers (owning up to 1.0 ha) will be considered for recommendation regarding social viability.

169. The sections on social and institutional viability included in feasibility study of subprojects will draw upon field data and information on social and socio-economic profile of the benefitted population and on viability of the Water Management Cooperative Association (WMCA), collected under PRA study vide ***Exhibit G3-A, Forms G3-A.5 (social)*** and ***G3-A.6 (women)*** and provide succinct but clear analytical comments on the following issues in relation with subprojects socio-institutional selection criteria.

- Farm size distribution, land ownership, and household occupation of the landless,
- Poverty level and its assessment,
- Wage rates of farm and non-farm day laborers –both male and female,.
- Migration of laborers – in-migration and out-migration, male and female laborers
- Assessment of the present levels of involvement and cooperation of local people in local organizational / institutional activities,
- Assessment of the level of support or opposition to the subproject by interest groups inside and outside subproject area,
- Assessment of possible negative impact outside of subproject boundary, and occupational profile of negatively impacted people,
- Assessment of overall viability of the institution - Water Management Cooperative Association,
- Assessment of willingness of people of subproject area to form a multi-purpose cooperative society (WMCA),
- Assessment of willingness to pay an upfront contribution to the O&M fund of the WMCA before starting the subproject construction, and.

170. Observations/findings on Indigenous People[1], if present within or outside of the subproject and their comment about the subproject must be described elaborately.

3.6 Environmental Assessment, Planning and Management

3.6.1 Introduction

171. Projects for SSWR development comprise of a large number of subprojects that are identified, studied and implemented in a rolling process throughout the period of the project implementation and thus the subprojects that will be implemented are not known beforehand. However, by criteria, the subprojects must be small – less than 1000 ha benefited area, only involve rehabilitation of existing systems for improving water management to enhance agricultural and fisheries production. Accordingly, SSWRD projects and, for that matter, all SSWRD subprojects are in Category B (Orange) of the *Bangladesh Environment Conservation Rules, 1997* that are not likely to have significant adverse environmental impacts. The SSWRD projects are therefore given environmental clearance for implementation subject to the condition that environmental assessment of all subprojects under the project shall be done and copies sent to the DOE for review and clearance. Detail Guidelines for Environmental Assessment of SSWRD Subprojects are given in Document ***G5: Environmental Assessment of Subprojects***. Environmental feasibility analysis of subprojects required for the FS study will draw upon the above Environmental Assessment Report of the subproject which will be appended to the FS Report as ***Annex-III***.

3.6.2 Data Requirement and Collection

172. Data required to carry out environmental assessment includes data and information from the subproject area and also from adjacent areas outside the subproject. These include information and data that will be used as benchmarks for future impact monitoring. A general list of data required for environmental assessment is listed below. Recent field data and individual subproject designs should be used to carry out the environmental assessment. For collection of detail specific data the feasibility study Consultant will use the standardized forms developed through the past SSWRD projects - Questionnaire for Environmental Field Data Collection as shown in Document ***G5 Environmental Assessment of Subprojects, Exhibit G5-B.***

a. Data from inside the subproject area

On Physical Environment:	Flood, drainage/waterlogging, water quality, soil characteristics, soil fertility.
On Biological Environment:	Aquatic and terrestrial habitat, fisheries, biodiversity.
On Social Environment:	Agricultural development, land acquisition/loss, accessibility, employment, health/nutrition, community impact, cultural values

b. Data from adjacent area

Information on general environment:	dissimilarity/specialty in condition/ environment with the subproject area, if any.
On adverse impacts, risks:	Local people’s comment on these that may arise in their area due to the subproject implementation with suggested remedial measures.

[1] Working definition of indigenous peoples (by ADB): Indigenous peoples should be regarded as those with social or cultural identity distinct from the dominant or mainstream society, which makes them vulnerable to being disadvantaged in the processes of development.

On any possible positive impact:	Local people's comment on this that may come for their area due to the subproject.

3.6.3 Environmental Planning

173. Environmental planning refers to measures taken proactively to identify and avoid or address, early in the subproject cycle, environmental concerns including potential adverse impacts. Environmental planning activities should,

- address impact assessment & monitoring requirements to improve the overall subproject planning system and planning of some selected disciplines.
- explore environmental sustainability issues, and
- review and improve reporting for completeness, accuracy, and responsiveness to stakeholders.

3.6.4 Assessment of Environmental Feasibility

174. Specifically designed methods to obtain relevant information, based on the foregoing analysis, shall be applied for Environmental Assessment (EA). The objective of EA is to determine, on the basis of existing information, whether:

c. **Based on Initial Environmental Examination (IEE), enough is known to conclude that the subprojects' impacts are within acceptable limits and environmentally feasible.**

d. **Enough is known to conclude that subproject impacts are unacceptable and the subproject design must be modified or dropped, or**

e. **The existing information is inadequate to determine if impacts are acceptable. Therefore, a detail Environmental Impact Assessment (EIA) involving further field studies is required. In this case, the EA would include a TOR for the EIA focused on the areas of uncertainty or concern.**

175. The SSWRDP subprojects falling in (a) above shall be cleared to proceed. As there is no provision to undertake EIA, subprojects falling in (b) shall be deferred for further review for a modified design or be dropped. For the subprojects under (c), EIA will be conducted and depending on the outcome of EIA results, prepared in consultation with the subproject planners, the subproject will be either dropped or cleared to proceed.

176. The IEE/EIA procedures include the following steps. The details of conducting IEE or EIA are given in ***G5 Environmental Assessment of Subprojects.***

- Site reconnaissance and scoping of important environmental components (IEC).
- Collection of field information for IEE/EIA and data for impact monitoring.
- Analysis of impacts and preparation of IEE/EIA report including outline of environmental management plan (EMP).

3.6.5 Environmental Management

177. Environmental management refers to activities related to environmental performance of the subproject during construction and operation. Environmental management therefore relates to the preparation and implementation of mitigation, compensation, monitoring and institutional measures and reporting on their implementation and results. Environmental management activities include:

- Monitoring and improvement of enhancement and mitigation methodology packages formulated by discipline specialists.
- Formulation of additional enhancement and mitigation methods, for resources/concerns not addressed by other disciplines.
- Monitoring of subproject planning and design stage activities related to mitigation and enhancement procedures and measures.
- Preparation of preliminary environmental management plan (EMP) for individual subprojects, as part of EA. Detail implementation arrangements for EMPs shall be developed in consultation with WMCAs during subproject construction and operation.
- Follow-up on the implementation of proposed environmental management measures.

178. Implementing projects will prepare EMP for each subproject during IEE. The EMP used in the just completed JICA supported SSWRD Project (2009-2015) is given in ***G5 Environmental Assessment of Subprojects, Exhibit G5-G.***

3.7 Development and Institutionalization of Beneficiaries Participation

3.7.1 Preamble

179. The purpose of this section is to present a synoptic picture of beneficiaries' participation development initiatives and efforts continued along with the process of preparing the subproject from its identification to construction completion and handing over to the WMCA. The elements of beneficiaries' participation are common for all subprojects – that is these are not different depending on type of subprojects. Broadly, the elements can be divided into:

- Initial mobilization of beneficiaries through consultative participation,
- Institutional mobilization of beneficiaries and formation of WMCA
- Beneficiary Commitment to Operation and Maintenance

180. Beneficiaries' participation is an essential key aspect in developing SSWR subprojects because the subprojects will be operated, maintained and managed by the beneficiaries after their construction are completed. Experience from the implemented SSWRD projects has shown, as it should have been, that where WMCAs cared for it, the subprojects performed well. That is to say, development of a good and capable WMCA is as important as implementing technically good infrastructure for a subproject. Therefore, the activities related to beneficiaries participation development and institutionalization need to be conducted very diligently and persuasively.

3.7.2 Initial Mobilization of Beneficiaries through Consultative Participation

181. When the Union Parishad receives a request for a subproject from local farmers, the Parishad discuss the request in a meeting and prepare a subproject proposal in the specified ***Form-1*** and approach LGED Upazila Engineer for assistance for its implementation. The Upazila Engineer visits the area of the proposed subproject to assess the problems and proposed solutions. To do so, the Upazila Engineer discusses with local people of different classes, both inside and outside the area, to obtain their views about the proposed subproject. He specifically discusses people who might be negatively affected by the subproject.

182. When the LGED Upazila Engineer is reasonably satisfied that the subproject has both technical and social potential, he prepares technical documentation of the proposed

subproject in specified ***Form-2*** and submits to the Upazila Parishad for its consideration and approval.

183. In a meeting of the Upazila Parishad, Chairpersons of the concerned Union and other adjacent Unions and the representatives of the various development related government departments and agencies discuss the proposed subproject. After necessary amendments, if any are made, the Upazila Parishad approves the subproject proposal and it is sent to the District Executive Engineer, LGED.

184. The Executive Engineer reviews the proposal in the context of the district strategies for SSWR development and, if satisfied that the proposal contributes to the development objectives of the District, forwards it to the IWRM Unit of LGED in Dhaka for consideration under available development project

185. From the IWRM Unit, a technical reconnaissance of the subproject site by professional specialists are made when specialists of different disciplines discuss with local farmers and knowledgeable persons at field level to obtain views and opinions of the local stakeholders.

186. Upon recommendation of the reconnaissance team that the proposed subproject has potential for development, a PRA study is undertaken that involves a very extensive discussion with local people of all classes and communities in groups village to village. Objective of the PRA is to assess if there is wide based support for the subproject from local people and if there is any opposition to it from any section or group of people.

187. If the proposed subproject is recommended by the PRA study, a preliminary planning of the required physical works made and costs thereof are estimated, a preliminary assessment of benefits made and preliminary indices for economic viability checked. If the subproject appears, through this preliminary analysis or prefeasibility analysis, to be technically and economically promising, the beneficiaries and other stakeholders are consulted about the physical works that are being planned for the subproject in a large general ***Planning Meeting*** and agreement of the local people on the overall subproject planning obtained. With this agreement on subproject planning and the preliminary technical and economic viability, the Prefeasibility Report of the subproject is finalized and place to DLIAPEC for inter-agency clearance regarding duplication or overlapping.

188. It may be noted that up to this stage, participation of the beneficiaries and other stakeholders in the subproject matters are of consultative nature, not through any institutional platform, but are conspicuously tailored into the development process of the subproject in such a way that the participation is quite intensive.

3.7.3 Institutional mobilization of Beneficiaries and Formation of WMCA

189. As the subproject is cleared by the DLIAPEC, works on detail feasibility study as the *"technical process*" and on establishing institution for local stakeholders' participation as the *"institutional process*" commence simultaneously.

190. The objective of institutional process is to establish a Water Management Cooperative Association (WMCA) as an institution of the local stakeholders of the subproject under the legal framework of Cooperative Act in force in the country. The first step in the institutional process is to form a ***"Organizing Committee*"** and, through it, perform the initial organizing works - information campaigning for beneficiaries to participate in operation and maintenance of the subproject and forming the WMCA, setting up office with books and records, beneficiary listing, membership enrolment, opening Bank Account, and most importantly drafting Bye-Law for the WMCA and holding election of the first management committee of the WMCA.

191. The ***First Management Committee (FMC***) becomes the focal point for a number of key activities:

- Commenting on design of subproject physical works
- Membership enrolment
- Build WMCA capital by share and savings collection
- Appoint Accountant/Cashier and maintain accounts and records
- Apply and obtain registration of the WMCA
- Form Sub-Committees
- Prepare for General Election of the WMCA
- Collecting upfront beneficiary contributions for O&M.

192. It is expected that the WMCA formed through workings of the OC and FMC will be a broad-based and strong water management organization – a platform for all decisions on the management of the subproject. This will include resolving conflicts of interest between different groups that come up time to time. Registration of the WMCA and collection of upfront O&M contribution from the beneficiaries are the two critical activities that are the pre-conditions to signing IA to initiate construction activities of the subproject.

193. The Cooperative Act and Rules framed under it governs registration, supervision and management of operational, financial and legal administration of the WMCAs. Defining aims and objectives of the Association including the methods and manners to achieve them are left to the Association to be framed in a detailed Bye-Law of the WMCA to the extent that those are not contradictory to the provisions of the Act and Rules.

3.7.4 Operation and Maintenance Sub-Committee

194. After handover of the completed subproject to the WMCA, main responsibility of water management in the subproject with the help of the constructed physical facilities - khals, embankments, hydraulic structures (regulators, sluices, WRS, Rubber Dams, irrigation canals, buried pipe irrigation systems, etc) and maintenance of those physical facilities rest mainly on the WMCA. To discharge these two specific responsibilities, the WMCA will need a dedicated Subcommittee - the O&M Subcommittee which will be formed under provision of the Bye-Law of the WMCA.

195. The O&M Subcommittee will have 9 - 12 members with 3 members taken from the elected Management Committee of the WMCA. The remaining 6-9 members will be selected from amongst the general members. It is recommended that these members be selected one from each of the subproject villages for equity. Details of formation and functions of O&M Subcommittee is given in the Guidelines Document ***G8 Guidelines for SSWR Development: Operation and Maintenance of Subprojects.***

3.7.5 Beneficiary Commitment to Operation and Maintenance

196. The only objective for which all the pains and procedures for establishing a capable and performing WMCA are undertaken is that the Operation and Maintenance of the subproject would be good and the subproject would give its planned benefit to its beneficiaries. In real term, this will mean that the subproject beneficiaries and for that matter their institution – the WMCA will own the subproject and be committed for sustainable O&M of the subproject. The following steps will help the WMCA to become committed in this respect:

- Ensuring that the beneficiaries and later the WMCAs understand early in the subproject processing cycle that the subproject infrastructure would be formally handed over to them and that routine operation and maintenance including costs thereof will be their responsibility.

- Obtaining from subproject beneficiaries, formal commitment to contribute in cash and in kind to routine operation and maintenance costs. These commitments are ensured in the IA signed by WMCA, and Executive Engineers, LGED. The O&M costs are currently estimated at 3% for earthworks and 1.5% for structures costs of the subproject. The cost figures is also included in the IA..
- Involving the beneficiaries and obtaining their satisfaction about planning and design of the subproject's component structures.
- Providing the WMCA with copy of Document "**G8 *Guidelines for SSWR Development: Operation and Maintenance of Subproject Infrastructure***" as an all time reference book on operation of water regulating structures of the subproject and conducting routine annual and periodic maintenance of the subproject infrastructure – embankment, khal and hydraulic structures.
- On completion of the subproject works, WMCAs are to be provided with elaborate trainings, referring to the Guidelines Document G7, on operation of the hydraulic structures (opening and closing gates based on water levels on both sides to maintain an optimum water level inside the subproject) and maintenance of subproject infrastructure (assessment of required maintenance and estimate of cost, collection of fund and doing the works in time).
- The WMCA is provided with a *O&M Plan of the subproject* prepared by the FSDD Consultant that includes basic operation schedules of the gates of all hydraulic structures of the subproject over the crop seasons of a year and dimensions and other parameters of different physical works that form basis of estimate of possible maintenance works. The WMCA will need to update and adjust the schedules of operation of gates and actual maintenance needs on the basis of above O&M trainings they receive, experience from 1-year joint O&M with LGED and actual on-field requirements.
- There is provision for a LGED-WMCA joint O&M of each subproject after its hand-over to the WMCA. This provides the WMCA with a sort of on-the-job training on O&M of the subproject.
- Assisting the WMCA in the preparation of agriculture and fisheries development plans. SSWRD projects usually provide Agricultural and Fisheries Facilitators at Districts to provide necessary technical assistance to WMCAs and also to local LGED offices.
- After the project is closed, WMCAs will receive technical support from Upazila Officers of DAE and Fisheries Department with cooperation from LGED.
- Planting trees on embankments, which provide some protection to embankments from erosion as well as resources for generating some income to the WMCAs and the care taking poor women of the locality.

3.8 Gender Perspective in SSWRD Subprojects

197. As SSWRD subprojects are related to water and agriculture, women have sufficient scope to contribute in subproject matters. SSWRD projects envisage that at least one-third of members of the WMCAs, both general members and members of the Management Committees, should be women. Local stakeholders should encourage womenfolk to become general members of the WMCA and, in particular, family-head women should come in the MC of the WMCAs. LGED field officers and project staff, when available, will assist the stakeholders in this respect..

198. To encourage women's participation in the subproject matters, women members should be included in the Organizing Committee.

199. The principle of equal employment opportunity will be followed in all matters of the subproject and WMCA. Equal wages for the same work and equal scope of working in LCS will be followed.

200. Special training program shall be arranged for women members of WMCAs to start income generating activities that will help rural women to raise family income. The women beneficiaries may get training on seed production and processing, poultry farming and processing, seasonal vegetable production, pond fish culture, etc. WMCA would be encouraged to provide micro-credit to the trained women for IGA.

201. WMCA will ensure that poor women groups are engaged in maintenance works of subprojects like embankment maintenance, caretaking of tree plantations, etc.

3.9 Financial and Economic Analysis

3.9.1 Introduction

202. Each subproject shall be subjected to both financial and economic analysis to:

- Determine potential impact of the subproject on local economy.
- Establish potential impact of the subproject on national economy.

203. The procedure and model used in economic analysis of subprojects of LGED's earlier SSWRDPs are based on Guidelines of Asian Development Bank for Project Appraisal, 1996 and the same shall continue to be followed for financial and economic analysis of subprojects under future projects unless improvements are specifically justified.

204. The economic appraisal model uses a Microsoft Excel Spreadsheet Program containing macros and user assistance dialogues as required. The Program's input requirement is data on costs including O&M costs, land use, socio-economics, agriculture, fisheries, other subproject approval requirements and its outputs are tables and chart displays including sensitivity analysis of the computed IRR.

205. The subproject appraisal Program is available with IWRMU (P&D Section) and PMO-Project Consultants of ongoing projects. FS consultant firms of ongoing projects are also provided with the program for use in their works.

3.9.2 Investment Costs (financial)

206. Investment cost of subprojects are broken down into the following categories:

- Engineering works
- Ancillary facilities
- Supporting works
- Physical contingency
- Price contingency
- Administration and Engineering

207. Physical works that result from engineering analysis and feasibility level design shall be estimated by using the LGED Schedule of Rates in force to derive the cost of engineering cost. The engineering works will generally include items such as hydraulic structures (regulators, sluices, water retention structures, Rubber Dams, weirs, aquiducts, syphones, irrigation canals(pucca), buried PVC irrigation pipelines, etc), other structures (WMCA Office buildings, culverts, bridges, etc), earthworks associated with constructing embankments,

excavating drainage khals, etc. Costs of these main works may be guided by unit costs - cost per km of khal or embankment or buried irrigation pipelines, cost per unit of regulator/sluice/WRS of required sizes (1-vent, 2-vent, etc) that can be obtained from MIS for the recently completed projects. Nevertheless, adjustments to the above derived costs based on engineering judgement of the conditions of the concerned subproject will be necessary.

208. If design of works (sections of khals and/or embankments, sizes of regulators, sluices, WRS, etc) are desired for more realistic estimate of costs, Spreadsheet Design Programs available in Guidelines Document ***G6: Detail Design of Subproject Structures*** may be used to have the designs done.

209. As a yet another alternative to have feasibility level design of structures, design Tables have been reproduced from the previous *Standard Design Catalog* (not in use now) and given in ***Exhibit G4-H.***

210. Ancillary facilities include costs associated with subproject components such as buildings, equipment and machinery, and land acquisition. Costs of these works shall be based on engineering estimates.

211. The costs of supporting activities for agriculture, fisheries, livestock, socio-economic, and economic development and extension programs/services including demonstrations are estimated at 3% of the total costs of engineering works and ancillary facilities. Physical contingencies are estimated at 7% of the total base costs. Price contingencies are estimated appropriately based on the current rate of inflation (in recently completed/ongoing SSWRD Projects, 5% price contingency were used). Administration & Engineering design costs are estimated at 5 % of the total base costs.

3.9.3 Operation and Maintenance Cost (financial)

212. Costs estimates for operation and maintenance include provision for engineering works as well as ancillary facilities. Annual operation and maintenance costs shall be estimated at:

- 1.5% of structure cost,
- 3% of earthworks cost,
- 5% of submersible embankments cost,
- 10% of fish screen (made of bamboo) cost,
- 7% of equipment cost,
- 0.5% of total cost (as miscellaneous expenditures).

3.9.4 Economic Costs

213. Conversion factors to convert financial costs of usual investment cost components into economic costs are given in the appended **Exhibit G4-G, Table G4-G.2.**

3.9.5 Crop Budgets

214. Financial prices for agricultural inputs and outputs are initially derived for the Project area by averaging district-level prices provided by Directorate of Agricultural Marketing, Ministry of Agriculture and adjusted with field prices during study of an upcoming project.

215. Calculation of economic farm gate prices of internationally traded imported and exported commodities are shown based on prices of inputs and outputs in ***Table G4-G.4***. For non-traded commodities, economic prices are calculated by using conversion factors adopted from recent studies of water resources development projects that are conducted

using Flood Action Plan Guidelines for Project Assessment. **Exhibit G4-G, Table G4-G.3** gives such conversion factors which can be used for locally traded commodities.

216. Based on the above, conversion of financial prices to economic prices of agricultural inputs and outputs are given in ***Tables G4-G.5*** and ***G4-G.6*** respectively of the appended ***Exhibit G4-G***. Upcoming projects will update the figures in the Tables as would be needed.

217. Based on the financial and economic prices of agricultural inputs and outputs from above Tables and yield and input use data of different crops given in ***Table G4-G.1 (***part ***A*** and part ***B)***, standard crop budgets on per hectare basis is shown in ***Table G4-G.7*** (part ***A*** and part ***B***) of the appended ***Exhibit G4-G***. Upcoming projects will update figures in the Tables using respective field data and secondary data of the time concerned.

3.9.6 Fisheries Budgets

218. Fisheries budgets have been prepared for capture fisheries in perennial water bodies and in floodplains. Pond aquaculture is judged not to be significantly influenced by the investments under the Project and should not be in the analysis. Basis for fisheries analysis are given in ***Section 3.4.3.*** Details of economic analysis based on 1 ha fisheries are provided in ***Table G4-G.8a*** for perennial water bodies and ***Table G4-G.8b*** for floodplains in ***Exhibit G4-G***. The pre-and post-subproject financial and economic unit values corresponding to the given yields are shown below which is the output format of fisheries production in the economic analysis model. The model will calculate production values with input of project specific area data.

	Pre-Subproject						
				Unit Value		**Production Value**	
Habitat	**Area (ha)**	**Yield (kg/ha)**	**Production (t)**	**Financial (Tk/ha)**	**Economic (Tk/ha)**	**Financial (Tk)**	**Economic (Tk)**
Floodplain (F2+F3)	0	50	0	2,275	68	0	0
Perennial Water Bodies	0	220	0	2,250	3,601	0	0
Totals	0		0			0	0
	Post-Subproject						
				Unit Value		**Production Value**	
Habitat	**Area (ha)**	**Yield (kg/ha)**	**Production (t)**	**Financial (Tk/ha)**	**Economic (Tk/ha)**	**Financial (Tk)**	**Economic (Tk)**
Floodplain (F2+F3)	0	25	0	1,138	-284	0	0
Perennial Water Bodies	0	110	0	-240	845	0	0
Totals	0		0			0	0

219. Financial prices for fish products, as well as operating costs and labour are based on field data collected for the project studies and review/optimized by PMO-Project Consultants. Since these are not internationally traded commodities, the conversion to economic prices was made using standard conversion factors of 0.87 for fish products and operating costs, and 0.75 for labour.

3.9.7 Assumptions in Financial and Economic Analysis

220. The financial and economic analyses are based on a number of assumptions. The key assumptions are:

- Subprojects have a life of 30 years (including construction). The “present” and the “future without subproject” conditions of the subproject areas remain the same.

- Full post-project benefits are achieved within three years of completion of subproject infrastructure (phasing 50%, 75%, and 100%).
- Indirect benefits are not included in benefit stream.
- The exchange rate of US Dollar is taken as the IP rate existing in the Bank's auction market during project study. This may be reviewed from time to time. This exchange rate is assumed to represent real opportunity costs of capital.

3.9.8 Appraisal Model's Output Tables and Charts

221. With the requisite inputs of costs and benefit elements based on discussions in the foregoing paragraphs, the model gives ***11 Tables*** and ***4 Charts*** as the results of financial and economic analysis and appraisal of the subproject. *Table-1, Chart-1* and *Table-2, Chart-2, Chart-3* depict respectively Land Types and changes in Land Use in the subproject while *Tables 3 to 10* presents financial and economic analysis including cash flow and FIRR and EIRR for the assumed 30-year life period of the subproject.

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EXHIBITS

Exhibit G4-A:
PROCEDURE FOR FIELD INVESTIGATION AND PREPARATION OF PREFEASIBILITY REPORT BY FEASIBILITY STUDY CONSULTANTS

A. PREPARATION FOR FIELD INVESTIGATION

1. Prior to field investigation of a proposed SSWRD subproject the WR Planning Engineer, as the Team Leader of the FS Consultant Team, must have completed the following:

- Review subproject proposal
- Obtain primary information of the subproject – Form-1, Form-2 and Form-3 along with the GIS based preliminary subproject Index Map from PMO. The Index Map may be checked for the subproject boundaries and improved by adding land elevation contour lines from 4" to 1 mile irrigation planning maps. This preliminary subproject Index Map will be used in the field investigation;
- Identify the nearest relevant Water Level stations and determine statistical and historic water levels at the subproject site;
- Check the problems stated in the subproject proposal and pre-screening reports against the topographic and hydrologic data (ground elevations from the contour map and the available water level data);
- Review the proposed type of interventions and possible extent of solution to the problems;
- Check possible impacts of the interventions i.e., elimination/reduction of pre-monsoon or monsoon flood, improvement of drainage – pre-monsoon / early monsoon drainage or removal of post-monsoon water logging, improvement in water availability for irrigation or irrigation facilities;
- Demarcate on the above Subproject Index Map the preliminary subproject gross benefited area. The benefited area may include area presently affected by flood, prolonged inundation, water logging or irrigated area including new area likely to come under irrigation. Depending on the subproject type the gross benefited area may or may not coincide with the subproject area or catchment area.

2. On completion of the above tasks, the WR Planning Engineer should apprise the other team members - Agronomist, Fisheries Specialist, Sociologist and Environmentalist the preliminary information about the subproject in group meeting:

i. Present conditions (topography, existing infrastructure, water management conditions and problems)

ii. Proposed interventions, and

iii. The expected impacts.

Each team member should take note of the above information and have copies of the preliminary Subproject Index Map and other relevant information – Form-1, Form-2 and Form-3. The Sociologist/Socio-economist will use a copy of Upazila Base Map for identification of the subproject villages and mouzas which are identified by J.L. No. (Jurisdiction List Number). If necessary the team members should be given time to collect necessary secondary data and prepare for the subproject field inspection. In case of the first field investigation visit of the team or several members of it, the team may seek a brief orientation from the PMO-Project Consultants.

3. For efficient use of time and to have better interaction, it is advised to conduct the field investigation by the team jointly. However, in the field, some member like the Sociologist and environmentalist may conduct their own program - holding group discussions etc separately. Usually, a 2-4 days time would be required for the field investigation depending on size and complexity of the subproject.

4. The FS Consultant's field inspections should follow standard rules and procedures, which should be known to all the involved parties and individuals; these are as follows.

i. The Consultant informs the LGED District Executive Engineer, with sufficient lead time, by telephonic discussion and followed by FAX message, the following information:

- Date of inspection (provide day and hour of arrival at the Executive Engineer's office)
- Name of subproject(s) to be inspected with names of Upazilas and Unions
- Name of Consulting Firm
- Names and designations of the inspection team members
- Additional information about the subproject that the team may require from the District LGED Office prior to commencement of the field inspection and assistance like accompanying staff, etc.

The above information should also be given to the Upazila Engineer by phone. The followings are expected to happen in follow up:

i. The Executive Engineer informs the Upazila Engineer about the Consultant's field inspection and instructs concerned district level project staff (Water Resources Engineer, Community Participation Officer) to collect necessary documents and be ready to accompany and assist the Consultant team.

ii. The Upazila Engineer instructs Upazila level project staff (if available) and CO to make preparations for the Consultant's field visit and accompanying them.

iii. The project staff work together and organize presence of Union Parishad Chairperson and Members of the area during visit of the Consultant team.

B. CONDUCTING FIELD INVESTIGATION

Courtesy Meeting at Local LGED Offices

5. On arrival at the District, the multidisciplinary field investigation team of consultants will have a short courtesy meeting with the Executive Engineer, LGED and District level project staff (WRE, CPO). The team will explain the purpose of the visit and seek for support as may be necessary. The project staff will accompany the team.

6. At the Upazila Office, the Consultants team accompanied by District level project staff will discuss Upazila Engineer and his staff about their investigation program. The Upazila level project staff (SAE/Construction Supervisor) will attend the discussion and join the field works.

Subproject Field Investigation

Objective of the field investigation is to verify the existing problems, which are listed in the subproject proposal, to identify new/additional problems if any, and to obtain more refined information and data that will be useful in conducting feasibility analysis and design of the subproject.

7. The investigation should start at the lowest point in the subproject area; the outfall channel or structure point in drainage and flood management subprojects. Starting field inspection from the lowest point will allow immediate verification of flood problems, which should be most serious in the lowest area and less serious or diminish in upper areas.

8. The WR Planning Engineer verifies in the field the subproject catchment boundary by walking around the subproject boundary previously defined from the maps. Any culverts and bridges must be marked on the Index Map with dimensions and direction(s) of flow, depth and dates of maximum and minimum flows.

9. The Consultant team members will interview people at suitable locations to obtain specific data and information according to their disciplines. It is important that the Consultant's team members introduce themselves to every person they ask questions.

10. The Sociologist and Fisheries specialist will interview people and collect information from selected villages and households using the Fisheries Questionnaire. The Fisheries Specialist should ask people about existence of open water fisheries like flood plain fisheries, which is defined by more than 0.9 m depth of flooding. This information is vital for cross checking with agriculture and engineering conditions.

11. The WR Planning Engineer and Agronomist will ask farmers inside and also outside of the subproject, about the current problems and their ideas about possible solution:

- The Agronomist collects information about cropping patterns, yields and constraints like crop damage by floods and drought. He should note dates of floods and mark on the map extent of floods, water logging and drought affected areas.
- The WR Planning Engineer collects information about water related problems, their causes, origin and possible solutions.

12. There are 3 basic types of water related problems:

- Flood
- Drainage, and
- Drought or shortage of water

Depending on topography and hydrological conditions these problems can appear as a single problem or as a combination of two or all the three problems.

13. For efficient use of resources, the collection of field information should be grouped into the following three categories of problems and the questions asked should be specific.

Investigation of Flood Problems

Flood management subprojects require rehabilitating/upgrading/construction of embankments or road-cum-embankments and construction of regulator/sluice structures to check flood inflow and drain excess water (local runoff from rainfall) from the protected area. In SSWR subprojects regulator / sluice structures are integral part of a FM intervention.

<u>Extent and levels of floods</u>

14. The term Flood refers to inundation of land by water of external or mixed origin; water coming from upper area and accumulating in lower area of the same catchment is also considered as flood. Typically the information to be collected includes:

- Pre-monsoon maximum flood level - flood that damages Boro crops before harvest (ask people to show water marks of this flood on houses, roads/embankments, bridges, parmanent posts, trees, etc.).

- Extent of area in the field that is inundated during Boro crop season.
- Monsoon season maximum flood level
- Monsoon season average flood level
- Extent of deep monsoon flooding, i.e., limit of area in the field that remains inundated and no crops can be grown.

15. Limits of floods identified in the field should be marked on the subproject Index Map with contours, from which approximate flood elevations can be estimated. The flood elevations will be determined later in more detail by surveying the flood-water marks (mPWD) during topographic survey.

Source of Floods

- Backflow through a khal connecting the subproject with adjacent or downstream river
- Overland flow from upper catchment
- Overtopping embankments and roads
- Source of the overland/overtopping flow
- What is the water level in the adjacent river at the time of subproject flooding (above or below the water level in the subproject; give approximate difference in cm or meters)

16. Local people should be asked about points, direction and dates/month of flood entry, and these should be marked on the Subproject Index Map.

Required Flood Prevention Works

17. Local people should be asked about their ideas on how to protect the area from floods:

- Construction of new flood embankments are not encouraged and therefore suitable alignments along existing village roads should be preferred. However, in unavoidable situations, short lengths of new construction to connect existing road alignments may be accepted.
- If re-sectioning of road or existing embankment involved, mark sections overtopped by high floods, and depth of overflowing water.
- Required structures – check the sites and make notes on required access road, link dykes or other works like channels for local drainage or depressions cut off by local dykes.

Investigation of Drainage Problems

Generally drainage subprojects comprise earthworks like re-excavation of khals and there is no need for embankments. Hydraulic structures are not usually required in drainage improvement subprojects unless specially needed to prevent over-drainage of beels, etc.

Drainage problems relate to prolonged inundation in local depressions and flat lands by rain water of local (subproject boundary) or external origin due to lack of or insufficient drainage facilities like channel(s) with too small longitudinal slope or reduced flow section. The channel flow section can be reduced by channel siltation, accumulation of debris, water hyacinth, construction of artificial cross-dams or improperly designed culverts and hydraulic structures.

Insufficient drainage is indicated when water level in the affected area remains high while water level in the outfall channel (khal or river) is falling down.

Drainage Problems

18. There are two types of drainage problems
    i. drainage congestion (external) and
    ii. water logging (internal).

Drainage congestion occurs when the capacity of external outfall channels is not sufficient to evacuate excess water from the subproject area. Generally removal of drainage congestion involves re-excavation of channels (rivers or khals) outside the subproject boundary.

Water logging occurs when the capacity of internal channels or drainage system is not sufficient to drain the excess water from the subproject area. All obstructions of flow including too small structures will cause water logging. Removal of water logging requires excavation/re-excavation of channels or construction of additional structures within the subproject.

[In practice, in the initial stages of subproject preparation including PRA investigation, drainage problems may be confused with flood problems as both result in inundation of land. Therefore, it is important that the Consultants collect relevant information and data necessary for proper identification of the existing problems].

19. Questions to be asked to local people should include:

- When land inundation is a problem?
  - in pre-monsoon season
  - in monsoon season
  - in post-monsoon season
- Identify in the field areas inundated during pre-monsoon
- Period of inundation (dates and days)
- What is the source of inundation water
  - local rain
  - upstream overland inflow
  - backflow from downstream khal/river
- What is the water level in the outfall river/khal at the time of inundation?
  - the same as in subproject? - Yes/No
  - if lower, by how much ? (m)
- Is the area inundated during monsoon season?
- What is the water level in the outfall river/khal at the time of inundation?
  - the same as in subproject? Yes/No
  - if lower, by how much (m)
- If the problem is delayed post-monsoon drainage ?
  - average date when water drains from the area
  - date when land preparation is required for planting Boro rice

Investigation of Drought Problems

As drought or shortage of water in the dry season prevails all over Bangladesh, there is no need for verification of the problem; the field investigation should rather be directed entirely on finding means to facilitate irrigation water availability.

Two types of subprojects are implemented under the SSWRD projects to alleviate drought: Command Area Development (CAD) and Water Conservation (WC) subprojects.

Command Area Development (CAD) Subprojects

[CAD subprojects include improvement and/or extension of irrigation systems and irrigation area. Irrigation water is lifted from a river channel with perennial flow by means of pumps (stationary or floating pumps)]

20. Field investigation for CAD subprojects generally comprises:

- collection of data on flood water levels during monsoon and minimum flow and water levels in the source river during the dry season
- inspection of existing irrigation systems and the constraints with a view to improve/expand conveyance of irrigation water, and
- inspection of additional area to be brought under irrigation; availability of irrigable land, required new canals and canal structures, availability of land for the works availability of adequate water to lift.

Water Conservation (WC) Subprojects

[The WC subprojects are designed for retention of water in a khal (drainage channel) at the end of monsoon. By heading-up water in the channel upstream from the structure the out flow from the subproject is reduced or terminated and water, that otherwise would drain out unutilized, is used for irrigation of Rabi and Boro crops. Usually, the retained water is lifted from the channel into adjacent fields by LLPs. With suitable topography the headed up water may be diverted for gravity irrigation downstream from the structure.

A continuous minimum flow in the channel throughout the dry season is the primary requirement for a successful WC subproject. Ideally, if the channel flow dries out by the end of February, there may be not enough water in the storage of the subproject for full irrigation of Boro crops, even with enlarging storage capacity by re-excavation of the channel. However, people may be interested for partial irrigation using the stored water and the rest using ground water using tube wells. Also, return flow from ground water irrigated upper lands adding up to the storage is also counted in many cases (large areas of ground water irrigation).]

21. Field investigation for WC subprojects comprises:

- verification of the catchment boundary upstream from the proposed structure site
- inspection of the proposed structure site (note khal dimensions, channel stability, bank erosion, dimension of existing bridge or culvert on the khal nearby)
- minimum dry season flow (measure depth, area and velocity of flow (by float method) to determine discharge)
- maximum flood water level and channel section to estimate maximum design discharge in case the catchment area cannot be defined (missing map coverage of hilly area or catchment is beyond international border) and also as a check of catchment calculated discharge.
- longitudinal slope of the khal to assess if the conserved water will extend up to short distance only when after construction of the now proposed structure, people may ask for another structure upstream i.e. the subproject may need cascaded water retention with several structures if land slope is steeper.

22. During the field inspection the WR Planning Engineer should obtain enough information about the state of the subproject khal(s) to determine if re-excavation is needed or not. He should mark on the index map the required surveys.

23. The WR Planning Engineer should assess if a cascaded water retention is required for the subproject.

B.3 Completion of Field Investigation

24. Before the field inspection is completed the WR Planning Engineer has to make sure that he has collected enough information to

i. prepare a plan of all the required physical works for the subproject,

ii. carry out calculations to assess approximate size of the works (khal and embankment lengths and sections, number and size of structures) and their tentative costs,

iii. plan the required engineering surveys and give precise instructions to the surveyor how to conduct and what to survey.

25. As a team leader the WR Planning Engineer will exchange information with other team members about his findings and proposed changes if any about the type of intervention and the required works. The Agronomist should have obtained adequate data and information to be able to estimate an approximate annual return from agriculture. The other team members should also be satisfied about their investigation and collection of data/information.

26. On completion of the field investigation, the team will meet the District Executive Engineer, LGED and project staff in a short de-briefing session on the investigation and preliminary findings.

27. After completion of the field inspection and back to office, the team will hold discussion on preparing the Prefeasibility Report and submit their respective write-ups. The WR Planning Engineer will update the Index Map of the subproject by incorporating information from field investigation (natural physical features and existing infrastructure, boundaries - subproject area, catchment area and benefited area, interventional works considered necessary, etc). He will also prepare draft of a Prefeasibility Report with contribution from all the team members following the outline given in ***Exhibit G4-B*** appended to this document.

28. The improved subproject Index Map and the draft of the Prefeasibility Report prepared by the FS Consultant based on their field investigation will be reviewed by the PMO-Project Consultants and discussed with the FS Consultant team taking into consideration the findings and recommendation of the Reconnaissance and PRA Reports. The draft Prefeasibility Report along with the draft Index Map will be finalized through this discussion including modifications if any for holding the Planning Meeting.

Exhibit G4-B:
TABLE OF CONTENTS OF PRE- FEASIBILITY REPORT

(With Text Guidelines)

1. Introduction: (Information on current SSWRD Project, subproject proposal by UP and recommendation from Upazila Parishad with dates, screening, reconnaissance by IWRMU, LGED with dates and taking up for detail study for technical and economic viability)

2. Subproject Overview: (Location - by mouza, Union, Upazila and District; Development Concept – main water management problem and approach to solve or mitigate it; Category and Type of Subproject; Interaction with existing large WM projects, if any; etc)

3. PRA : (PRA done by firm with dates and outcomes, particularly on beneficiaries' commitments and special comments /conditions, if any)

4. Field Investigation: (Visit by FS firm's Consultant Team on dates, main activities done, important observations, etc)

5. Subproject Planning: (Physical works planned are listed with names, quantities and approximate costs; showing in subproject's Index Map)

6. Subproject Benefit: (Agricultural Benefit by seasons, crops, land under the crops, production and returns; Fisheries benefit – positive or negative)

7. Economic Appraisal: (EIRR, B-C ratio based on the approx. cost and benefit)

8. General Observations on Social and Environmental viability:

9. Recommendation:

Exhibit G4-C:
USUAL PROBLEMS AND PHYSICAL WORKS REQUIRED FOR DIFFERENT TYPES OF SUBPROJECTS

Subproject Type	Present (pre-subproject) Problems		Possible Causes / Origin of Problems	Usual Physical Works Required
	Hydrological	Agricultural		
1. Flood Management (FM)	• Pre-monsoon river flood inundates the area. • Monsoon river floodwater enters the area fast; frequent/repeated inundation by peak floods. • Deep flooding in monsoon.	• Inundation and damage of Boro rice before or at harvesting. • Inundation prevents plantation of Aus and Deep Water Rice (DWR), or damage young Aus or DWR seedlings. • Damage of mature Aus in early monsoon; fast inundation and damage of young T. Aman rice. • Delayed transplantation of T. Aman; transplantation required more than once; late transplantation reduces yield • No crops or only DWR can be grown during monsoon.	• Short duration and high peak floods in small and medium flashy rivers with hilly catchments. • Multiple peak floods in medium to large rivers in northern part of the country. • Vast floodplains of very large rivers in the country. • High intensity rainfall in upper catchments.	• Construction of flood embankments. • Re-sectioning / strengthening of existing flood embankments or road-cum- embankments. • Construction of sluices with automatic flap gates. • Construction of regulators with vertical lift gates.
2. Drainage Improvement (Dr)	• Delayed/slow drainage of pre-monsoon rain accumulated in lower lands. • Delayed/slow drainage of monsoon runoff from upper parts of subproject basin. • Water logging in land depressions in pre- and	• Inundation and damage of Boro rice before or at harvesting. • Inundation and damage of Aus or young Aman rice. • Excess water prevents land preparation and plantation of Kharif-1 crops. • Water remaining in the field prevents land preparation and	• Insufficient capacity of internal drainage system due to narrowed or silted internal drainage channels. • Insufficient capacity of structure constructed over drainage channel; culvert or hydraulic structure with too high invert level or structure too small.	• Re-excavation / excavation of internal drainage channels (ditches, khals). • Construction of additional drainage structure (bridge, culvert, sluice/regulator or weir). • Excavation of drainage-link channel. • Re-excavation/dredging of outfall channel, if the channel is adjacent

Subproject Type	Present (pre-subproject) Problems		Possible Causes / Origin of Problems	Usual Physical Works Required
	Hydrological	Agricultural		
	post-monsoon seasons. • Drainage congestion; water does not drain or drains very slow from the subproject area.	plantation of Rabi crops.	• High water level in outfall drainage channel/river with sufficient section. • No drainage channel in the area. • Silted outfall drainage channel.	to the subproject. It may not be feasible under the project if channel is large or outside subproject.
3. Tidal Irrigation (TI)	• Tidal water (fresh water) cannot propagate deep inland through khals in dry season	• Cultivation of Boro rice crop suffers and at times remains only rain fed in fresh water tidal areas.	• Bed of tidal khals became high due to silting up of khals and so tides can go only short distance inside.	• Re-excavation of tidal khals to facilitate tidal water reach further inland to cover more land under irrigation.
4. Water Conservation (WC)	• Shortage of water and drought conditions during winter and pre-monsoon season. • Water drains fast at the end of monsoon and cultivable lands experience drought. • Shortage of water during long rainless period in later part of monsoon season.	• Rabi and Boro crops suffer drought damage or crops can be grown only in small area. • Soil residual moisture level falls fast and there is not enough water to grow Rabi crops and wheat. • Shortage of irrigation water for Boro rice cultivation in areas where groundwater is not available. • Aman rice crop suffer shortage of water during dry spells in the later part of monsoon –require supplementary irrigation.	• Steeper gradient of drainage khals drains area quickly. • Rainwater drains fast from the area due to high land slope. • Long dry spells (rainless days) towards later part of monsoon – as rainfall reduces.	• Construction of water conservation facilities like gated water retention structure (WRS), elevated sill fixed weirs, drainage regulators/sluices provided with slide gates for retention of water in the channels; • Re-excavation of khals to increase water storage and facilitate water availability for longer time.
5. Command Area Development (CAD)	• Shortage of water and drought conditions during winter and pre-monsoon season. • Drought condition in long rainless days during monsoon season. (in northern	• Non-availability of irrigation water for Boro rice cultivation though land remains fallow. • Yield of Aman rice reduces due to lack of supplementary irrigation in the later part of monsoon when crop is in flowering stage.	• Existing irrigation system is poorly performing due to loss of water, less irrigation efficiency, obstruction to take irrigation water further, or too little pumping capacity, etc	• Construction of lined canals, buried pipelines, structures for water distribution, cross drainage, pump stations, headwater tank, etc. • [Sufficient water at the source river should be checked.]

Subproject Type	Present (pre-subproject) Problems		Possible Causes / Origin of Problems	Usual Physical Works Required
	Hydrological	Agricultural		
	parts of country) requiring supplementary irrigation.			
6. Flood Management and Drainage (FMD)	• Inundation by river flood in pre-monsoon, monsoon seasons • Slow and delayed drainage following heavy rain or river flood inundation. • Pre-monsoon and /or post- monsoon Water logging in low lands	• Flood damage of Boro rice; grows only local variety Boro; low land remains fallow. • Flood damage of Aus and/or Aman rice; land remains fallow. • Late planting of Rabi crops; crops can not be cultivated.	• High river stages compared to subproject land elevations; • Reduced capacity of drainage khal system • Lack of drainage channel from isolated lowlands.	• Construction of / upgrading of roads to flood embankments. • Excavation / re-excavation of khals. • Construction of sluices / regulators.
7. Flood Management, Drainage and Water Conservation (FMD&WC)	• Pre-monsoon and/or monsoon flood inundation; • Slow/delayed drainage following heavy rain or river flood inundation; • Pre-monsoon and /or post- monsoon Water logging in low lands • Shortage of water in post monsoon and dry seasons.	• Flood damage of Boro rice. • Flood damage of Aus and/or Aman rice; land remains fallow. • Late planting of Rabi crops. • Boro crops suffer from water stress (droughty crops). • Expansion of Rabi and Boro crops not possible for shortage of water; crops cannot be cultivated.	• High river flood stages in relation to subproject land elevation. • Inadequate drainage facilities. • Lack of drainage channel from isolated lowlands. • Lack of or insufficient facilities for storage or control of water outflow.	• Construction / upgrading road to flood embankments. • Re-excavation of drainage channels. • Construction of sluices or regulators equipped with slide gates designed for retention of water.
8. Drainage and Tidal Irrigation (Dr& TI	• Delayed and slow drainage during pre-monsoon and post-monsoon. • Water logging in land depressions in pre- and post-monsoon seasons.	• Flood damage of Boro crops; late or no planting of Kharif-1 crops. • Late planting of Rabi crops or crops canot be cultivated. • Cultivation of Boro rice crop suffers and at times remains	• Silted up drainage khals. • Lack of drainage channel from isolated lowlands. • Bed of tidal khals became high due to silting up of khals and so tides can go only short distance inside	• Re-excavation / excavation of internal drainage channels (ditches, khals). • Excavation of drainage-link channel • Re-excavation of tidal khals to facilitate tidal water reach further

Subproject Type	Present (pre-subproject) Problems		Possible Causes / Origin of Problems	Usual Physical Works Required
	Hydrological	Agricultural		
	• Tidal water (fresh water) cannot propagate deep inland through khals in dry season	only rain fed in fresh water tidal areas		inland to cover more land under irrigation
9. Drainage and Water Conservation (DR& WC)	• Delayed and slow drainage during pre-monsoon. • Delayed and slow drainage during post-monsoon. • Shortage of water in winter season.	• Flood damage of Boro crops; late or no planting of Kharif-1 crops. • Late planting of Rabi crops or crops canot be cultivated. • Drought damage of Rabi and limited area or droughty Boro crops; crops cannot be grown	• Silted up drainage khals. • Lack of drainage channel from isolated lowlands. • Lack of or insufficient facilities for storage or control of water outflow from subproject.	• Excavation / re-excavation of drainage channels. - Reconstruction or construction of additional drainage sluices. • - Construction of gated water retention structure (WRS) and / or providing sluices/regulators with vertical slide gates.
10. Command Area Development and Drainage (CAD&DR)	• Shortage of water and drought conditions during winter and pre-monsoon season. • Water logging in lower parts of subproject benefited area.	• Growing of crops during winter is not possible without irrigation. • During pre-or monsoon season crops are damaged due to water logging. Slow and late drainage in post-monsoon limits cultivation of Rabi crops.	• Silted up drainage facilities. • - Lack of drainage channel from isolated lowlands. - General shortage of water for cultivation or increase of area under Boro rice.	• Construction / re-construction of irrigation water delivery and distribution systems like lined canals,etc. and distribution structures, • - Improvement of drainage system (excavation / re-excavation of drainage channels)

Exhibit G4-D:
GUIDELINES FOR CONDUCTING ENGINEERING SURVEY OF SSWRD SUBPROJECTS

A. Reference BM and Transfer of BM Value to Subproject TBM by Fly Level Survey

1. Reference BM

All survey works for SSWRD subprojects must be done with Reduced Levels (RL) referring to Public Works Datum (PWD) in meter units. This is required because the surveyed levels are used for design of interventions like embankments (top level), khals (bed level), irrigation canals (supply water level), regulators/sluices/dams (invert level, water retention level), etc in relation to ground levels and water levels records that are available with reference to PWD. Therefore, to start a survey work, it is necessary to look for and find out a reference Bench Mark (BM) with correct RL with reference to PWD in meter unit (mPWD). For practical purpose, such a BM may be (i) a BM Pillar/Monument established by the Survey of Bangladesh (a large number of such BM Pillars have been established by SOB all over the country with RL values inscribed therein – list of the BM Pillars are public and usually available with survey firms and one of which should be available nearby on search) or (ii) the known RL value of some critically important point (invert level, crest level, etc) of an existing permanent water management structure (regulator, sluice, weir, dam, etc) that are known to be built with dependably correct RL with reference to PWD.

2. Transfer of RL from Reference BM to a TBM at Subproject Site by Fly Level Survey

The RL value of the reference BM shall be transferred by Fly Level Survey to the subproject site at a location near its main structure (regulator, sluice, dam, pump station) and kept on a Temporary Bench Mark (TBM) which may be a point on an existing permanent structure distinctly marked with color and specifically described in the Level Book or a permanent TBM Pillar established kept protected near the construction site.

The route followed during the fly leveling survey shall be indicated and defined by drawing a sketch map of the survey route in a page of the Level Book with names of places along the route. TBM points with RL value written and marked by color shall be kept at different locations along the route (preferably about every kilometers) and locations of all such TBM points and the RL values shall be clearly described in the Level Book and marked in the sketch map prepared so that the TBM values can be checked during back check survey and also during checking of the BM transfer survey any time later, if necessary.

3. Back Check Fly Level Survey and Correction of Minor Differential Error

After establishing RL on the TBM at the subproject site as described above, a back fly level survey shall be done up to the original BM to check correctness of the transferred TBM value. If any error is found during the back check, standard methodology of correction shall be adopted. For error up to 300 mm, method of average is to be used – half of the error is to be distributed proportionately with distance between the BM and TBM and accordingly revise the RL values of the subproject TBM and all the intermediate TBMs. If the error is larger, a fresh survey of BM transfer including back check is to be undertaken. The correction calculations shall be shown in the Level Book.

4. Map and Records of Fly Level Survey Work

Based on the Level Book hand sketch prepared during the BM transfer survey, a map showing the Reference BM – its location and description including the RL value, the route of fly leveling survey, the locations and descriptions of TBMs with RLs kept along the route and at the subproject site shall be prepared in a standard drawing sheet and included in the Album of Drawings for record and future reference.

B. Survey of Khals

5. Sketch Plan of Start Point and Left/Right Bank Delineation

(a) Survey of a khal shall be started from its outfall and proceed upwards. The start point of the khal survey shall be the point at the crossing of khal center line and the bank line of the outfall khal. The start point shall be referenced on ground by distances from two permanent reference objects nearby and considered at Ch 0+000.

(b) For the main khal, a hand sketch showing plan configuration of the main khal and the outfall river/khal (covering 200-300 m on both upstream and downstream) at the outfall place indicating direction of flow, bends, bank erosions, etc and the north direction shall be drawn on the left hand page of the Level Book before starting the survey. The start point shall be indicated in the sketch map along with the reference objects. For branch khals, the hand sketch is not necessary.

(c) The left and right banks of the khal shall be indicated in the sketch map with reference to the direction of flow of the khal i.e. the surveyor shall look along the direction of flow of the khal and call the khal bank on his left hand side as the “left bank” and the khal bank on his right hand side as the “right bank”. The surveyor will follow this rule always during survey of khals.

6. Cross-Section of Outfall Channel

(a) Three cross-sections of outfall khal/river shall be surveyed – one at the outfall point (start point) of the khal, and the other two at 100m upstream and downstream from the outfall point. If the outfall river is big (mention approximate depth and width), the cross sections may be taken up to the deep channel at the place of the section. Positions of these cross-sections are to be shown on the sketch plan prepared.

(b) If the subproject TBM is far from the start point of survey, its RL should first be carried to a site TBM near the survey start point and survey of first cross-sections started with the back reading from this site TBM. For subsequent cross-sections, RL from the start point of previous cross-section will be carried to the start point of the new cross-section.

7. Survey of Khal Cross-Sections

(a) First cross-section of the khal shall be at Ch 0+00 (start point defined above) and other cross-sections shall be surveyed at every 100m proceeding upwards. All cross-sections will be serially numbered. At start of survey of every cross-section, Chainage of khal and the cross-section number should be written in the Level Book.

(b) Cross-sections are to be surveyed up to the point beyond which khal does not exist or the khal joins another khal or the point up to which re-excavation has been instructed. If the khal joins another khal at upstream end which is not planned for re-excavation, that khal should also be surveyed with three cross-sections like the outfall khal.

(c) At each cross-section of khal, staff readings are to be taken at 1 (one) m intervals starting from 5 m away from the left bank (according to flow direction) of khal and ending at 5 m away from the right bank. However, additional staff readings are to be taken, as necessary, to define bed width of khal or significant change in elevations. If there is embankment along the khal and is close to the khal bank, the khal cross-section shall include the embankment up to 5m beyond its outside toe.

(d) Additional cross-sections, other than the 100m internal sections, will have to be surveyed, as necessary, to depict special conditions of the khal – wide and/or narrow sections, reach of deeper channel, etc.

(e) During survey of khal, locations and important dimensions (chainage, opening size, bed and top levels) of existing structures on the khal (bridge/culvert/regulator/sluice) are to be recorded in Level Book. For box culverts, sluices, regulators, water retention structures, top level of base slab (invert level), top levels of upstream and downstream floors must be recorded carefully using hand sketch. Existing condition of the structures (good or bad) are also to be recorded.

(f) When a branch khal is found, its Chainage of outfall, location (left or right side), bed level of the khal being surveyed and bed level of the branch khal as well as depth and top width of the branch khal should be noted in the Level Book in a small hand sketch with local name of the branch khal.

C. Survey of Embankments

8. Embankments are usually developed along existing alignments of village roads to reduce land loss. As existing alignments are used, setting out of embankment center line on ground is not required. Before staring the survey work, RL of the subproject TBM should first be carried to a site TBM near the start point of embankment survey and then cross-section survey will proceed as outlined below.

(a) Start point of survey with Ch 0+000m of embankment should be identified on ground and the position should be defined by physical condition (crossing point of roads, end point of a bridge/culvert, etc) or by distance from two fixed reference objects. The location and referencing of the start point should be recorded in the Level Book with a hand sketch. Survey of the first cross-section be started with back reading from the site TBM.

(b) Cross sections of embankments are be surveyed at 100 m intervals and at each cross-section staff readings are to be taken at every 1.5m distance starting from centre line of the existing road or embankment first towards countryside (c/s) and then towards riverside (r/s) up to 10 m away from toe of the existing road/embankment. Additional staff readings may be needed at places to depict real situation.

(c) Additional cross-sections other than those at 100m intervals are to be surveyed, as required, to depict particular existing conditions like breaches, too weak sections, sections at homestead places, etc.

D. Plane Table Survey of Structure Sites

(a) Detail physical conditions and features of the area surrounding a hydraulic structure should be clearly known at the time of its designing so that subsequent undesirable situations can be avoided. For this, Plane Table (PT) survey with spot GL at 5m grid points over an area around the center point of the structure should be done when the structure site has been finally decided. If any structure site is changed, the PT survey should again be at the new site. PT survey with GL at grid points will be submitted in A3 size drawing.

(b) The PT survey area shall be as below for the usual range of structures used in SSWRD subprojects:

Regulator/sluice/WRS up to 2-vent sizes: 50m x 50m around structure center

Regulator/sluice/WRS above 2-vent sizes: 100m x 100m around structure center

=x=

Exhibit G4-E:
Field Survey Forms for Agricultural Data and Information

Subproject Name:

Upazila:

District: Date of Survey: Name and Designation of Surveyor(s):

Table G4-E.1: Crop Patterns

No.	Name of Crop Cultivated in Three Seasons			Percent of Total Cultivated Area in Each Land Type			
	Kharif 1	Kharif 2	Rabi/Boro	High Land	Medium High Land	Medium Low Land	Low Land
Total				100	100	100	100

Crop Pattern: The name of crops grown on the same piece of land one after another covering three crops seasons in a year. For example, B. aus-LT Aman-Wheat crop pattern indicates land is cultivated in kharif I, kharif II and rabi seasons.

Crop seasons: Kharif I: March/April to June; Kharif II: July-October; Rabi: November to March

Land type: Highland (F0): The cultivated land where flooding depth is 0 to 30 cm; Medium highland (F1): The cultivated land where flooding depth is 30 to 90 cm; Medium lowland (F2): The cultivated land where flooding depth is 90 to 180 cm; Lowland (F3): The cultivated land where flooding depth is more than 180 cm

Percent of Total Cultivated Area in Each Land Type: For example, B. Aus-LT Aman-Wheat crop pattern occupies 60% of the total highland, 50% of the total medium highland, 20% of the medium lowland and 5% of the lowland in the proposed subproject area. Accordingly, other crop patterns occupy remaining 40% of the highland, 50% of the medium highland, 80% of the medium lowland and 95% of the lowland.

Table G4-E.2: Crop Cultivation Practices and Input Use

Subproject Name:…………………………………………… Date: ……………………

Name of Crop	Operation Time (Week/Month)			Irrigated Area (percent of cropped area)					Fertilizer Use (kg/hectare)					Pesticide (kg/ha)	Labor Use (person-day / ha)	Draught Animal Use (pair/ha)
	Sowing	Trans-plantation	Harvest	LLP	STW	DTW	HTW	Traditional	Urea	TSP	MP	Organic	Other			

Operation Time (Week/Month): For example, 3w 4m would mean 3rd week of April
Irrigated area: For example, 20% of the total HYV boro area is irrigated by LLP, 30% by STW and 50% by DTW.
LLP: low lift pump; STW: shallow tubewell; DTW: deep tubewell; HTW: hand tubewell; Traditional: don, sewti
Fertilizer use: TSP: triple super phosphate; MP: murate of potash; organic: compost; green manure; Other: zinc sulphate, gypsum, borax or DAP.
Labor use: labor employed for crop production from sowing to storing.
Person day: eight hours.
Draught Animal: pairs of bullock used for plough, laddering, weeding, threshing, carrying.

Table G4-E.3: Crop Damage (percent of total area under the crop)

Subproject Name:……………………………………………………… Date: …………………….

Name of Crop	Damage free				Damaged by pre-monsoon flooding				Damaged by monsoon flooding			
	High Land	Medium High Land	Medium Low L	Low Land	High Land	Medium High Land	Medium Low Land	Low Land	High Land	Medium High Land	Medium Low Land	Low Land

Table G4-E.3 (contd): Crop Damage (percent of total area under the crop)

Subproject Name:…………………………………………………… Date: ……………………

Name of Crop	Poor drainage				Drought				Pest infestation			
	High Land	Medium High Land	Medium Low Land	Low Land	High Land	Medium High Land	Medium Low Land	Low Land	High Land	Medium High Land	Medium Low Land	Low Land

Table G4-E.4: Crop Yield (ton/hectare)

Subproject Name:…………………………………………………… Date: ……………………

Name of Crop	Damage free cropped area				Pre-monsoon flood damaged cropped area				Monsoon flood damaged cropped area			
	High Land	Medium High Land	Medium Low Land	Low Land	High Land	Medium High Land	Medium Low Land	Low Land	High Land	Medium High Land	Medium Low Land	Low Land

Table G4-E.4 (contd): Crop Yield (ton/hectare)

Subproject Name:…………………………………………………… Date: ……………………

Name of Crop	Poor drainage cropped area				Drought damaged cropped area				Pest infested cropped area			
	High Land	Medium High Land	Medium Low Land	Low Land	High Land	Medium High Land	Medium Low Land	Low Land	High Land	Medium High Land	Medium Low Land	Low Land

Table G4-E.5: Farmers' Needs

Subproject Name:……………………………………………………… Date: …………………….

Name of Crop	Flood Reduction (✓mark)	Flood Protection (✓mark)	Flood control (✓mark)	Crop Protection from Submergence (✓mark)	Drainage Improvement (✓mark)	Increase in Soil Moisture (✓mark)	Irrigation Water Supply (✓mark)	Other (mention)

Table G4-E.6: Farmers' Views on Impact of Proposed Subproject

Subproject Name:…………………………………………………… Date: …………………

Name of Crop	Protect crop form flooding (✓ mark)	Improve drainage (V mark)	Protect crop from drought (✓mark)	Land can be cultivated (✓mark)	Increase in cultivated area (%)	Increase in yield level (%)	No impact, because	Subproject will create problem, because	Other (specify)

Exhibit G4-F:
FISHERIES FIELD SURVEY AND DATA COLLECTION

Subproject Name:

Upazila:

District:

Date of Survey:

Name and Designation of Surveyor(s):

PART-I: SUMMARY

A. Fisheries Resource Base and Production

A-1. Estimation on the basis of secondary data

Type of Water Body*	Area (ha)	Yield (kg/ha)	Production (ton)
F2 + F3			
Perennial Water Body			

* Water Bodies inundated by monsoon flood and likely to be affected by project intervention (Part-IIA)
F2 +F3 = Seasonal Water body with at least 0.9 m of water depth standing for at least 4 months
Perennial Water Body = Lowland and permanent water body like Khal, Beel, Baor, Haor, River segment etc. holding water through the year.

A-2. Estimation on the basis of the field survey

Type of Water Body	Area (ha)	Yield (kg/ha)	Production (ton)
a. Seasonal Flood land**			
b. Beel, Baor, Haor			
c. Khal, River segment			
Total			

** Seasonal Flood Land = Seasonally flooded area of the flood plain with 0.5 m water standing at least for 4 months.

A-3. Particulars of public water bodies

Sl. No.	Type of Water Body	Name of the water body	Area (ha)	Lessee	Lease Value (Taka)	Lease Period From -To (year)

B. Fisheries Community

B-1: Fishers and Fish Farmers (operating within the sub-project area)

Category		Number of Household		Average Annual HH Income	Other Profession	No. of persons involved (# F)	Annual catch per person (Kg)
		Total	Female Farmer HH				
Genuine* Fisher	Ethnic(Hindu)						
	Neo-Fisher						
Subsistence Fisher							
Genuine Fish Farmer							
Subsistence Fish Farmer							

* **Genuine Fisher/ Fish Farmer**: Fulltime fisher/fish farmer spending most of his time in fishing/fish farming and earning livelihood mostly from fishing / fish farming.
Ethnic Fisher:Traditional Hindu fisherman or woman
Neo-Fisher: Fulltime fisher, mostly Muslims, who have adopted the profession in recent years
Subsistence Fisher/ Fish Farmer: Part time Fisher/Fish Farmer

C. Fisheries

C-1 Fish Species

i. Culture Species: (1) .... (2) .... (3) ....
(Name the species cultivated in the sub-project area, if any)

ii. Wild Species (Enclose the list as per proforma below)

Sl. No.	Local Name (with alternative local names)	English Name	Occurrence: 1 =Very Common (50%) 2 =Common (25%) 3 =Rare (10%) 4 =Very rare (5%)

PART II: Particulars of Water Bodies

Type of Water Body a. Seasonal Floodland b. Beel, Baor, Haor c. Khal, River Segment d. Pond, Dighi, Ditch, Borrow Pit								
1. Name, if any								
2. Location (village)								
3. Recorded area (ha)								
4. Total Water Area (ha)								
a. Rainy Season (June-Sept)								
b. Dry Season (Jan-April)								
5. Depth (m)								
a. Rainy Season (June-Sept)								
b. Dry Season (Jan- April)								
6. Fisheries Production (ton/year)								
a. Fish								
b. Prawn (G-Galda,B-Bagda)								
c. Crab								
7. Lease Status								
a. Lessee								
b. Lease Period								
c. Lease value								
8. Seasonality I-Seasonal P-perennial								
9. Tidal Influence (Y/N)								
10. Flooding Source Khal-1, River-2, Other-3								
11. Mode of Fishing Single, Group, CBF								

12. Fishing period								
a. Seasonal (month)								
b. Round the year								
13. Fisheries Type a.Capture Fisheries, b. Culture-based Fisheries c. Culture								
14. Stocking Information								
a. Species stocked*								
b. Number per decimal								
c. Size (cm)								
15. Water Control Structure R-Regulator, S-Sluice, WRS								
16. Fish Passage Control Structure a. Fish- Screen b-Other								
17. Culture Status a-Cultivated b-Cultivable c-Derelict								
18. Type & Mode of Culture a-Monoculture b-Polyculture c-Traditional d-Managed e- Fish and Poultry f- Nursery g-Grow out								
19. Flooding Status a-Flood free b-Flood prone								
20. Mode and Method of Fishing a-Partial b-Total c-Netting d -Dewatering e-Self-fishing f-Contract fishing								
21. Source of Fingerlings a-Natural b-Hatchery raised c-Self collected of raised d-purchased e-Local f-Out sourced								
22. Ownership i-Public ii-Private iii-Institutional								
23. Effect of Project Intervention (Yes / No)								

Note: *Species 1.................. 2.............. 3............... 4 ....5..........

Exhibit G4-G:
FINANCIAL AND ECONOMIC DATA

Table G4-G.1: Input Use and Yield Levels per Hectare

A. In cropped area without water resource management

Crop		Seeds (kg)/ Seedlings (no.) (per ha)	Organic Manure (kg/ha)	Fertilizers				Pesticides (kg/ha)	Irrigation (Tk/ha)	Machine hire* (Tk/ha)	Labour (pd/ha)	Yield (unhusked)	
				Urea (kg/ha)	TSP (kg/ha)	MP (kg/ha)	Other (kg/ha)					Main Product (kg/ha)	By-Product (kg/ha)
Aus Rice	HYV	42	265	140	125	85	5.5	2.0	4236	4415	120	3500	1540
	Local	80	300	60	50	25	0.0	2.0	4236	2810	41	1900	855
Aman Rice	Local	51	300	70	47	16	3.5	1.0	0	2309	90	2300	851
	HYV	50	600	143	96	75	19.8	1.5	1412	1297	124	3700	969
	Deepwater	80	0	55	45	20	0.0	1.0	1412	894	37	1550	698
Boro Rice	HYV	45	1112	213	183	107	33.5	3.0	8472	3774	189	6400	4589
	Hybrid	31	1600	211	215	107	41.4	3.0	9178	4010	210	6795	4335
	Jute	10	371	120	87	37	0.0	1.0	1412	5074	181	1648	2059
	Wheat	122	2100	112	112	51	13.0	1.0	3295	2780	89	2200	1870
	Maize	44	3000	157	134	75	16.0	1.0	4236	5220	113	4500	5085
Sweet	Potato	700	500	103	65	90	0.0	0.0	0	2750	127	7500	0
Oilseed	Mustard	10	3300	88	86	43	0.0	2.0	1412	4633	66	970	158
Pulse	Lentil	33	800	71	91	47	0.0	2.0	0	5791	70	770	105
	Potato	1140	3700	161	141	60	17.4	3.0	12708	4633	192	11500	0
Vegetable	Summer	0.4	2900	119	135	48	8.0	3.4	14826	2862	202	6300	0
	Winter	0.5	1700	201	177	102	31.5	7.0	10166	6178	195	8800	0
Spice	Onion	11	7000	157	198	118	22.5	5.0	5648	4015	287	5300	0
	Chili	1	1100	265	190	100	17.2	5.0	4236	7722	219	3500	0
	Sugarcane	25000	900	135	116	57	0.0	6.0	2118	7862	144	17700	3540
Water	Melon	2	2800	150	135	75	21.5	3.0	6354		205	9235	0
	Banana	1200	1100	278	335	222	0.0	3.0	4497		205	7400	0
	Tobacco	2800	1100	222	296	200	50.0	2.5	3608	3707	383	2669	14820

* For land preparation.

B. In cropped area with water resource management

Crop		Seeds (kg)/ Seedlings (no.) (per ha)	Organic Manure (kg/ha)	Fertilizers				Pesticides (kg/ha)	Irrigation (Tk/ha)	Machine hire* (Tk/ha)	Labour (pd/ha)	Yield (unhusked)	
				Urea (kg/ha)	TSP (kg/ha)	MP (kg/ha)	Other (kg/ha)					Main Product (kg/ha)	By-Product (kg/ha)
Aus Rice	HYV Aus	47	1950	200	150	74.1	15	3	4236	4817	126.69	4064	1804
	Local	80	300	60	50	25	0.0	2.0	4236	2810	41	1900	855
Aman Rice	L T Aman	56.8	988.4	69.2	54.3	27.2	0.0	4.0	0	5001.8	114.6	2935.5	1097.1
	HYV Aman	52.4	1600.0	120.0	105.0	55.0	8.0	7.0	1412	5001.8	139.4	4463.0	1168.6
	Hybrid Aman	39.5	1600.0	160.6	103.7	51.9	49.4	4.0	1412	5003.8	144.8	4645.5	1284.9
	Deepwater	80	0	55	45	20	0.0	1.0	1412	894	37	1550	698
Boro Rice	HYV Boro	45.5	2400.1	225.0	190.0	65.0	15.0	3.0	8472	5189.1	156.0	6850.0	4910.0
	Hybrid Boro	29.7	2718.8	214.9	205.0	73.0	30.6	3.0	9178	5189.1	171.5	7270.0	4638.0
	Jute	9.0	1700.0	87.2	74.1	37.1	0.0	3.0	1412	5436.2	192.9	2700.3	3375.4
	Wheat	124.0	2500.0	150.0	130.0	40.0	23.0	1.0	3295	4633.1	110.0	3320.0	2822.0
	Maize	40.0	2200.0	110.0	95.0	70.0	11.0	2.0	4236	4818.5	123.0	6310.0	7130.3
Sweet	Potato	700	500	103	65	90	0	0	0	2750	127	7500	0
Oilseed	Mustard	10.0	2255.0	148.0	148.0	74.0	5.0	2.5	1412	4633.1	84.0	1230.0	200.0
Pulse	Lentil	30.0	1598.0	74.0	136.0	62.0	7.0	3.0	0	4633.1	74.0	1170.0	159.5
	Potato	1200.0	4260.0	180.0	145.0	90.0	25.0	3.0	12708	4633.1	211.0	19700.0	0
Vegetable	Summer	0.4	3860.0	160.0	90.0	70.0	22.0	4.4	14826	4633.1	230.0	9690.0	0
	Winter	0.4	2100.0	210.0	165.0	110.0	25.0	8.0	10166	6177.5	209.0	11600.0	
Spice	Onion	9.0	1500.0	170.0	190.0	110.0	17.0	3.0	5648	4633.1	303.0	12500.0	0
	Chili	0.7	1200.0	274.0	173.0	97.0	13.0	6.0	4236	7721.9	234.0	4390.0	
	Sugarcane	30000.0	1035.0	183.0	118.0	71.0	0.0	6.5	2118	6177.5	169.0	52000.0	10400.0
Water	Melon	2	2800	150	135	75	21.5	3.0	6354		205	9235	0
	Banana	1200.0	2780.0	278.0	335.0	222.0	20.0	3.0	4497		205.0	8280.0	0
	Tobacco	2800.0	1100.0	222.0	296.0	200.0	50.0	2.5	3608	3706.5	383.0	2668.7	14820.0

* For land preparation.

Table G4-G.2: Conversion Factors

Item of Cost	Conversion Factor*	Item of Cost	Conversion Factor*	Item of Cost	Conversion Factor*
Capital Cost Components		**Agricultural Inputs**		**Agricultural Outputs**	
Engineering Works		**Labour**	0.84	**Products**	
Earthworks	0.90	**Machine**	0.90	Rice	1.171
Structures	0.90	**Seeds**		Wheat	0.786
Roads-Bank Protection	0.90	Paddy	0.90	Jute	0.90
Forestation/Demolition	0.90	Wheat	0.90	Maize	0.90
Labour		Jute	0.90	Tobacco	0.90
Skilled Labour	0.90	Tobacco	0.90	Potato	0.90
Unskilled Labour	0.83	Sugarcane	0.90	Sweet potato	0.90
Machinery/Equipment/Transport		Pulses 3/	0.90	Vegetables	0.90
Transport vehicles	0.90	Oilseeds 3/	0.90	Spices	0.90
Machinery/Equipment	0.90	Potato	0.90	Lentil	0.88
Materials		Sweet potato	0.90	Sugarcane	0.807
Cement	0.90	Vegetables	0.90	Water Melon	0.90
Steel (Basic metal)	0.90	Spices	0.90	Banana	0.90
Bricks and Others	0.90	Others	0.90	Others	0.90
Engineering and Administration	0.90	**Manure**	0.90		
Physical Contingencies	0.90	**Fertilizers**		By-products	0.90
O&M*	0.71	Urea	0.975		
		TSP	1.288		
		MP	1.726		
		Pesticides	0.84		
		Irrigation	0.79		
		Miscellaneous	0.90		

* Weighted average of miscellaneous items.

Table G4-G.3: Estimates of Conversion Factor for Local Cost Component of Capital Cost Items

Item	Skilled Labour		Unskilled Labour		Materials		Taxes & Duties		F.E.C		Transportation		Total	
	%	CF	%	CF	%	CF	%	CF	%	CF	%	CF	%	CF
Embankment	6.34	0.90	78.16	0.833		0.90	15.5	0		1		0.90	100	70.82
Re-excavation of Drainage Channel	6.34	0.90	78.16	0.833		0.90	15.5	0		1	0	0.90	100	70.82
Protective work	17	0.90	17	0.833	25	0.90	15.5	0	20	1	5.5	0.90	100	76.93
Structure	17	0.90	17	0.833	25	0.90	15.5	0	20	1	5.5	0.90	100	76.93

Table G4-G.4: Derivation of Economic Farmgate Prices for Internationally Traded Commodities

Items	Unit	Conversion Factor	Rice		Wheat		Sugar		Triple Super Phosphate		Muriate of Potash		Urea	
			financial	economic	financial	economic	financial	economic	financial	economic	financial	economic	financial	economic
Projected FOB 2011/2025 Price a/	US$/t		407	407	183	183	361.02	361	305	305	274.594	275	203	203
Quality adjustment			0.75	0.75	0.80	0.80	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adjusted FOB value	US$/t		305	305	146	146	361	361	305	305	275	275	203	203
Freight and Insurance	US$/t		50	50	50	50	50	50	50	50	50	50	0	0
Import price CIF Chittagong , in US$	US$/t		355	355	196	196	411	411	355	355	325	325	203	203
Exchange rate	Tk/$		80.0	80	80	80	80	80	80	80	80	80	80	80
Import price CIF Bangladesh, in Taka	Tk/t		28418	28418	15693	15693	32882	32882	28418	28418	25968	25968	16279	16279
Port, storage, handling, & transport costs from port to regional market	Tk/t	0.90	1752	1578	1752	1578	1691	1523	1140	1027	1140	1027	903	813
Price at regional market	Tk/t		30170	29996	17445	17270	34573	34404	29558	29445	27108	26994	15376	15466
Transport and handling from rice mill to regional market	Tk/t	0.90	750	675	750	675	750	675	500	450	500	450	500	450
Marketing margin and costs to regional market (5%)	Tk/t	0.90	713	642	713	642	713	642	475	428	475	428	475	428
Price in local market	Tk/t		28708	28679	15982	15953	33110	33087	28583	28567	26133	26116	16351	16344
Price of rice/sugar ex-mill														
Equivalent in Paddy (65%) / sugar cane (8%)	Tk/t		18660	18641			2649	2647						
Milling costs	Tk/t	0.90	300	270		0		0		0		0		0
Transport and handling between farm and local market / rice mill	Tk/t	0.90	250	225	250	225	250	225	250	225	250	225	250	225
Farm gate price (calculated)			18110	18146	15732	15728	2399	2422	28333	28342	25883	25891	16601	16569
Farm gate price (actual)			15500	18146	20000	15728	3000	2422	22000	28342	15000	25891	17000	16569
Conversion factor				1.171		0.786		0.807		1.288		1.726		0.975

Source: a) World Bank Commodity Price forecast (constant US dollars),July 26, 2016, Adjusted MUV Index.

Table G4-G.5: Financial and Economic Prices of Inputs of Agricultural Products

Item	Unit	Financial Price (2016)[a]	Conversion Factor [b]	Economic Price	Economic Price Selection Basis
Labour and Machine					
Labour	Tk/pd	230-300	0.84	193-252	Conversion factor
Machine	Tk/Plough/ha	1300-3700	0.90	1170-3300	Conversion factor
Seeds/Seedling					
HYV Aus Rice	Tk/kg	40.0	0.90	36	Conversion factor
Local Aus Rice	Tk/kg	35.0	0.90	31.5	Conversion factor
L T Aman Rice	Tk/kg	40.0	0.90	36	Conversion factor
HYV Aman Rice	Tk/kg	50.0	0.90	45	Conversion factor
Hybrid Aman Rice	Tk/kg	235	0.90	211.5	Conversion factor
Deepwater Aman Rice	Tk/kg	30.0	0.90	27	Conversion factor
HYV Boro Rice	Tk/kg	50.0	0.90	45	Conversion factor
Hybrid Boro Rice	Tk/kg	235.0	0.90	211.5	Conversion factor
Jute	Tk/kg	185.0	0.90	166.5	Conversion factor
Wheat	Tk/kg	38.0	0.90	34.2	Conversion factor
Maize	Tk/kg	62.0	0.90	55.8	Conversion factor
Sweet Potato	Tk/kg cutting	5.0	0.90	4.5	Conversion factor
Mustard	Tk/kg	65.0	0.90	58.5	Conversion factor
Lentil	Tk/kg	125.0	0.90	112.5	Conversion factor
Potato	Tk/kg	40.0	0.90	36	Conversion factor
Vegetable Summer	Tk/kg	13000.0	0.90	11700	Conversion factor
Vegetable Winter	Tk/kg	16950	0.90	15255	Conversion factor
Onion	Tk/kg	2500	0.90	2250	Conversion factor
Chili	Tk/kg	15850	0.90	14265	Conversion factor
Sugarcane	Tk/kg cutting	2.5	0.90	2.25	Conversion factor
Water Melon	Tk/kg	3000	0.90	2700	Conversion factor
Banana	Tk/seedling	2.5	0.90	2.25	Conversion factor
Tobacco	Tk/seedling	0.04	0.90	0.036	Conversion factor
Fertilizers and Pesticides					0
Urea	Tk/kg	16.5-17.0	0.975	16.1-16.6	Conversion facto
TSP	Tk/kg	21-22	1.288	27-28	Conversion facto
MP	Tk/kg	15	1.726	25.89	Conversion facto
Other	Tk/kg	47.5	0.90	42.75	Conversion factor
Manure	Tk/kg	5	0.90	4.5	Conversion factor
Pesticides	Tk/kg	225	0.84	189	Conversion factor
Irrigation	Tk/ha	1412-14826	0.79	1115-11712	Conversion factor

Notes

[a] Source: Department of Agricultural Marketing, Bangladesh Agricultural Development Corporation and Field Survey.

[b] onversion factors based on Bhabodah Feasibility Study, 2017. Bangladesh Water Development Board.

Table G4-G.6: Financial and Economic Prices of Agricultural Outputs

Item	Unit	Financial Price (2016)[a]	Conversion Factor [b]	Economic Price	Economic Price Selection Basis
Main Products					
HYV Aus Rice	Tk/ton	18400	1.171	21546	Conversion factor
Local Aus Rice	Tk/ton	18100	1.171	21195	Conversion factor
L T Aman Rice	Tk/ton	22000	1.171	25762	Conversion factor
HYV Aman Rice	Tk/ton	18850	1.171	22073	Conversion factor
Hybrid Aman Rice	Tk/ton	18850	1.171	22073	Conversion factor
Deepwater Aman Rice	Tk/ton	19500	1.171	22835	Conversion factor
HYV Boro Rice	Tk/ton	17100	1.171	20024	Conversion factor
Hybrid Boro Rice	Tk/ton	17100	1.171	20024	Conversion factor
Jute	Tk/ton	39400	0.90	35460	Conversion factor
Wheat	Tk/ton	19200	0.786	15091	Conversion factor
Maize	Tk/ton	16500	0.90	14850	Conversion factor
Sweet Potato	Tk/ton	16400	0.90	14760	Conversion factor
Mustard	Tk/ton	45600	0.90	41040	Conversion factor
Lentil	Tk/ton	63750	0.88	56100	Conversion factor
Potato	Tk/ton	14830	0.90	13347	Conversion factor
Vegetable Summer	Tk/ton	23100	0.90	20790	Conversion factor
Vegetable Winter	Tk/ton	19900	0.90	17910	Conversion factor
Onion	Tk/ton	29800	0.90	26820	Conversion factor
Chili	Tk/ton	38420	0.90	34578	Conversion factor
Sugarcane	Tk/ton	8000	0.807	6456	Conversion factor
Water Melon	Tk/ton	21000	0.90	18900	Conversion factor
Banana	Tk/ton	28350	0.90	25515	Conversion factor
Tobacco	Tk/ton	91000	0.90	81900	Conversion factor
By-Products					
Local rice straw	Tk/ton	2000-3000	0.90	1800-2700	Conversion factor
HYV rice straw	Tk/ton	2000	0.90	1800	Conversion factor
Wheat	Tk/ton	1000	0.90	900	Conversion factor
Maize	Tk/ton	500	0.90	450	Conversion factor
Jute sticks	Tk/ton	1000	0.90	900	Conversion factor
Sugarcane	Tk/ton	2200	0.90	1980	Conversion factor
Pulses	Tk/ton	1000	0.90	900	Conversion factor
Oilseeds	Tk/ton	1000	0.90	900	Conversion factor
Tobacco	Tk/ton	3000	0.90	2700	Conversion factor

Notes

[a] Source: Department of Agricultural Marketing and Field Survey.

[b] Conversion factors based on Bhabodah Feasibility Study, 2017. Bangladesh Water Development Board.

Table G4-G.7: Financial and Economic 1-Hectare Crop Budgets

A. In cropped area without water resource management

Sl. No.	Crop	Yield (ton/hectare)	Net Return (Tk/ha)	
			Economic	Financial
1	HYV Aus	3.500	64400	75412
2	Local Aus	1.900	34390	40271
3	Local Aman	2.300	50600	59253
4	HYV Aman	3.700	69745	81671
5	Deepwater Aman	1.550	30225	35393
6	HYV Boro	6.400	109440	128154
7	Hybrid Boro	6.795	116195	136064
8	Jute	1.648	649312	58438
9	Wheat	2.200	42240	33201
10	Maize	4.500	74250	66825
11	Sweet Potato	7.500	123000	110700
12	Mustard	0.970	44232	39809
13	Lentil	0.770	49088	43197
14	Potato	11.500	170545	153491
15	Summer	6.300	145530	130977
16	Winter	8.800	175120	157608
17	Onion	5.300	157940	142146
18	Chili	3.500	134470	121023
19	Sugarcane	17.700	141600	114271
20	Melon	9.235	193935	174542
21	Banana	7.400	209790	188811
22	Tobacco	2.669	242879	218591

B. In cropped area with water resource management

Sl. No.	Crop	Yield (ton/hectare)	Net Return (Tk/ha)	
			Economic	Financial
1	HYV Aus Rice	4.064	74778	87565
2	Local Aus Rice	1.900	34390	40271
3	L T Aman Rice	2.936	64581	75624
4	HYV Aman Rice	4.463	84128	98513
5	Hybrid Aman Rice	4.646	87568	102542
6	Deepwater Aman Rice	1.550	30225	35393
7	HYV Boro Rice	6.850	117135	137165
8	Hybrid Boro Rice	7.270	124317	145575
9	Jute	2.700	106392	95753
10	Wheat	3.320	63744	50103
11	Maize	6.310	104115	93704
12	Sweet Potato	7.500	123000	110700
13	Mustard	1.230	56088	50479
14	Lentil	1.170	74588	65637
15	Potato	19.700	292151	262936
16	Vegetable Summer	9.690	223839	201455
17	Vegetable Winter	11.600	230840	207756
18	Onion	12.500	372500	335250
19	Chili	4.390	168664	151797
20	Sugarcane	52.000	416000	335712
21	Water Melon	9.235	193935	174542
22	Banana	8.280	234738	211264
23	Tobacco	2.669	242852	218567

Table G4-G.8a: Fisheries Budget - Perennial Water Bodies

(Per 1 ha Basis)

Items of Benefits/Costs	Physical Unit	Without Subproject					With Subproject				
		Physical	Financial		Economic		Physical	Financial		Economic	
		Quantity/ha	Price/Unit	Value/ha	Price/Unit	Value/ha	Quantity/ha	Price/Unit	Value/ha	Price/Unit	Value/ha
Revenue											
Main product	kg	220	55	12100	47.85	10527	110	55	6050	47.85	5263.5
Sub-total Revenue				12100		10527			6050		5263.5
Operating Costs (excluding labor)											
Gear	ha	1.00	2200	2200	1914	1914	1.00	1100	1100	957	957.0
Craft	ha	1.00	1100	1100	957	957	1.00	550	550	478.5	478.5
Lease Fee	ha	1.00	1000	1000	0	0	1.00	500	500	0	0
Guarding	ha	1.00	700	700	609	609	1.00	350	350	304.5	304.5
Other Costs	ha	1.00	300	300	261	261	1.00	150	150	130.5	130.5
Sub-total Operating Costs				5300		3741			2650		1870.5
Income (without labor costs)				6800		6786			3400		3393
Labor Costs (hired labor)											
March	person-day	5.5	91.00	500.5	63.7	350.4	4.4	91.00	400.4	63.7	280.3
April	person-day	4.0	91.00	364.0	63.7	254.8	3.2	91.00	291.2	63.7	203.8
May	person-day	1.0	91.00	91.0	63.7	63.7	0.8	91.00	72.8	63.7	51.0
June	person-day	1.5	91.00	136.5	63.7	95.6	1.2	91.00	109.2	63.7	76.4
July	person-day	2.0	91.00	182.0	63.7	127.4	1.6	91.00	145.6	63.7	101.9
August	person-day	2.0	91.00	182.0	63.7	127.4	1.6	91.00	145.6	63.7	101.9
September	person-day	3.0	91.00	273.0	63.7	191.1	2.4	91.00	218.4	63.7	152.9
October	person-day	4.5	91.00	409.5	63.7	286.7	3.6	91.00	327.6	63.7	229.3
November	person-day	6.0	91.00	546.0	63.7	382.2	4.8	91.00	436.8	63.7	305.8
December	person-day	7.0	91.00	637.0	63.7	445.9	5.6	91.00	509.6	63.7	356.7
January	person-day	8.0	91.00	728.0	63.7	509.6	6.4	91.00	582.4	63.7	407.7
February	person-day	5.5	91.00	500.5	63.7	350.4	4.4	91.00	400.4	63.7	280.3
Sub-total Labor costs		50.0		4550		3185	40		3640		2548
Income (with labor costs)				**2250**		**3601**			**-240**		**845**

Table G4-G.8b: Fisheries Budget – Floodplain

(Per ha Basis)

Items of Benefits/Costs	Physical Unit	Without Subproject					With Subproject				
		Physical	Financial		Economic		Physical	Financial		Economic	
		Quantity/ha	Price/Unit	Value/ha	Price/Unit	Value/ha	Quantity/ha	Price/Unit	Value/ha	Price/Unit	Value/ha
Revenue											
Main product	kg	50	55	2750	47.85	2392.5	25	55	1375	47.85	1196.3
Sub-total Revenue				2750		2392.5			1375		1196.3
Operating Costs (excluding labor)											
Gear	ha	1.00	250	250	217.5	217.5	1.00	125	125	108.8	108.8
Craft	ha	1.00	125	125	108.8	108.8	1.00	62.5	62.5	54.4	54.4
Lease Fee	ha	1.00	0	0	0	0	1.00	0	0	0	0
Guarding	ha	1.00	0	0	0	0	1.00	0	0	0	0
Other Costs	ha	1.00	100	100	87	87	1.00	50	50	43.5	43.5
Sub-total Operating Costs				475		413.2			237.5		206.6
Income (without labor costs)				2275		1979.3			1137.5		989.6
Labor Costs (hired labor)											
March	person-day		91.00	0	63.7			91.00	0	63.7	
April	person-day		91.00	0	63.7			91.00	0	63.7	
May	person-day		91.00	0	63.7			91.00	0	63.7	
June	person-day		91.00	0	63.7			91.00	0	63.7	
July	person-day	3		0	63.7	191.1	2		0	63.7	127.4
August	person-day	6		0	63.7	382.2	4		0	63.7	254.8
September	person-day	9		0	63.7	573.3	6		0	63.7	382.2
October	person-day	12		0	63.7	764.4	8		0	63.7	509.6
November	person-day		91.00	0	63.7			91.00	0	63.7	
December	person-day		91.00	0	63.7			91.00	0	63.7	
January	person-day		91.00	0	63.7			91.00	0	63.7	
February	person-day		91.00	0	63.7			91.00	0	63.7	
Sub-total Labor costs		30		0	63.7	1911	20		0		1274
Income (with labor costs)				**2275**		**68**			**1138**		**-284**

Exhibit G4-H:
TABLES FOR SELECTING SIZE AND DIMENSIONS OF HYDRAULIC STRUCTURES

(Reproduced from previous *Standard Design Catalogue (not in use now) for use only in feasibility level study)*

Table 2-1: Standard Opening Sizes of Hydraulic Structures (in mm)

Regulator/Sluice		**WRS**	**Weir**	
RCC Pipe (Diameter)	**RCC Box** (Width x Height)	**(Width x Height)**	**Retention Height**	**Overflow Depth**
600	900 x 900	1200 x 1500	1000	600
900	900 x 1200	1200 x 1800	1200	800
1200	1000 x 1200	1500 x 1500	1500	1000
	1200 x 1200	1500 x 1800	1500	
	1200 x 1500	1500 x 2000		
	1500 x 1500			
	1500 x 1800			

Table 2-2: Standard Hydraulic Dimensions of Non-Tidal Regulators/Sluices

Conduit Size W x H (m)	**Discharge Capacity** **Q** (m^3/s)	**Glacis Drop** (m)		**Glacis Length** (m)		**Basin Length** (m)		**Basin Width** (m)		**Cutoff Depth** (m)	
		C/S	**R/S**	**C/S**	**R/S**	**C/S**	**R/S**	**C/S**	**R/S**	**C/S**	**R/S**
0.60 Dia.	0.5	0.20	0.30	0.60	0.75	3.60	3.75	1.80	1.80	1.20	1.20
0.90 Dia.	1.2	0.30	0.40	0.75	0.75	4.45	4.75	2.50	2.50	1.50	1.50
1.20 Dia.	2.2	0.30	0.40	0.75	0.75	4.45	4.75	3.20	3.20	1.50	1.50
0.90x0.90	1.5	0.30	0.40	0.75	0.75	4.45	4.75	3.00	3.00	1.50	1.50
0.90x1.20	2.1	0.30	0.40	0.90	1.20	4.75	5.00	3.20	3.20	1.50	1.50
1.00x1.20	2.3	0.30	0.40	0.90	1.20	4.75	5.00	3.30	3.30	1.50	1.50
1.20x1.20	2.7	0.30	0.40	0.90	1.20	4.75	5.00	3.50	3.50	1.50	1.50
1.20x1.50	3.4	0.30	0.50	0.90	1.50	5.10	6.00	3.70	3.70	1.80	1.80
1.50x1.50	4.3	0.30	0.50	0.90	1.50	5.10	6.00	4.00	4.00	1.80	1.80
1.50x1.80	5.2	0.40	0.60	1.00	1.80	6.00	7.20	4.50	4.50	2.10	2.10

Note: Discharge capacities Q in non-tidal structures represent discharges at 0.30m hydraulic head (dh).

Basin length and Cutoff wall depths represent values calculated at 0.60 m hydraulic head.

Table 2-3: Standard Hydraulic Dimensions of Tidal Sluices/Regulators in Zone 1 (Very Low Tide Level, Reference Area Patuakhali)

Conduit Size W x H (m)	**Discharge Capacity Q** (m^3/s)	**Glacis Drop** (m)		**Glacis Length** (m)		**Basin Length/ Type** (m)		**Basin Width** (m)		**Cutoff Depth** (m)	
		C/S	**R/S**	**C/S**	**R/S**	**C/S**	**R/S**	**C/S**	**R/S**	**C/S**	**R/S**
0.90x1.20	2.2	0.40	1.50	1.00	3.00	7.00(1)	7.00(2)	3.50	3.50	1.80	1.80
1.00x1.20	2.5	0.40	1.50	1.00	3.00	7.00(1)	7.00(2)	3.70	3.70	1.80	1.90
1.20x1.20	3.0	0.40	1.50	1.00	3.00	7.00(1)	7.00(2)	4.00	4.00	1.80	2.10
1.20x1.50	3.9	0.50	1.50	1.50	3.50	7.50(1)	8.50(1)	4.50	4.50	2.00	2.10
1.50x1.50	5.0	0.50	1.50	1.50	3.50	7.50(1)	9.00(1)	5.00	5.00	2.10	2.40
1.50x1.80	6.1	0.60	1.20	1.50	3.00	8.50(1)	10.00(1)	5.50	5.50	2.40	2.40

Table 2-4: Standard Hydraulic Dimensions of Tidal Sluices/Regulators in Zone 2 (Low Tide Level; Reference Area Barisal)

Conduit Size W x H (m)	**Discharge Capacity Q** (m^3/s)	**Glacis Drop** (m)		**Glacis Length** (m)		**Basin Length / Type** (m)		**Basin Width** (m)		**Cutoff Depth** (m)	
		C/S	**R/S**	**C/S**	**R/S**	**C/S**	**R/S**	**C/S**	**R/S**	**C/S**	**R/S**
0.60 Dia.	0.6	0.40	0.60	1.00	1.50	3.80(2)	4.00(2)	2.00	2.00	1.50	1.50
0.90 Dia.	1.3	0.40	0.90	1.00	2.00	5.00(2)	5.00(2)	2.70	2.70	1.80	1.80
1.20 Dia.	2.3	0.40	0.90	1.00	2.00	6.50	6.50(2)	3.50	3.50	1.80	1.80
0.90x0.90	1.7	0.40	0.90	1.00	2.00	6.00	6.00(2)	3.00	3.00	1.80	1.80
0.90x1.20	2.2	0.40	0.90	1.00	2.00	7.00	7.00(2)	3.50	3.50	2.00	2.00
1.00x1.20	2.5	0.40	0.90	1.00	2.00	7.00	7.00(2)	3.70	3.70	2.00	2.00
1.20x1.20	3.0	0.40	0.90	1.00	2.00	7.00	7.00(2)	4.00	4.00	2.00	2.00
1.20x1.50	3.9	0.50	0.90	1.50	2.00	7.50	8.00	4.50	4.50	2.10	2.10
1.50x1.50	5.0	0.50	0.90	1.50	2.00	7.50	8.50	5.00	5.00	2.10	2.10
1.50x1.80	6.1	0.60	0.90	1.50	2.00	8.50	9.00	5.50	5.50	2.10	2.10

Notes:

1. Discharge values Q of tidal structures shown in Table 2-3 and Table 2-4 represent approximate average discharge rate during drainage period for tidal conditions prevailing in Patuakhali and Barisal districts. These values can be used during the initial stage of subproject planning as indicative figures only. **During the preparation of final designs the structure discharge capacity should be calculated based on actual ground levels and tide levels applicable to the structure site.**

2. Figures in brackets indicate type of stilling basin; (1) = Indian Standard Stilling Basin Type 1, and (2) = USBR Stilling Basin Type 2.

Table 2-5: Standard Hydraulic Dimensions of Water Retention Structures (Gated) (in meter)

Structure Size	Disch. Capacy (m^3/s) Q	Country Side				Sill Length Sl	River Side				Basin Width bw	Chute Blocks Height h_{Ch}	Baffle Blocks		Dentated End Sill Height h_s
		Cutoff Depth $d_{C/S}$	Apron Length $L_{C/S}$	Glacis Length $Gl_{C/S}$	Glacis Rise Gr		Glacis Drop Gd	Glacis Length $Gl_{R/S}$	Apron Length $L_{R/S}$	Cutoff Depth $d_{R/S}$			Dista n-ce d_b	Height h_b	
1-1.2x1.5	2.90	1.80	5.75	0.75	0.30	1.60	0.60	1.50	7.70	2.10	3.50	0.35	1.20	0.42	0.30
2-1.2x1.5	5.80	1.80	5.75	0.75	0.30	1.60	0.60	1.50	7.70	2.10	5.00	0.35	1.20	0.42	0.30
3-1.2x1.5	8.70	1.80	5.75	0.75	0.30	1.60	0.60	1.50	7.70	2.10	7.00	0.35	1.20	0.42	0.30
1-1.2x1.8	3.60	2.00	5.75	0.75	0.30	1.60	0.60	1.50	9.20	2.50	3.50	0.45	1.35	0.54	0.33
2-1.2x1.8	7.30	2.00	5.75	0.75	0.30	1.60	0.60	1.50	9.20	2.50	5.00	0.45	1.35	0.54	0.33
3-1.2x1.8	10.90	2.00	5.75	0.75	0.30	1.60	0.60	1.50	9.20	2.50	7.00	0.45	1.35	0.54	0.33
1-1.5x1.5	3.60	1.80	5.50	1.25	0.50	1.60	0.80	2.00	8.70	2.40	4.00	0.35	1.20	0.45	0.30
2-1.5x1.5	7.30	1.80	5.50	1.25	0.50	1.60	0.80	2.00	8.70	2.40	6.00	0.35	1.20	0.45	0.30
3-1.5x1.5	10.90	1.80	5.50	1.25	0.50	1.60	0.80	2.00	8.70	2.40	8.00	0.35	1.20	0.45	0.30
4-1.5x1.5	14.50	1.80	5.50	1.25	0.50	1.60	0.80	2.00	8.70	2.40	10.00	0.35	1.20	0.45	0.30
								.							
1-1.5x1.8	4.50	2.00	5.75	1.25	0.50	1.60	0.80	2.00	9.70	2.90	4.00	0.45	1.40	0.56	0.35
2-1.5x1.8	9.10	2.00	5.75	1.25	0.50	1.60	0.80	2.00	9.70	2.90	6.00	0.45	1.40	0.56	0.35
3-1.5x1.8	13.60	2.00	5.75	1.25	0.50	1.60	0.80	2.00	9.70	3.00	8.00	0.45	1.40	0.56	0.35
4-1.5x1.8	18.10	2.00	5.75	1.25	0.50	1.60	0.80	2.00	9.70	3.00	10.00	0.45	1.40	0.56	0.35
1-1.5x2.0	5.10	2.20	6.25	1.25	0.50	1.60	0.80	2.00	10.80	3.00	4.00	0.50	1.50	0.60	0.40
2-1.5x2.0	10.30	2.20	6.25	1.25	0.50	1.60	0.80	2.00	10.80	3.00	6.00	0.50	1.50	0.60	0.40
3-1.5x2.0	15.40	2.20	6.25	1.25	0.50	1.60	0.80	2.00	10.80	3.00	8.00	0.50	1.50	0.60	0.40
4-1.5x2.0	20.40	2.20	6.25	1.25	0.50	1.60	0.80	2.00	10.80	3.00	11.00	0.50	1.50	0.60	0.40

For hydraulic energy dissipation during drainage period, Water Retention Structures are provided on the riverside with an Indian Standard Stilling Basin Type 1. The dimensions of the stilling basin appurtenances are determined from the recommended ratios given below. The width and spacing of the appurtenances may need to be adjusted to fit the floor widths of individual structures.

Table 2-6: Standard Hydraulic Dimensions of Weirs (Un-gated) (in meter)

Weir Height	Flow Depth	Unit Discharge ($m^3/s/m$)	Total Head	Country Side		River Side					
				Cutoff Depth	Min. Apron Length	Apron Drop	Impact Blocks		Basin Length	End Sill Height	Cutoff Depth
							Location	Height			
P	H_e	q	Y	$d_{C/S}$	$L_{C/S}$	A_d	L_P	h_b	L_B	h_s	$d_{R/S}$
1.00	0.60	1.02	1.40	1.50	5.15	0.40	3.90	0.40	5.50	0.20	1.80
1.00	0.80	1.57	1.40	1.50	5.15	0.40	4.70	0.50	6.50	0.30	2.30
1.20	0.60	1.02	1.60	1.50	5.15	0.40	4.20	0.40	5.80	0.20	1.80
1.20	0.80	1.57	1.60	1.50	5.25	0.40	4.90	0.50	6.80	0.25	2.30
1.50	0.60	1.02	2.00	1.95	5.30	0.50	4.70	0.40	6.60	0.20	1.95
1.50	0.80	1.57	2.00	1.50	5.40	0.50	5.50	0.50	7.60	0.25	2.30
1.50	1.00	2.20	2.00	1.50	5.50	0.50	6.30	0.60	8.60	0.30	2.80
1.80	0.60	1.02	2.40	2.45	5.60	0.60	5.10	0.40	7.20	0.20	2.45
1.80	0.80	1.57	2.40	2.35	5.60	0.60	5.90	0.50	8.30	0.25	2.35
1.80	1.00	2.20	2.40	1.80	5.60	0.60	6.60	0.60	9.20	0.30	2.80

ANNEXES

Annex G4-IA: Engineering Annex of Subproject (Dr, TI, FMD, WC Subprojects)

Annex G4-IB: Engineering Annex of Subproject (CAD Subprojects)

ANNEX G4-IA: ENGINEERING ANNEX OF SUBPROJECTS

(For Dr, TI, FMD, WC Subprojects)

[This document, a part of the Guidelines for SSWR Development, will contain hydrological and hydraulic data and analysis for a SSWRD subproject's feasibility study and form the Engineering Annex of the FS Report]

Appendix G4-IA.A

Salient Data, Design and Impact of Subproject

A1 Subproject Processing Information

Subproject Name			**Type**
Location		**Subproject Area:**	
Zone		Gross	ha
District		Net	ha
Upazila			
Union:			

Subproject Processing Dates		**Comments**
Proposal received in IWRMU		
Pre-screening		
Field reconnaissance		
PRA and Social Survey		
Name of PRA Firm/NGO	Date of Assigning Work: Field Work: Date Start: End: PRA Report Completed (date):	
Feasibility Study		
Name of FSDD Firm		Assign Date:
Data Collection		
Multidisciplinary Field Visit Period	Start Date:	End Date:
Pre-Feasibility Report (draft)	Submitted:	Reviewed
Planning Discussion Meeting	Date Held	Place
Pre-Feasibility Report (final)	Submitted:	Finalized:
DLIAPEC Clearance	Date Obtained	
Detail Data Collection		
- *Agricultural*	Date From:	Date To:
- *Fisheries*	Date From:	Date To:
- *Environmental*	Date From:	Date To:
- *Engineering Survey*	Date From:	Date To:
Feasibility Analysis		
Feasibility Report - Draft	Submitted	Reviewed
Feasibility Report – Final Draft	Submitted	Reviewed
Feasibility Report	Submitted	Approved
Environmental Clearance	Date Submitted	
Comments:		

A2 Climatic Design Data of Subproject

Parameters	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Year
Temperature (^{0} C)			**Station Number & Name:**						**Period of Data:**				
Max													
Mean													
Min													
Evaporation, E (mm/day)			**Station Number & Name:**						**Period of Data:**				
Average													
Evapo-transpiration, ETo (mm/day)			**Station Number & Name:**						**Period of Data:**				
Average													
Rainfall, R (mm/month)			**Station Number & Name:**						**Period of Data:**				
Average													
Water Balance (mm/month)													
Water Body													
Crop Land													

A3 Hydrological Design Data of Subproject

A 3.1 Rainfall Data

A. Mean Monthly Rainfall (mm)

Station Number and Name:.. Period of Data:......................

Parameters	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Year
Max													
Mean													
Min													

B. Design Storm Rainfall (Synthesized 5-day 10-year Storm)

Station Number and Name:.. Period of Data:......................

Pre-monsoon (Jan-Jun)

Duration (Days)	1	2	3	4	5
Cumulative Depth (mm)					

Monsoon (Annual)

Duration (Days)	1	2	3	4	5
Cumulative Depth (mm)					

A 3.2 River (Outside) Water Level Data

A. Mean Monthly Water Levels (Tidal Zone)

Subproject WL	**Apr**		**May**		**Jun**		**Jul**		**Aug**		**Sep**	
	HTL	**LTL**	**HTL**	**LTL**	**HTL**	**LTL**	**HTL**	**LTL**	**HTL**	**LTL**	**HTL**	**LTL**
Max												
Mean												
Min												
	Oct		**Nov**		**Dec**		**Jan**		**Feb**		**Mar**	
	HTL	**LTL**	**HTL**	**LTL**	**HTL**	**LTL**	**HTL**	**LTL**	**HTL**	**LTL**	**HTL**	**LTL**
Max												
Mean												
Min												

Computational Basis and Procedures	
U/S Stn. Number & Name: **Period of Data:**	**D/S Stn. Number & Name:** **Period of Data:**
Subproject Data Derived by: Interpolation Extrapolation Correlation	Sketch representation of reference stations and the subproject with distances and other comments, assumptions if any:

B. Mean Monthly Water Levels (Non-Tidal Zone)

Subproject WL	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**
Max												
Mean												
Min												

Computational Basis and Procedures	
U/S Stn. Number & Name: **Period of Data:**	**D/S Stn. Number & Name:** **Period of Data:**
Subproject Data Derived by: Interpolation Extrapolation Correlation	Sketch representation of reference stations and the subproject with distances and other comments, assumptions if any:

C. High Flood Level (HFL)

Return Period (year)	**Pre-monsoon**	**Monsoon**
2.33		
5		
10		
20		
50		

Computational Basis and Procedures	
U/S Stn. Number & Name: **Period of Data:**	**D/S Stn. Number & Name:** **Period of Data:**
Subproject Data Derived by: Interpolation Extrapolation Correlation	Sketch representation of reference stations and the subproject with distances and other comments, assumptions if any:

A4 Area – Elevation - Storage Relationship of Subproject

Land Elevation(1) (m PWD)	**Cumulative Area** (ha)	**Cum Storage Volume** (ha-m)	**Land Use**
			Permanent Water Body
			Highland and Homesteads

v(1) Usually areas and storage volumes are incremented for incremental land elevations at 0.30 m intervals.

A5 Drainage Rate and Basin WL (From Routing of Design Storm Rainfall)

Season	**Area (ha)**			**LGL** (mPWD)	**Dr Level** (mPWD)	**Dr Rate** (mm/day)	**Basin WL** (mPWD)
	Drainage	**Gr Benefit**	**Damage**				
Pre-monsn							
Monsoon							
Comments:							

A6 Land Type Changes

Average (1:2.33 Year) Monsoon Flood Level in Subproject : .... mPWD
Design Basin Water Level in Subproject : .... mPWD

Land Type(1)	**Nature of Flooding**	**Pre-subproject Area** (ha)	**Post-subproject Area** (ha)
Non-cultivated highland	Not flooded		
F0 (d < 0.3 m) Highland	Intermittent		
F1 (0.3< d <0.9 m) Medium	Seasonal		
F2 (0.9< d <1.8 m) Medium	Seasonal		
F3 (d>1.8 m) Lowland	Seasonal >9 month		
Non-cultivated lowland and permanent water bodies	Perennial		
Floodplain Fish Habitat (F2+F3)			
Net Area (F0+F1+F2+F3)			
Gross Area			

(1) Areas of (i) pre-subproject land types are calculated by depths from average Monsoon (annual) Flood Level and (ii) post-subproject land types are calculated from Design Basin Water Level.

A7 FMD Subprojects: Area Benefited in Floods of Different Degrees

Reference Flood / Water Level Condition	WL (m PWD)	Gross Area Below WL (ha)	Net Area Below WL (ha)	Benefit Area for Reference Condition (ha)
Partial Flood Protection (Submersible Embankment) Subprojects				
1:10-yr Pre-Monsoon FL.				
1:2.33-yr Annual HFL				
1:10-yr Annual HFL.				
Pre-Monsoon Basin WL				
Full Flood Protection (High Embankment) Subprojects				
1:2.33-yr Annual HFL				
1:10-yr Annual HFL				
1:20-yr Annual HFL				
Design Basin WL				

A8 Design of Component Works

A. Drainage Khal Re-excavation

Nos	Name of Khal	Length (km)	Design Section Dimensions (m)		Depth of Excavation (average)
			Bed Width	Depth	
1					
2					
3					

B. Embankment Re-sectioning / Upgrading

Nos	Embankment Chainage		Length (km)	Design Section Dimensions (m)			Height above GL (average)
	From	To		Bed Width	Depth	Side Slope	
1							
2							
3							

C. Hydraulic Structures

Nos	Name & Location	Size of Structure		Gate Type	Purpose of Structure
		No of Vents	Vent Size		
1					
2					

A9 Summary Quantities and Cost for Subproject

Nos	Names of Khal / Embankment / Structure	Quantity Km / No	Unit Cost	Estimated Cost (Tk)
A. Re-excavation of Khal				
1				
2				
B. Embankment Re-sectioning / Upgrading				
1				
2				
C. Hydraulic Structures				
1				
2				
D. Others				
1.				
2.				

Total Subproject Cost			

A10 Economic Viability Index

EIRR	
NPV	
B/C	

Appendix G4-IA.B

Hydro-Climatic Data and Analyses for Feasibility Study

B1 Basic Data and Statistical Analyses

A. Climatic Data

Notes and Explanations: Climatic data for study of SSWRD subprojects will usually include Temperature, Evaporation, Evapo-transpiration and Rainfall. Sunshine hours, wind speed, etc may also be needed for certain specific subprojects. It may be adequate to use district level climatic data as required (*refer to requirements in Appendix G4-IA.A, Table A2*) from secondary sources. However, source from where the secondary data have been acquired should be mentioned as foot note under the data Table.

[Provide data table here. Use pages as required]

B. Rainfall Data

Notes and Explanations: **(i)** The Rainfall station that will most closely represent the rainfall at the subproject site shall be identified using hydrological station network map and its name and ID number, location, distance and direction shall be properly mentioned and described. **(ii)** The length of data record used shall also be mentioned. **(iii)** Daily rainfall records for the number of years considered in the analysis shall be arranged in tabular form with rows representing days (1 to 31) and columns representing months. Thus, each year's data will be accommodated in one page. These basic data shall then be organized and analyzed statistically for the required parameters (*refer to requirements in Appendix G4-IA.A, Table A3.1 A, B*). **(iv)** For the design storm rainfall, the process of synthesizing 1-day, 2-day, 3-day, 4-day and 5-day maximum cumulative rainfall amounts for each year from the basic data tables shall be explained/elaborated by referring to the values of the data tables. The series of 1-day rainfall data so obtained shall then be analyzed statistically to obtain the 1-day 10-year maximum rainfall. Similarly, the 2-day maximum cumulative rainfall data series shall be analyzed statistically to obtain the 2-day 10-year maximum cumulative rainfall. The procedure will be repeated for 3-day, 4-day and 5-day cumulative rainfalls also. **(v)** All assumptions made, formulas used and values of coefficients and constants involved should be mentioned and explained and all computations be shown elaborately, preferably arranged in tabular forms.

[Provide basic data and analysis tables here. Use pages as required]

C. Water Level Data

Notes and Explanations: (i) The Water Level station or stations, the records of which will be required to calculate water levels at the subproject site, shall be identified from the hydrological station network map and the names and ID numbers, locations, distances, directions, etc of the stations from the subproject shall be properly mentioned and described. (ii) The length of data record used for analysis shall also be mentioned. (iii) Daily mean WL for non-tidal stations and daily maximum High Tide Level (HTL) and minimum Low Tide Level (LTL) for tidal stations shall be the basic WL data. These basic WL data shall be organized in tabular form, one page for one year's data, with rows representing days (1 to 31 days) and two columns (one for HTL and one for LTL data) for each month. (iv) The basic data shall then be organized and analyzed statistically for the required parameters (*refer to requirements in Appendix G4-IA.A, Table A3.2 A, B, C*). (v) If interpolation or extrapolation between stations is required to calculate subproject water level, derivation of the required mathematical equation to be used for the interpolation or extrapolation should be shown and explained by a layout sketch and distances of the reference stations from the subproject. (vi) All assumptions made, formulas used and values of coefficients and constants involved should be mentioned and explained and all computations be shown elaborately, preferably arranged in tabular forms.

[Provide basic data and analysis tables here. Use pages as required]

B2 Physical and Hydrological Characteristics of Subproject

[This subsection is to be read and worked with ***Subsection 3.2.5: Anticipated Impacts of Different Types of Subprojects*** of the Guidelines Document ***G4: Feasibility Study of Subprojects***]

A.1 Area-Elevation-Storage Characteristics of Subproject

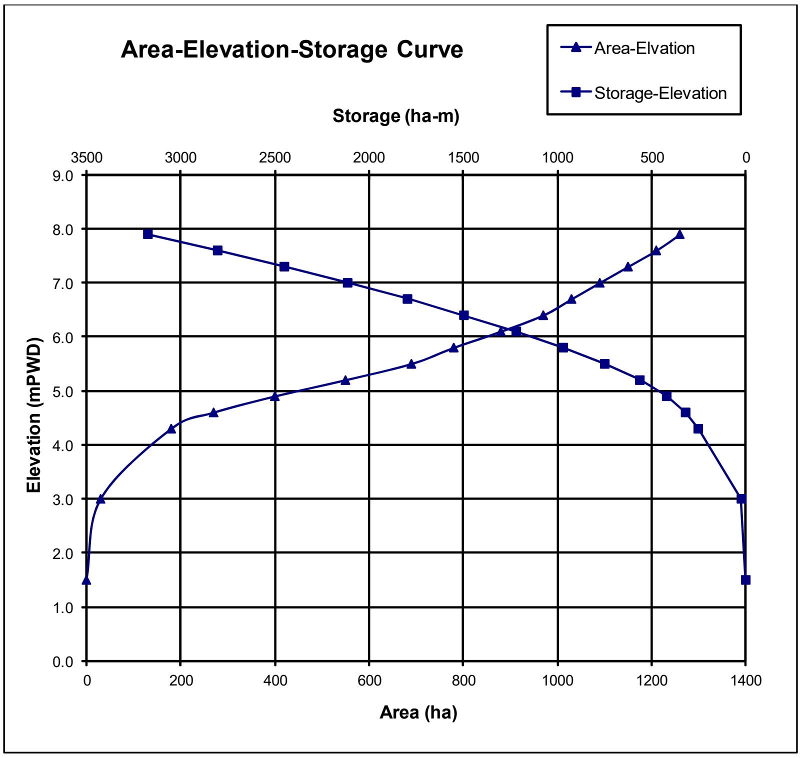
Notes and Explanations: Area within the subproject boundary for each incremental ground elevation of 0.30 m starting from the lowest ground level shall be measured from the 4" to 1 mile topographic map of the subproject area having ground elevation contours at intervals of 30 cm (1-foot). If the subproject area is not surveyed as above, land elevation characteristics of the subproject area shall be established by conducting a survey for ground levels at specified grid points (usually at 100 m) and areas under incremental 0.30 m ground levels as mentioned above shall be determined. The incremental areas are then cumulated to establish a land elevation versus area relationship for the subproject area. Also, the volumes of water that can stand in storage in the subproject area below land elevations incremented as above, by 0.30m above the lowest ground level, shall be calculated. The relationships between cumulated values of ground elevation, area and storage volume are organized in Table for use by computer program for engineering analysis of the data. The relationship shall also be shown in linear graphs drawn with GL in y-axis and Area and Storage Volume in x-axis (giving two x-axes and two graphs in one drawing sheet).

[Provide data table and graph here]

(This is an example data and graph. FS Consultants will provide data and curves for the concerned subproject)

Subproject ....
Upazila: ....
District: ....

Elevation (mPWD)	Area (ha)	Storage (ha-m)
1.5	0.00	0.00
3.00	30.00	22.50
4.30	180.00	252.00
4.60	270.00	319.50
4.90	400.00	420.00
5.20	550.00	562.50
5.50	690.00	748.50
5.80	780.00	969.00
6.10	880.00	1218.00
6.40	970.00	1495.50
6.70	1030.00	1795.50
7.00	1090.00	2113.50
7.30	1150.00	2449.50
7.60	1210.00	2803.50
7.90	1260.00	3174.00



A.2 Land Type Analysis of Subproject

Notes and Explanations: (i) Land Type Classification of the subproject, meaning calculation of lands under the different flood phases of standard land types (F0, F1, F2, F4) for a given WL in the subproject, shall be done by the standard Spreadsheet Program using both pre-subproject and post-subproject WLs. For this, tabulated area-elevation data of the subproject will be used as an input. (ii) For full flood management subprojects, the pre-subproject and post subproject WLs will be different and difference between amounts of lands of respective land types under the two WLs will denote the land type change as the impact of the subproject. (iii) As other type of subprojects (partial FM, drainage, WC, etc) have no impact on land type change, the analysis can be done by using the same Spreadsheet Program by putting the pre-subproject WL also in place of the post-subproject WL. The calculations will give the same land areas under different land types meaning that there will be no land type change.

[Provide calculations of Land Type Analysis here]

(This is an example calculation. FS Consultants will provide calculations of the concerned subproject)

				LAND TYPE CLASSIFICATION							
	Subproject :	Bansgari									
	Upazilla :	Kalkini									
	District :	Madaripur									
Land elevation (m)	**Cum. area excldg NC lowland (ha)**			Gross area =	525.00	**ha**					
				NC high land and homestead area =	90.00	**ha**					
				Non cultivable low land =	10.00	**ha**					
1.20	0.00			Benefited area =	425.00	**ha**					
1.30	5.00										
1.50	25.00										
1.80	82.24			Pre project WL =	3.74	**m**					
2.10	160.81			Post project WL =	3.74	**m**					
2.40	232.55		**Preproject**						**Post Project**		
2.70	305.00		**Land type**	**WL (m)**	**Area(ha)**	|	**Area(ha)**	**WL (m)**	**Land type**		
3.00	399.94		Not flooded =	3.74	0.00	|	0.00	3.74	**= Not flooded**		
3.30	458.01		F0(0.0-0.3) =	3.44	15.12	|	15.12	3.44	**= F0(0.0-0.3)**		
3.60	480.00		F1(0.3-0.9) =	2.84	59.88	|	59.88	2.84	**= F1(0.3-0.9)**		
3.90	495.00		F2(0.9-1.8) =	1.94	230.40	|	230.40	1.94	**= F2(0.9-1.8)**		
4.20	505.84		F3(1.8+) =		119.60	|	119.60		**= F3(1.8+)**		
4.50	515.00	**NC high land and homestead area =**			90.00	|	90.00		**= NC high+HS area**		
			NC low land =		10.00	|	10.00		**= NC lowland**		
			Total =		525.00	|	525.00		**= Total**		
				Land type	***Area(Pre)***		***% NBA***		***Area(Post)***		***% NBA***
				F0------>	***15***	***ha***	***3.53***	***F0------>***	***15***	***ha***	***3.53***
				F1------>	***60***	***ha***	***14.12***	***F1------>***	***60***	***ha***	***14.12***
				F2------>	***230***	***ha***	***54.12***	***F2------>***	***230***	***ha***	***54.12***
				F3------>	***120***	***ha***	***28.24***	***F3------>***	***120***	***ha***	***28.24***
				Benefited area =	***425***	***ha***	**Benefited area =**		***425***	***ha***	

B Design Basin Water Level and Design Drainage Rate of Subproject

Notes and Explanations: Rainfall of the Design Storm (synthesized 5-day 10-year storm) established earlier occurring over the relevant catchment area shall be routed through the drainage channel of the subproject, assuming that there is no obstruction to drainage from downstream WL, to establish an acceptable highest WL in the subproject (usually called Design Basin WL) and the corresponding rate of drainage (the possible maximum drainage rate for use in design of the system), in mm per day, that is required to give the Basin WL using the project specified MS Excel Spreadsheet Program for simplified storm routing and crop damage criteria, usually taken as 5% of cultivated area (excluding permanent water body) unless otherwise decided for any specific subproject, The simplified routing program yields a Basin WL corresponding to crop damage scenario in respect of depth and duration of crop inundation when a trial drainage rate is applied. Thus, an acceptable Design Basin WL is obtained by trial and the corresponding drainage rate is taken as the design drainage rate. Design drainage rate shall be calculated for both (i) pre-monsoon and (ii) monsoon design storms.

[Provide design calculations of the routing program here]

(This is an example calculation. FS Consultants will provide calculations of the concerned subproject)

ANALYSIS OF DRAINAGE RATE

Sub-Project: .... SP No.
Upazila: ....
District: ....

CRITERIA:
- Design Storm ☒ 10-Yr 5-Day storm recorded at the nearest Rainfall Station
- Crop Damage ☒ Sub-Project WL during design storm may not inundate more than 5% area by depth more than 300mm for duration of more than 3 days.

ASSUMPTIONS:
- Infiltration, Evapo-Transpiration and Depression Storage are neglected.

INPUT DATA:
- Catchment Area (Ha.): 525.00 Gross Area (Ha): 525
- Benefited Area (Ha.): 425.00
- Drainage Level (mPWD): 1.30
- Allowable Damage Area (% of Benefited Area): 5.0%
- Area-Elevation-Storage Data:

	Elevation (m)	Cum. Area (Ha.) including non cultivable low land	Cum. Stor. (Ha-m)
	1.20	6.00	0.00
LGL=>	1.30	15.00	1.05
	1.50	35.00	6.05
	1.80	92.24	25.14
	2.10	170.81	64.59
	2.40	242.55	126.60
	2.70	315.00	210.23
	3.00	409.94	318.97
	3.30	468.01	450.66
	3.60	490.00	594.36
	3.90	505.00	743.61
	4.20	515.84	896.74
	4.50	525.00	1052.86

- Design Storm Rainfall (mm): (Pre-Monsoon)

Days	1	2	3	4	5
Cum Depth	179.00	232.00	266.00	288.00	308.00

- Trial Drainage Rate (mm/day): 65.00

CALCULATIONS FOR DRAINAGE MODULUS (PRE-MONSOON)

Day	Cum RF (mm)	Cum DR (mm)	Cum RO (mm)	Cum. Storage (Ha-m)	WL_{basin} (mPWD)	Basin Dr WL (mPWD)	Basin Dr WL+0.3 (mPWD)	Day with WL for Full Damage	100% Crop Damage (Ha.)	Design Drain. Rate (mm/day)
1	179.00	65.00	114.00	59.85	2.06	1.36	1.66	Day-1		
2	232.00	130.00	102.00	53.55	2.02	1.36	1.66	Day-2		
3	266.00	195.00	71.00	37.28	1.89	1.36	1.66	Day-3	21.25	65.00
4	288.00	260.00	28.00	14.70	1.64	1.36	1.66	-ve		
5	308.00	325.00	-17.00	-8.93	0.00	1.36	1.66	-ve		

Note:
1. A day is counted as "day with WL corresponding to full damage of allowable % of Area" if WL_{basin} > Basin Drainage Level +0.3 for the day.
2. If 3 consecutive days are counted to be crop damage days, crops of land corresponding to allowable % area will be considered fully damaged.
3. If count of crop damage day < 3, rivise trial drainage rate downward.
4. If count of crop damage day > 3, rivise trial drainage rate upward.
5. 21.25 ha crop damage area is including 10 ha permanent water bodies. So, 11.25 ha is actual crop damage area.

Appendix G4-IA.C

SUBPROJECT MAPS

A. Subproject Index Map

Notes and Explanations: The Index Map of the subproject shall be a comprehensive map incorporating almost all information that one might like to find therein. Two Index Maps will be used. The *first* one, identified as ***Figure 1A: Index Map (Google Image)*** shall be based on Google Image of the subproject area and show current position of physical features including rivers, khals, water bodies, roads, bridges, homesteads, crop fields, places, etc. The subproject boundary, all planned physical works and impact area boundaries, etc are shown on the Google Image map using AutoCAD. The *second* one, identified as ***Figure 1B: Index Map (Topography)*** shall be based on the available 4 inch to 1 mile topographic map with 1-foot land elevation contour lines prepared by the Survey of Bangladesh. Important features of the subproject area like subproject area, catchment area and benefit area boundaries, alignment of rivers, khals, important roads, locations of water bodies are copied on this map from the Google image map. As the topographic map is quite old, physical features like rivers, khals, water bodies, roads, homesteads etc of this map may be different from the Google image map which represent the present position correctly. This Index Map will be used for establishing land elevation characteristics of the subproject area. Index Maps shall be in standard A3 size. If necessary, more than one A3 sheets may be used showing match lines with contiguous sheets.

*[The Index Maps shall be attached in the Feasibility Study and IEE/EIA Report of the subproject as **Figure-1A Index Map (Google Image) and Figure-1B (Topography)** as has been discussed in Guidelines **G4 Feasibility Study, Subsection 3.2.1, Para on Figure1: Index Map**]*

B. Base Map

Notes and Explanations: The Base Map of the subproject shall be prepared on LGED Upazila Base Map of scale 1:50000 showing all salient features of the subproject – subproject boundary; rivers, khals, beels and haors; existing roads, bridges and culverts, growth centers/important markets, Union Parishad, etc and importantly all the works proposed under the subproject. This map shows location of the subproject in wider surroundings in the Upazila and presents the setting in relation to communication system, markets, important places and towns, etc. This Map shall also be prepared in A3 size.

*[The Base Map shall be attached in the Feasibility Study and IEE/EIA Report as **Figure-2** as has been referenced in Guidelines **G4 Feasibility Study, Subsection 3.2.1, Para on Figure-2: Base Map**]*

C. Regional Map

Notes and Explanations: The Regional Map for the subproject shall be prepared using topographic map of 1:250,000 scale or hydrological network map (BWDB) howing BWDB’s larger water resource projects (if any) and other subprojects of LGED (if any); hydrometric stations used in analysis; main rivers and khals; main roads and railways; District, Upazila and other main towns, etc. This Map shall also be prepared in A3 size.

*[The Regional Map shall be attached in the Feasibility Study and IEE/EIA Report as **Figure-3** as has been referenced in Guidelines **G4 Feasibility Study, Subsection 3.2.1, Para on Figure-3: Regional Map**]*

ANNEX G4-IB: ENGINEERING ANNEX OF SUBPROJECTS

(For CAD Subprojects)

[This document, a part of the Guidelines for SSWR Development, will contain hydrological and hydraulic data and analysis for Feasibility Study of a SSWRD Subproject (CAD) and form the Engineering Annex of the FS Report]

Appendix G4-IB.A
Data, Layout and Preliminary Design of CAD Subproject

A1 General Subproject Information

Subproject Name			**Type**
Location		**Subproject Area:**	
Zone		Gross	ha
District		Net	ha
Upazila			
Union:			
Subproject Processing Dates			**Comments**
Proposal received in IWRMU			
Pre-screening			
Field reconnaissance			
PRA			
Name of PRA Firm/NGO	Date of Assigning Work: Field Work: Date Start: End: PRA Report Completed (date):		
Feasibility Study			
Name of FSDD Firm			Assign Date:
Data Collection			
Multidisciplinary Field Visit Period	Start Date:		End Date:
Concept Report	Submitted:		Finalized:
Detail Data Collection			
- *Socio-Economic*	Date From:		Date To:
- *Agricultural*	Date From:		Date To:
- *Fisheries*	Date From:		Date To:
- *Environmental*	Date From:		Date To:
- *Engineering Survey*	Date From:		Date To:
Feasibility Analysis			
Feasibility Report - Draft	Submitted		Reviewed
Feasibility Report – Final Draft	Submitted		Reviewed
Planning Discussion Meeting	Date Held		Place
Feasibility Report	Submitted		Approved
Clearances			
DLIAPEC Clearance	Date Obtained		
Environmental Clearance	Date Submitted		
Detail Engineering Design			
Detail Design of Works - Draft	Submitted		Reviewed
Design Discussion Meeting	Date Held		Place
Detail Design of Works - Final	Submitted		Approved
LA Plan and BOQ			
Preparation of LA Plan	Date Form		Date To
Preparation of Detail BOQ	Date Form		Date To
Preparation of Bid Documents	Date Form		Date To
Comments:			

A2 Average Monthly Climate & Rainfall Data
(Subproject data same as this reference District)

[This is an example District data. FS Consultants will select applicable reference District and provide that District data here. Refer to G4 Feasibility Study of Subprojects, Subsection-3.2.5]

Barisal								
Month	**Rainfall**			**Min Temp ^0C**	**Max Temp ^0C**	**Humidity %**	**Wind km/day**	**Sunshine hours**
	Average	**Dry**	**Wet**					
Jan.	3.8	3.3	4.3	11.8	25.5	79	74	8.1
Feb.	22.3	19.2	25.1	14.9	28.3	76	81	8.1
Mar.	47.5	40.9	53.4	20.1	31.3	75	103	8.3
Apr.	94.4	81.2	106.0	23.6	32.3	80	158	8.2
May	221.3	190.2	248.5	24.7	33.0	83	173	6.8
Jun.	429.7	369.4	482.5	25.6	31.6	88	163	4.3
Jul.	421.9	362.7	473.8	25.5	30.9	90	148	4.2
Aug.	356.4	306.4	400.2	25.6	31.0	89	133	4.5
Sep.	293.9	252.6	330.0	25.3	30.5	88	111	5.2
Oct.	183.7	158.0	206.3	23.6	31.5	86	70	7.2
Nov.	39.5	34.0	44.4	18.9	29.5	83	68	7.9
Dec.	5.9	5.0	6.6	13.4	26.5	80	76	8.0
Average	2,120	1,823	2,381	21.1	30.2	83	113	6.7

A3 Crop Water & Irrigation Water Requirements and Design Duties *(Subproject data same as this reference District data)*

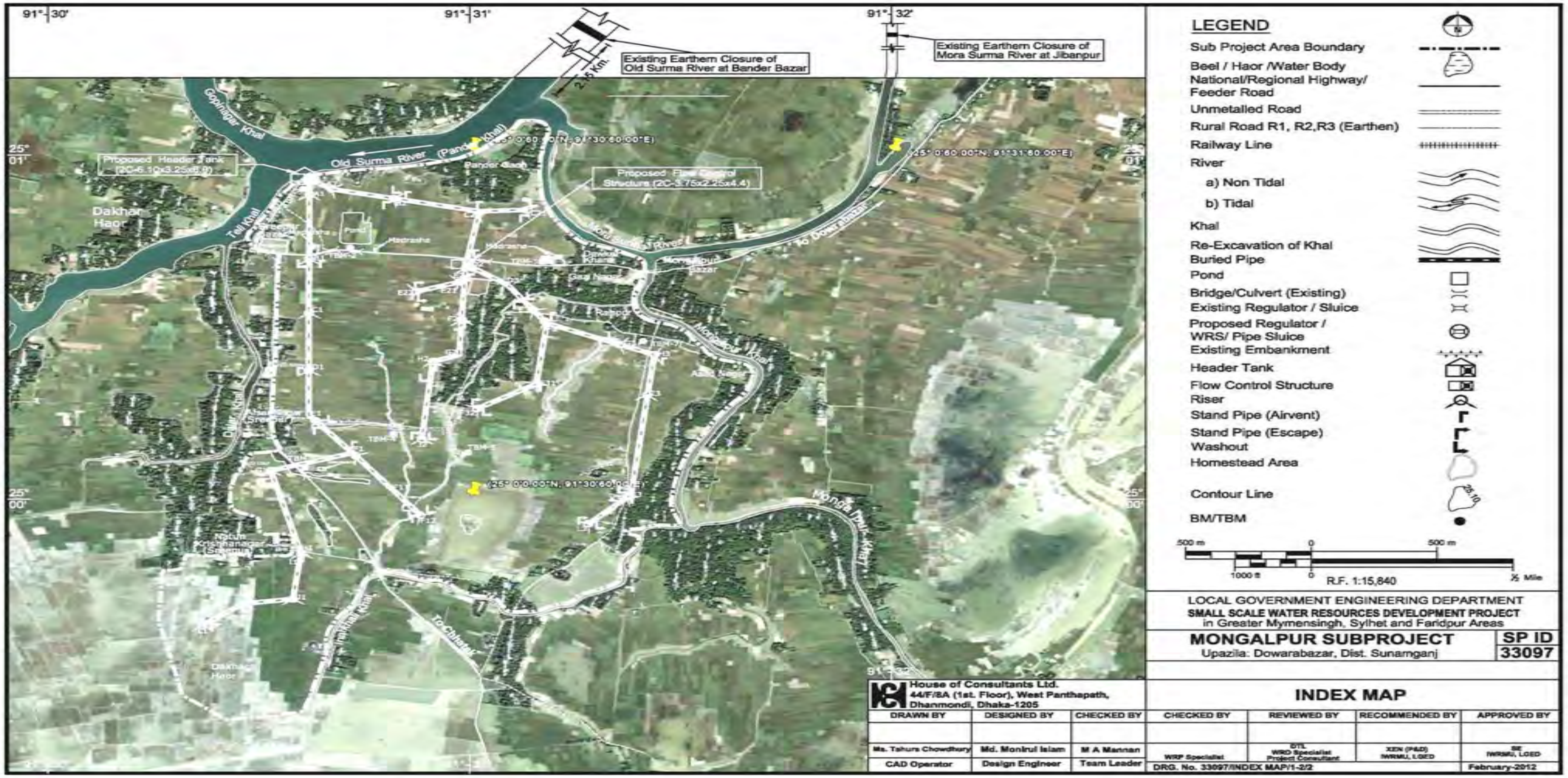
Barisal *[This is example District. Consultants will select applicable District and provide that District data here. Refer G4 Feasibility Study of Subprojects, Subsection-3.2.5]*

Description	Units	100% Rice: Early Planting (Dec to Feb)	100% Rice: Late Planting (Jan to Feb)	100% Vegetables	100% Pulses	10% Vegetables; 10% Pulses & 80% Rice	20% Vegetables; 20% Pulses & 60% Rice
Net irrigation requirements incl. land preparation & effective rainfall							
Nov	mm/month	0	0	0	0	0	0
Dec	mm/month	121	18	0	0	14	11
Jan	mm/month	**164**	**162**	54	32	138	114
Feb	mm/month	80	128	65	66	116	103
March	mm/month	108	105	**88**	**102**	103	101
April	mm/month	78	89	12	25	75	61
May	mm/month	8	18	0	0	14	11
Totals	**mm**	**559**	**520**	**219**	**225**	**460**	**401**
Peak net duty (based on peak month)	mm/d	5.29	5.23	2.84	3.29	4.79	4.36
	l/s/ha	0.61	0.60	0.33	0.38	0.55	0.50
Peak net duty (based on peak 3-month period)	mm/d	4.06	4.39	2.30	2.22	3.96	3.54
	l/s/ha	0.47	0.51	0.27	0.26	0.46	0.41
ratio duties 3-months / 1 month		0.77	0.84	0.81	0.68	0.83	0.81
Efficiencies, Duties & Water Requirements							
At Field boundary							
Field irrigation efficiency (weighted)	%	65%	65%	55%	55%	63%	61%
Peak field irrigation duty (based on 3 month period)	mm/d	6.2	6.8	4.2	4.0	6.3	5.8
	l/s/ha	0.72	0.78	0.48	0.47	0.73	0.67
Total water requirement at field level	**mm**	**860**	**800**	**398**	**409**	**731**	**657**
At Pumping Point at Head of System							
Conveyance efficiency (pipe outlet to field	%	80%	80%	80%	80%	80%	80%
Peak duty for at pipe outlet (based on 3 month period)	mm/d	7.8	8.4	5.2	5.1	7.9	7.2
	l/s/ha	0.90	0.98	0.61	0.58	0.91	0.84
Total water requirement at pipe outlet	mm	1,075	1,000	498	511	913	821
Conveyance efficiency (HT to pipe outlet)	%	100%	100%	100%	100%	100%	100%
Total water requirement at pumping point	mm	**1,075**	**1,000**	**498**	**511**	**913**	**821**

Appendix G4-IB.B
Layout Planning and Preliminary Design of Buried Pipe Irrigation Systems

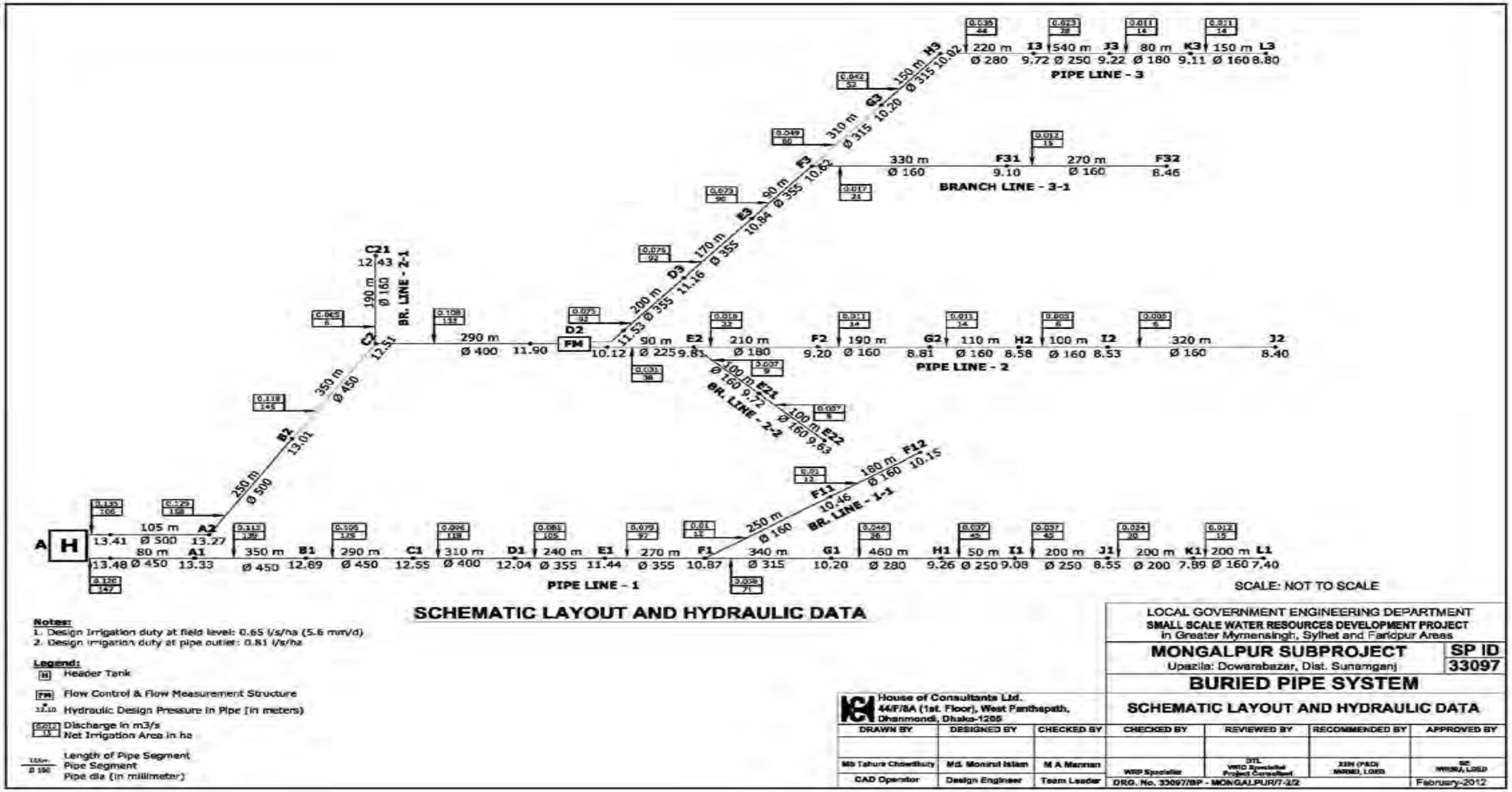
B1 Layout Planning of Buried Pipe Irrigation System of CAD Subprojects using Google Imagery of Subproject Area

(This is for example. FS Consultants will provide Google Imagery of concerned subproject and show layout planning on it. Refer Guidelines G4 Feasibility Study of Subprojects, *Subsection-3.2.5*)



B2 Schematic Layout of Pipeline System

(This is an example layout. FS Consultants will provide layout for the concerned subproject here. Refer *Guidelines G4 Feasibility Study of Subprojects, Subsection-3.2.5*)



B3 Command Areas, Design Flows & Minimum Pipe Diameters

(This is an example calculation for the pipeline layout system shown in B2 above. FS Consultants will furnish data of concerned subproject in this format. Refer *Guidelines G4 Feasibility Study of Subprojects, Subsection-3.2.5)*

Command Areas, Design Flows & Minimum Pipe Diameters Associated with Maximum PipeFlow

Name of SP : Mongalpur Subproject
Up : Dowrabazar
Dist : Sunamganj

Available PVC pipe sizes outer diameter (mm): 160, 180, 200, 225, 250, 280, 315, 355,400, 450 & 500
Max flow velocity is 1.5 m/s for PVC pipes. Typical max is 1.2 m/s
Pipe thickness for 3.25 bar working pressure

Pipeline-1

Sl No	Pipeline Reach	Length	RD	EL	Command Area (cumulative)	Design Duty		Irrigation Efficiency d/s of Outlet	Design Discharge, Q	Pipe Flow Velocity		Pipe diameters		Suggested Pipe Thickness & Diameter (mm)		
										Typ	Max	Typ	Min			
		m	m	m	ha	cfs/acre	l/s/ha	%	m3/s	m/s	m/s	mm	mm	External Dia	Thickless	Internal Dia
1	KL	200	2,990	6.60	15	0.0093	0.65	80	0.012	1.20	1.50	114	102	160	2.00	156
2	JK	200	2,790	7.00	30	0.0093	0.65	80	0.024	1.20	1.50	161	144	160	2.00	156
3	IJ	200	2,590	7.10	45	0.0093	0.65	80	0.037	1.20	1.50	197	176	200	2.50	195
4	HI	50	2,390	8.25	45	0.0093	0.65	80	0.037	1.20	1.50	197	176	200	2.50	195
5	GH	460	2,340	8.30	56	0.0093	0.65	80	0.046	1.20	1.50	220	197	225	2.80	219
6	FG	340	1,880	8.26	71	0.0093	0.65	80	0.058	1.20	1.50	248	221	250	3.10	244
7	EF	270	1,540	8.05	97	0.0093	0.65	80	0.079	1.20	1.50	289	259	315	4.00	307
8	DE	240	1,270	7.55	105	0.0093	0.65	80	0.085	1.20	1.50	301	269	315	4.00	307
9	CD	310	1,030	8.20	118	0.0093	0.65	80	0.096	1.20	1.50	319	285	355	4.40	346
10	BC	290	720	7.30	129	0.0093	0.65	80	0.105	1.20	1.50	334	298	355	4.40	346
11	AB	350	430	7.21	139	0.0093	0.65	80	0.113	1.20	1.50	346	310	355	4.40	346
12	HT-A	80	80	8.50	147	0.0093	0.65	80	0.120	1.20	1.50	356	319	400	5.00	390
		2,990		8.45												

Pipeline-2

Sl No	Pipeline Reach	Length	RD	EL	Command Area (cumulative)	Design Duty		Irrigation Efficiency d/s of Outlet	Design Discharge, Q	Pipe Flow Velocity		Pipe diameters		Suggested Pipe Thickness & Diameter (mm)		
										Typ	Max	Typ	Min			
		m	m	m	ha	cfs/acre	l/s/ha	%	m3/s	m/s	m/s	mm	mm	External Dia	Thickless	Internal Dia
1	IJ	320	2,015	7.60	6	0.0093	0.65	80	0.005	1.20	1.50	72	64	160	2.00	156
2	HI	100	1,695	7.51	6	0.0093	0.65	80	0.005	1.20	1.50	72	64	160	2.00	156
3	GH	110	1,595	7.55	14	0.0093	0.65	80	0.011	1.20	1.50	110	98	160	2.00	156
4	FG	190	1,485	7.80	14	0.0093	0.65	80	0.011	1.20	1.50	110	98	160	2.00	156
5	EF	210	1,295	8.20	22	0.0093	0.65	80	0.018	1.20	1.50	138	123	160	2.00	156
6	DE	90	1,085	8.70	38	0.0093	0.65	80	0.031	1.20	1.50	181	162	200	2.50	195
7	CD	290	995	8.17	133	0.0093	0.65	80	0.108	1.20	1.50	339	303	355	4.40	346
8	BC	350	705	8.55	145	0.0093	0.65	80	0.118	1.20	1.50	354	316	400	5.00	390
9	AB	250	355	7.68	158	0.0093	0.65	80	0.129	1.20	1.50	369	330	450	5.60	439
10	HT-A	105	105	8.05	166	0.0093	0.65	80	0.135	1.20	1.50	378	339	450	5.60	439
		2,015		8.45												

Pipeline-3

Sl No	Pipeline Reach	Length	RD	EL	Command Area (cumulative)	Design Duty		Irrigation Efficiency d/s of Outlet	Design Discharge, Q	Pipe Flow Velocity		Pipe diameters		Suggested Pipe Thickness & Diameter (mm)		
										Typ	Max	Typ	Min			
		m	m	m	ha	cfs/acre	l/s/ha	%	m3/s	m/s	m/s	mm	mm	External Dia	Thickless	Internal Dia
1	KL	150	1,910	7.42	14	0.0093	0.65	80	0.011	1.20	1.50	110	98	160	2.00	156
2	JK	80	1,760	8.30	14	0.0093	0.65	80	0.011	1.20	1.50	110	98	160	2.00	156
3	IJ	540	1,680	8.00	28	0.0093	0.65	80	0.023	1.20	1.50	155	139	180	2.30	175
4	HI	220	1,140	8.20	44	0.0093	0.65	80	0.036	1.20	1.50	195	174	200	2.50	195
5	GH	150	920	8.68	52	0.0093	0.65	80	0.042	1.20	1.50	212	189	225	2.80	219
6	FG	310	770	8.35	60	0.0093	0.65	80	0.049	1.20	1.50	228	204	280	3.50	273
7	EF	90	460	8.32	90	0.0093	0.65	80	0.073	1.20	1.50	279	249	280	3.50	273
8	DE	170	370	8.30	92	0.0093	0.65	80	0.075	1.20	1.50	282	252	355	4.40	346
9	D2-D3	200	200	9.17	92	0.0093	0.65	80	0.075	1.20	1.50	282	252	355	4.40	346
		1,910		8.17												

Branch 1-1

Sl No	Pipeline Reach	Length	RD	EL	Command Area (cumulative)	Design Duty		Irrigation Efficiency d/s of Outlet	Design Discharge, Q	Pipe Flow Velocity		Pipe diameters		Suggested Pipe Thickness & Diameter (mm)		
										Typ	Max	Typ	Min			
		m	m	m	ha	cfs/acre	l/s/ha	%	m3/s	m/s	m/s	mm	mm	External Dia	Thickless	Internal Dia
1	F11-F12	180	430	7.68	12	0.0093	0.65	80	0.010	1.20	1.50	102	91	160	2.00	156
2	F1-F11	250	250	7.90	12	0.0093	0.65	80	0.010	1.20	1.50	102	91	160	2.00	156
		430		8.05												

Branch 2-1

Sl No	Pipeline Reach	Length	RD	EL	Command Area (cumulative)	Design Duty		Irrigation Efficiency d/s of Outlet	Design Discharge, Q	Pipe Flow Velocity		Pipe diameters		Suggested Pipe Thickness & Diameter (mm)		
										Typ	Max	Typ	Min			
		m	m	m	ha	cfs/acre	l/s/ha	%	m3/s	m/s	m/s	mm	mm	External Dia	Thickless	Internal Dia
1	C2-C21	190	190	8.45	6	0.0093	0.65	80	0.005	1.20	1.50	72	64	160	2.00	156
		190		8.55												

Branch 2-2

Sl No	Pipeline Reach	Length	RD	EL	Command Area (cumulative)	Design Duty		Irrigation Efficiency d/s of Outlet	Design Discharge, Q	Pipe Flow Velocity		Pipe diameters		Suggested Pipe Thickness & Diameter (mm)		
										Typ	Max	Typ	Min			
		m	m	m	ha	cfs/acre	l/s/ha	%	m3/s	m/s	m/s	mm	mm	External Dia	Thickless	Internal Dia
1	E21-E22	100	200	7.93	9	0.0093	0.65	80	0.007	1.20	1.50	88	79	160	2.00	156
2	E2-E21	100	100	7.91	9	0.0093	0.65	80	0.007	1.20	1.50	88	79	160	2.00	156
		200		8.70												

Branch 3-1

Sl No	Pipeline Reach	Length	RD	EL	Command Area (cumulative)	Design Duty		Irrigation Efficiency d/s of Outlet	Design Discharge, Q	Pipe Flow Velocity		Pipe diameters		Suggested Pipe Thickness & Diameter (mm)		
										Typ	Max	Typ	Min			
		m	m	m	ha	cfs/acre	l/s/ha	%	m3/s	m/s	m/s	mm	mm	External Dia	Thickless	Internal Dia
1	F31-F32	270	600	7.40	15	0.0093	0.65	80	0.012	1.20	1.50	114	102	160	2.00	156
2	F3-F31	330	330	7.85	21	0.0093	0.65	80	0.017	1.20	1.50	135	120	160	2.00	156
		600		8.32												

Pumping Plant and Power Requirements

Total discharge at peak demand (for boro paddy - see note below)	0.254	m3/s	80% efficiency
	8.979	cusecs	
Nr of pumps	5	Nr	(Notes: (i) not less than the nr of Rotation units; (ii) no standby pump)
Pump discharage	51	l/s per pump	
	1.80	cusecs/pump	
Adopted pump capacity	57	l/s per pump	
	2.01	cusecs/pump	
	205	m3/hr per pump	
	902	USG/m per pump	1 USG = 3.8 ltr
Pump spare capacity	12%		(Note: adopt 10-20%) 1 USG = 0.83 UKG
Top of header tank	14.45	m	
EGL at header tank / near river (ie where pump to be located)	8.50	m	
River level during dry season (ie Dec - March)	3.60	m	(refer feasibility report: note data not too reliable)
Total Static Head	10.85	m	
Suction Head	4.90	m	Note: recommended limit: 2-3 m
Allowance for friction losses (pipe and fittings)	0.50	m	(Note: distance maybe about 50 m)
Total Pumping Head	11.35	m	
Adopted power unit efficiency	0.80		Note: electric unit: 75-85%)
Adopted pump efficiency	0.60		Note: 40 - 80%
Overall efficiency	0.48		
Power Demand per pump (for adopted pump capacity)	13.2	kW	Power (kW) = 9.81 x discharge (m3/s) x head (m) / overall efficiency
	18.0	HP (1 kW= 1.36 HP)	
Total Peak Power Demand for SP	66.1	kW	
	89.9	HP (1 kW= 1.36 HP)	

Note: 24/7 pumping at peak demand period is assumed. However electical power shortages mean that pumping may only be possible during night hours. If 100% rice cropping occurs in the SP area and if peak demand occurs over the whole command area simultaneously then the pipe system and pumps cannot meet crop water demand by only pumping at night. In practice: (i) some vegetables / wheat etc may be cropped; and (ii) transplanting of boro rice is usually staggered reducing peak water demand. None-the-less water shortage may occur due to non-availability of power in which case the WMCA may have to arrange hire / purchase of a generator for day time use over the peak water demand period.

B4 Number of Rotation and Irrigator Units and Related Data

(This Data Table is for an example subproject. FS Consultants will furnish data of concerned subproject in this format. Refer *Guidelines G4 Feasibility Study of Subprojects, Subsection-3.2.5)*

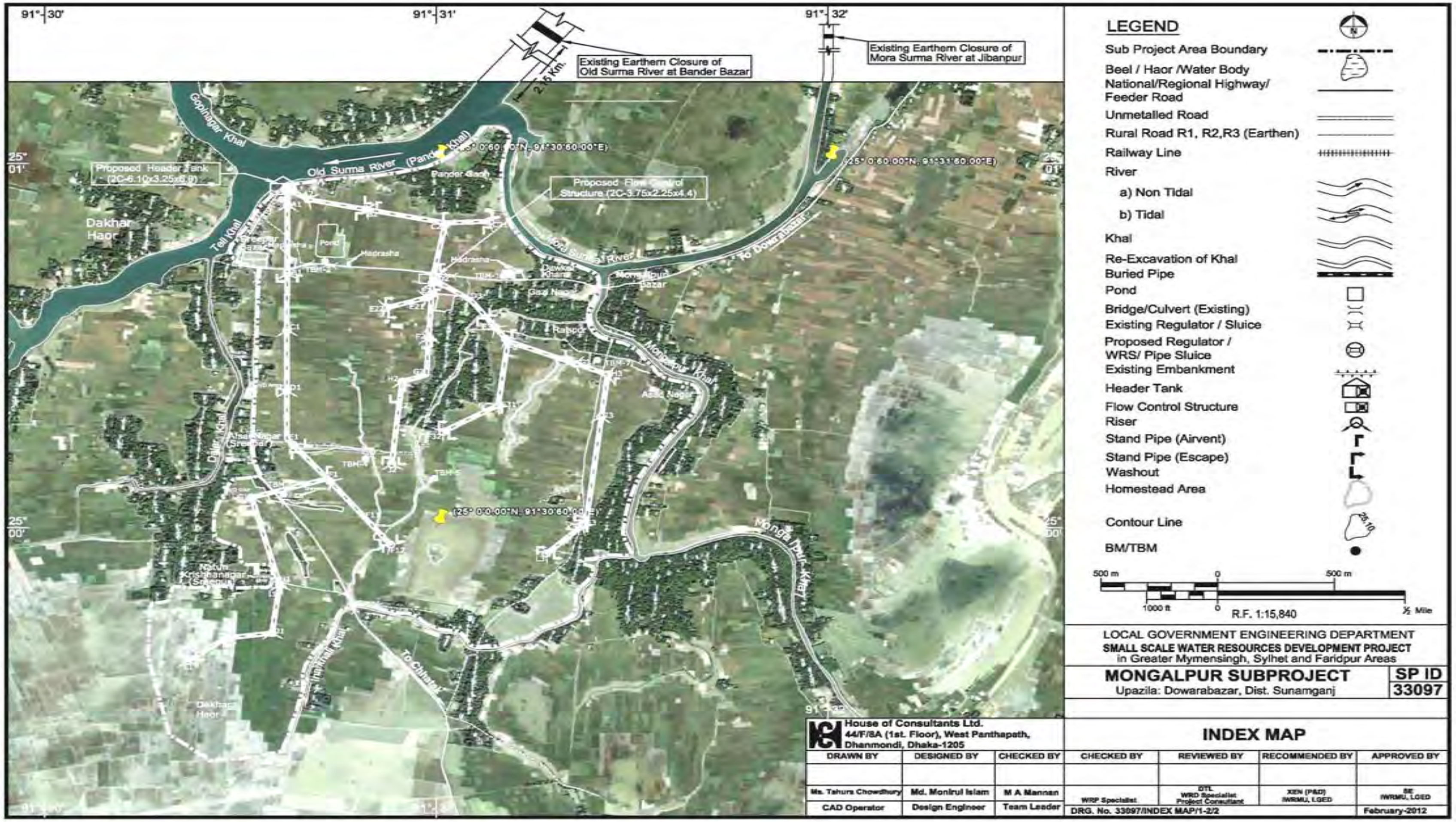
Nr of Rotation & Irrigator Units

Name of SP : Mongalpur Subproject
Up : Dowrabazar
Dist : Sunamganj

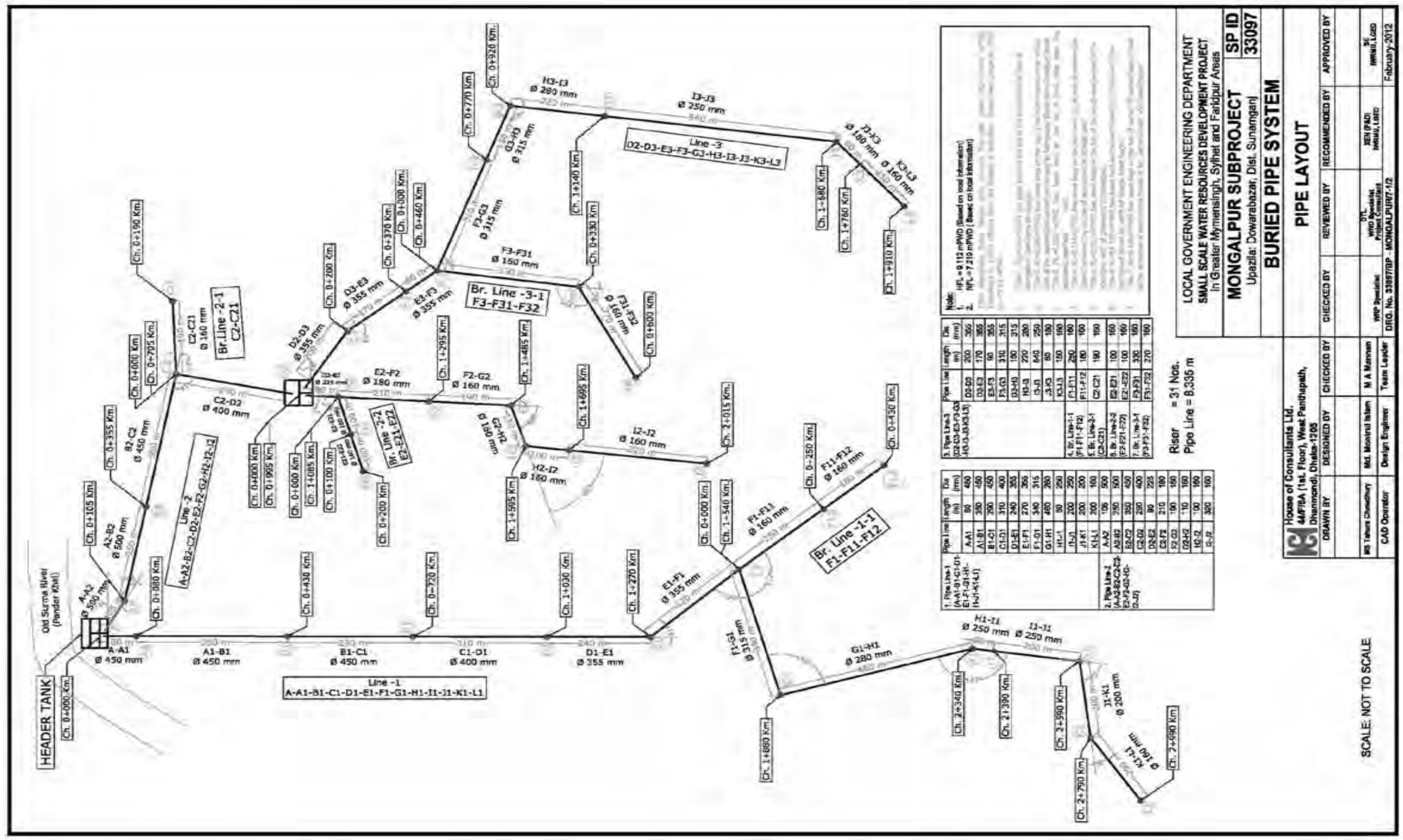
Item	Units	Quantity	Remarks
Gross Area	ha	**401**	
Net Irrigable Area	ha	**313**	
Crop Water Requirements	l/s/ha	**0.65**	
Efficiency d/s of outlet	%	**80.0%**	
Water Requirements at Outlet	l/s/ha	0.81	
Number of Rotation Units	Nr	**3**	Select to give 80-120 ha Rotation Units
Net Irrigable Area of Rotation Units (avg)	ha	104.3	
Number of Outlets (risers) ie Irrigator Units	Nr	**30**	Select to give 5-15 ha Irrigator Units, and generally
Net Irrigable Area of Irrigator Units (avg)	ha	10.4	every 200-500 m along pipe line
Nr of standpipes	Nr	15	Adopt about 50% of nr of riser outlets
Number of benefitting HHs	Nr	**704**	
Number of HH per Rotation Units	Nr	235	
Number of HH per Irrigator Units	Nr	23	
Rotation flows (avg)	l/s	85	
Irrigator flows (avg)	l/s	8	

Appendix G4-IB.C
Maps & Drawings

C1 Subproject Index Map (Example Subproject. FS Consultants will provide Index Map of concerned subproject following this example)



C2 Schematic Drawing for Pipeline System Layout *(Layout of example subproject)*



Attachment II-11
Bamankhali Khal
Subproject IEE Report

SMALL SCALE WATER RESOURCES DEVELOPMENT PROJECT

BAMANKHALI KHAL SUBPROJECT

KENDUA UPAZILA, NETROKONA DISTRICT

Initial Environmental Examination (IEE)

March 2017

Japan International Cooperation Agency

TABLE OF CONTENTS

1. INTRODUCTION

1.1 Purpose

The small scale water resources development (SSWRD) by Local Government Engineering Department (LGED) with the construction of hydraulic structures, rehabilitation of embankments, re-excavation of khals and development of command area are resulting in additional agricultural production, food security, employment generation and livelihood improvement. LGED involves local people for subproject planning, design, construction and operation and maintenance (O&M) of infrastructure. Local people participation in managing water resources and operation of water control infrastructure ensures sustainable use of water resources and maintaining of ecosystem in subprojects each covering 1,000 ha or less where the productivity of land is low due to unmanaged flood and irrigation water. The subprojects are subject to initial environmental examination (IEE) as part of Government's requirements for Environmental Impact Assessment. IEE is conducted as a part of feasibility study for each subproject. The Bamankhali Khal subproject IEE report has been produced in consultation with potential beneficiaries and subproject affected people. The IEE has concluded that there are positive and negative environmental impacts resulting from subproject implementation. The negative impacts are insignificant and can be satisfactorily managed and mitigated. This report contains an environmental monitoring plan which will be followed during subproject implementation and operation.

1.2 Background

The Bamankhali Khal subproject in Kendua upazila of Nterokona district was proposed for implementation under phase 1 of the SSWRDP in 2010 by the local people in Balaishimul and Noapara unions through their union parishad representatives to protect boro rice crop from flooding. The proposal was approved at the meeting of Kendua Upazila Development Coordination Committee (UDCC) and forwarded it to the Integrated Water Resources Management (IWRM) Unit at LGED headquarter through LGED district office at Netrokona. It was pre-screened and subsequently the proposed subproject area was visited by a multidisciplinary field reconnaissance team, which included Environmental Specialist. Participatory rural appraisal (PRA) was carried out by an NGO for assessing selected social and environmental parameters in the subproject area. Potential beneficiaries, affected persons, and union parishad representatives were consulted during the feasibility study carried out by a local consulting firm in March 2011. The feasibility study report was reviewed by the District Level Inter-Agency Project Evaluation Committee (DLIAPEC) at Netrokona. The subproject could not be implemented in the SSWRDP-phase 1 period as beneficiaries were unable to organize and establish WMCA. As a result physical construction could not be initiated without an implementation agreement signed between the WMCA and LGED. The subproject is now selected for implementation under the proposed SSWRDP-phase 2 to be co-financed by the JICA.

1.3 Rationale

The subproject was classified as DoE environmental category Orange-B in accordance with the Environment Conservation Rules (ECR), 1997 and Amendment of the Government of Bangladesh. The Orange-B category is compatible with the JICA B-category. This category of subproject requires IEE and environmental evaluation prior to implementation works in accordance with the Government's environmental requirements as set out in the applicable laws and regulations. The IEE assesses the impact of the subproject intervention on the local environment and suggest mitigation measures for environmental management. It has been conducted in accordance with the DoE set procedure on ECR, 1997 and following the JICA Guidelines for Environmental and Social Considerations, 2010.

1.4 Scope and Methodology

The procedure adopted by the JICA funded SSWRDP was followed in preparation of this IEE report. It was developed by the IWRM Unit, LGED supported by JICA according to the DoE guidelines for the implementation of SSWRD projects. The IEE was carried out in March 2011. The study covered physical, ecological, biological, social and economic conditions within the proposed subproject area. Information and data from primary and secondary sources were used in preparation of the report. The primary sources included field visits and interviews and meeting with various cross-sections of people. A multi-disciplinary team consisting of hydrologist/water resources engineer, agronomist, sociologist and environment and fishery expert collected data during the relatively short field work in the subproject area. The Balaishimul and Noapara union parishads chairmen and members were informed about the data collection. The secondary data sources included the Soil Resources Development Institute (SRDI), FAO/UNDP Land Resource Appraisal of Bangladesh, Bangladesh Bureau of Statists (BBS) and MIS at IWRM Unit of LGED. The IEE report was prepared as a part of feasibility report following the DoE requirements. DoE Environmental Checklist as provided in Annex-A was used to confirm that the subproject is not situated in any ecologically critical area in Bangladesh. The IEE was again carried out in January 2017 for updating information. A focus group discussion (FGD) in the subproject area and consultation meeting at Kendua Upazila Complex were organized on the IEE. These were participated by local stakeholders, union parishad chairman and members, upazila chairman and vice-chairman, LGED Upazila Engineer and Upazila Agriculture, Fisheries and Livestock Officers.

1.5 Report Structure

The report is divided into nine sections. A description of the subproject is provided in section 2. The environmental setting in the subproject area is presented in section 3. Section 4 describes the environmental mitigation measures. Institutional arrangements for mitigation and monitoring are presented in section 5. Section 6 briefly reviews community consultation and disclosure, and section 7 describes grievance redress. Section 8 provides findings and recommendations. Conclusions are provided in section 9.

2. SUBPROJECT DESCRIPTION

2.1 Location

The subproject extends over Balaishimul and Noapara unions in Kendua upazila of Netrokona district in the northeast region of the country. It is bounded on the north, west, and east by rural roads and on the south by Patkura River. The subproject area is traversed by Bamankhali and Solailakhali khals.

2.2 Type

The subprojects constructed by LGED are categorized into flood management (FM), drainage (D), water conservation (WC), command area development (CAD) and combinations of these four basic categories. The type of Bamankhali Khal subproject is flood management and drainage (FMD).

2.3 Need

Pre-monsoon flash floods following early rains damage boro rice crop during the harvest time in the subproject area. Early and deep flooding and rapid rise in flood levels restrict crop production in the pre-monsoon and monsoon seasons. Flood protection in the pre-monsoon is proposed to increase boro rice production. Improvement in drainage will allow timely transplantation of boro rice and provide an opportunity to bring more area under transplanted aman. Monsoon water is required to conserve for irrigation.

2.4 Physical Works

The interventions proposed in the subproject area include a 2-vent regulator with a size of 1.5 m X 1.8 m each vent, reference brick lined section and office for Water Management Cooperative Association (WMCA), and re-excavation of 1.85 km of Bamankhali khal and1.95 km of Solailakhali khal (Map 1). The regulator will be constructed on the Bamankhali khal at its outfall in the Patkura River. The Bamankhali Khal will be re-excavated from its outfall on the Patkura River to the RCC Bridge at the northeast boundary of the subproject. The re-excavation work of the Solailakhali khal will start from its outfall in the Bamankhali khal and continue to the box culvert at the northwest boundary of the subproject.

2.5 Implementation Schedule

The subproject implementation plan will be prepared in consultation with the beneficiaries. The physical works are scheduled to start in the 2018-2019 construction season.

3. ENVIRONMENTAL SETTING

3.1 Physical

Climate: The average annual temperature is 25.2ºC as recorded at Mymensingh metrological station, which is about 45 km away from the subproject area[1]. On average the annual minimum temperature is 20 ºC to 20.8ºC and the maximum temperature is 29.6 ºC to 30.3ºC. In 2015, the monthly average minimum temperature was 18.7ºC in January and the maximum temperature was 29.3ºC in September. The monthly average relative humidity recorded in 2015 was 74% in March and 87% in August. Historical data show that annual rainfall varies from 1,479 to 4,939 mm. In 2015, the rainfall varied from 1 mm in March to 502 mm in June. The mean annual rainfall was 2,084 mm. Major cyclonic storms from 1960 to 2015 indicate that the subproject area lies outside cyclone prone zone.

Agro-ecological zone: The subproject area is occupied by the subzone d (Medium Low) of agro-ecological zone (AEZ) 9 (Brahmaputra Floodplain)[2]. The subzone is differentiated on details of relief and flooding characteristics.

Physiography: The subproject area has broad ridges, depressions and low-lying basins[3]. The relief is locally irregular. The subproject area is moderately deeply flooded. Low-lying area is subject to early and rapid flooding by run-off from adjoining higher land when pre-monsoon or early monsoon occurs locally or in adjoining area.

Soils: The subproject area is predominated by dark grey floodplain soils. Silty loams or silty clay loams generally occupy most of relief on the higher ridges. Silty clay loams occupy the lower ridges and silty clays and heavy clays in the basins. Organic matter contents in the cultivated layer range from less than 1.0 to 1.5% in ridge soils and to 2.5% in basin soils. Permeability is generally slow in the cultivated layer. Moisture holding capacity is high in soils on ridges, moderate or low in shallow ridge soils and basin clays.

Land Types: More than half of the net cultivated area is lowland (F3), where the depth of flooding is more than 1.8 m. About 40% is medium lowland (F2), where seasonal flooding ranges from 90 to 180 cm. The remaining 8% of the net cultivated area is highland (F1), where seasonal flooding ranges from 30 to 90 cm.

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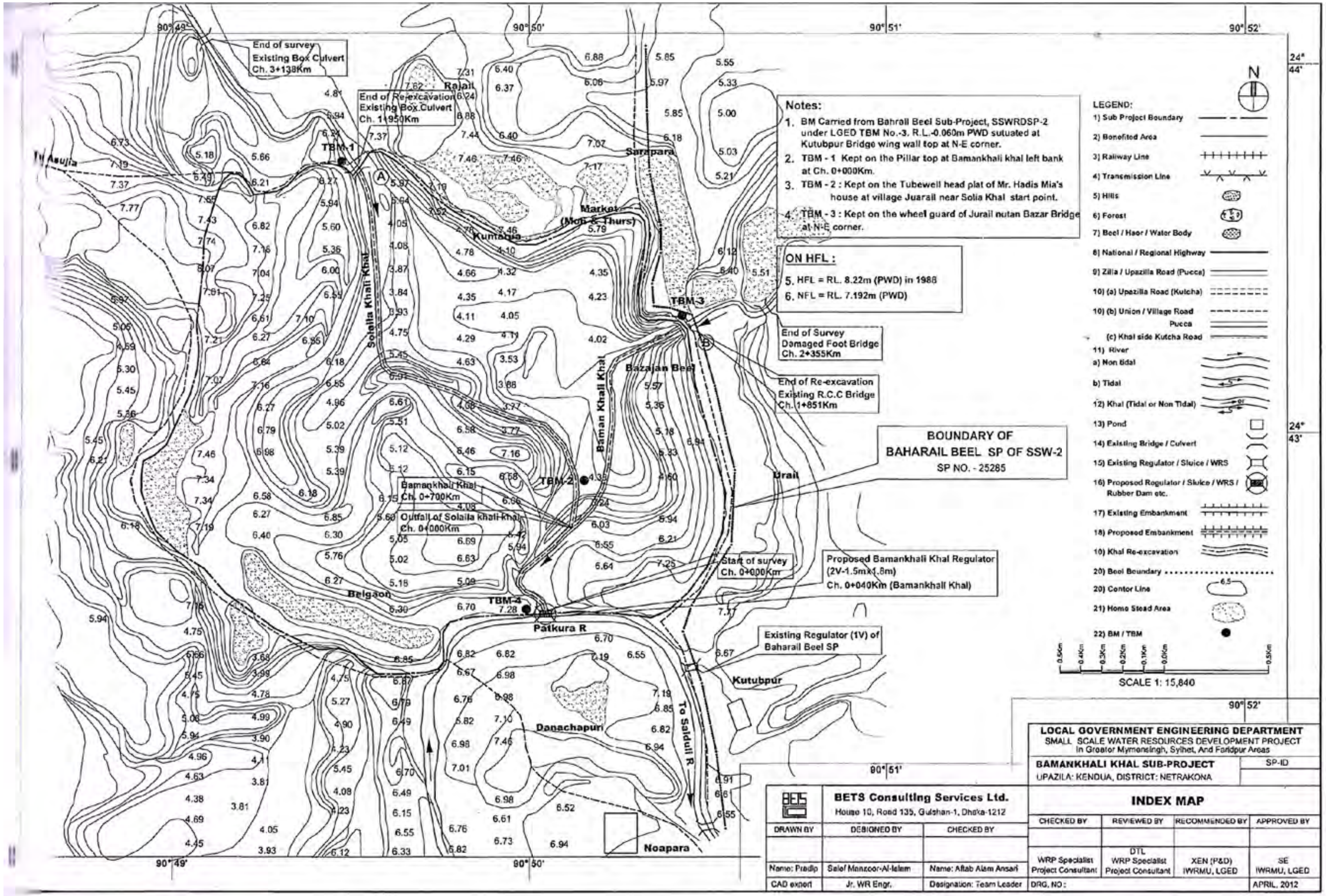
[1] Yearbook of Agricultural Statistics-2015, 27th Series, 2016, Bangladesh Bureau of Statistics

[2] Agroecological Regions of Bangladesh, Report 2. 1988. FAO/UNDP

[3] Reconnaissance Soil Survey Report, SRDI

Map 1: Subproject Physical Works



Land Use: Crop production is the main component of the farming systems and boro rice is the dominate crop farming. Almost 90% of the net cultivated area is used for the cultivation of boro as single crop. The double cropped area accounts for about 12%. Boro-transplanted aman is the only cropping patterns practised in double cropped area. The boro rice is transplanted in the early dry season. The crop is harvested in the pre-monsoon season. The aman is transplanted in the early monsoon season and harvested in the post-monsoon season. Basal doses of fertilisers are applied in the rice production.

Hydrology: The subproject receives water from the inflowing Patkura River through the Bamankhali khal, which originates from the Bazajan beel in the east and flows to the Patkura River on the south. The Solaliakhali khal flows from the north to fall on the Bamankhali khal in the southeast. The combination of the flash flood from the Patkura River, seasonal rainfall and inadequate drainage fill up the khals, Bazajan beel and most of the low-lying lands in the subproject area. The floodwater inundates standing boro rice crop in the early pre-monsoon season. Flood may occur at any time and more than once between March and June.

Water Resources: Surface water is not available in the dry season. The khals are dried up in the post-monsoon season. Groundwater is the only source of irrigation in the dry season. The entire boro rice cropped area in the subproject area is irrigated by STW.

3.2 Ecological

Fisheries: Open water fisheries cover about 461 ha. This includes medium lowlands (F2) and lowlands (F3), khal, beel and river. The perennial water bodies in khal, beel and river occupy 5 ha. The perennial water bodies including Bazajan beel serves as overwintering refuges for the fish species present in the area. Small indigenous species (SIS) including jatiputi, titputi, koi, shing, magur, baim, veda were identified in open water along with boal, shol, gozar and carps. The annual production of fish from the open water was estimated to be 43 ton. The open water fishery resource is declining. Foli, tatki and gotar species are endangered. Elong and ghania have become extinct. The ponds in the subproject area cover about 4 ha of which 1 ha is seasonal and 3 ha perennial. Mostly culture-based fish farming is practised in these ponds. The annual fish production from the ponds was reported be about 5 tons. There are two types of fishermen (fulltime and part time) who catch for generating income. There are 112 fisher households in the subproject villages. About 160 fulltime and 110 part time fishers were identified among the households. There are 23 female fishers households (8 fulltime and 15 part-time) in the subproject area.

Aquatic Flora and Fauna: The common aquatic animal species reported in the subproject area include frog (Bufo melanostictus), crabs and shamuk (Anastemus oscitans). Kachim (Trionyx gangeticus) is now rare. Among the aquatic plant species, kolmi (Ipomoea fistulosa) and kachuripana or water hyacinth (Elchhornis sp.) are common and hogol is rare.

Wildlife: The subproject area for its close proximity to Hail haor (river back swamp or bowl shaped depressions between the natural levees of rivers) harbours some resident and migratory water birds. Mammals animals including foxes, indur (Mus musculus), birds including sparrow (Passer domesticus), parrots, crows, cranes, duck, dove, stork, bulbuli and amphibian species including china jonke (leech), snakes and mule are very common. Owl (Tyto alba), hargila and kite are rare. There is no habitat for wild animals.

Forest: No reserve or social forest was identified. Plantation was found on the ridges, road sides, school compounds, graveyards and homestead areas. The common tree species noticed were neem, mehogany, raintree, black berry, akashmony, wood apple, hogplum, betel nut (supari), and bamboo clusters.

Rare and Endangered Species: No rare and endangered species of flora and fauna was reported in the subproject area.

3.3 Economic

Industries: No industry was identified in the subproject area.

Infrastructure: Rural roads, bridges and culverts are the major infrastructures of the subproject area. There are 8 km of pucca (blacktop) roads and 3 km of katcha (earthen) roads, 5 bridges and 14 culverts.

Institutions: Primary schools, madrashas (Islamic school), high school, mosques, temple and a number of community based organisations (CBOs) and NGOs including Bangladesh Rural Advancement Committee BRAC, Grameen Bank, Thengamara Mohila Sabuj Sangha (TMSS) and Association for Social Advancement (ASA) were reported in the subproject area.

Transportation: The subproject area is accessible by road. The main modes of transportation are cycle, van, rickshaws and limited number of motor driven vehicles.

Power Sources and Transmission: Bangladesh Rural Electrification Board (BREB) supplies electricity for home use and irrigation by shallow tube wells (STWs).

Mineral resource Development: There is no mineral resource in the subproject area.

Agricultural Resource: The gross area of the subproject is 480 ha of which about 90% is cultivated land. Boro is the main crop grown with a small area under transplanted aman. Subproject area is subject to pre-monsoon flash flood, which damages boro crop. Scarcity of irrigation water affects boro yield. Flood management will protect boro crop in the pre-monsoon season and conservation would improve irrigation water availability. Incremental food grain production will be about 600 tons, annually.

3.4 Social

Population and Communities: Number of villages exists within the subproject area is three. Total population was estimated to be 3,576 and total households 877. About 16% of the households were landless, 54% marginal and small farmers, and 30% medium and large. About 18% of the total households are involved only in agriculture farming, 20% are agriculture labour households, 12% are non-agriculture labour, 33% are involved in business, 2% are involved in poultry and dairy farming, and 15% are fisheries including 23 female fisher households. The business households are also involved in farming. About 160 fulltime fishers and 110 part-time fishers were reported in the subproject villages. The landless households constitute 16% of the total households. The members of these households are mostly day labourers. They also rear livestock and cultivate seasonal vegetables in their homestead adjacent. They are illiterate and face poverty and health related problems. The poor and destitute women of the subproject area constitute about 3% of the total population. These poor women, in addition to their household works, grow vegetables in homestead lands and rear livestock animal (cattle and poultry) taking loan from NGOs. They will be benefited with the creation of job opportunities and income generating activities for the subproject implementation.

Literacy, Cultural and Recreational Involvement: The average literacy rate in the subproject area is about 50%. Males and females literacy rates were 55% and 45%, respectively. There are 4 primary schools, 2 madrasas, 5 mosques and 1 temple within the subproject area. Community people observe cultural and religious festivals in traditional manners with friends and relatives. Affluent household owns TV and radio sets for their recreational purposes.

Healthcare and Sanitation Facilities: One healthcare centre was reported in the subproject area. Medicines and doctors are not always available at this centre. The general hospitals services are available in nearby upazila towns. As regards the sanitation facilities, 80% households have sanitary latrines and 20% katcha latrines mostly of temporarily structure. Usually, the poor households have limited and/or no access to sanitary latrines. The main source of potable of water is deepset hand tube wells (DHTW). The DHTW water was reported to contain iron and arsenic in some places within the subproject area.

Archaeological or Historical Treasures: No archaeological or historical site was noticed in the subproject area.

4. ENVIRONMENTAL MITIGATION

4.1 Impacts Screening

For the screening of potential environmental impacts a questionnaire was used (Annex B). The Important Environment Components (IECs) for the screening was selected in consideration with subproject interventions, environmental settings in the subproject area, possible environmental impacts as well as from the experience gained in implementing JICA funded SSWRDP. The results from the analysis of potential environmental impacts are given as an integral part of the IEE in the following table. The selected items of this screening are derived from site reconnaissance, field survey and consideration of the project impact. It is not expected that other impact caused by this subproject from the consideration with using Items of JICA Guidelines. Because this subproject is typical one and will be implemented by regular construction works.

Table 1: Potential Environmental Impacts in Bamankhali Khal Subproject Area

Sl. No.	Selected IECs	Present Condition	Potential Impact
A 1.0	**Physical Environment**		
1.1	Regional hydrological regime, flood pattern	The subproject is influenced by the hydrology of Saiduly river. It is regularly flooded in the pre-monsoon and monsoon seasons. Khals and beels are dried up during the dry season.	Construction of regulator at the outfall of Bamankhali khal and re-excavation of Bamankhali khal and Solailakhali khal to protect boro rice crops from pre-monsoon flash floods and water conservation in the khals in the post-monsoon period may change inundation depth during pre-monsoon season. It will have no impact on hydrological regime or flood patterns.
1.2	Natural flushing	The subproject area with high annual rainfall and favourable land slope allows natural flushing.	Implementation of the subproject will not obstruct natural flushing.
1.3	Ground water table	Groundwater use for irrigation in boro cropped area.	Drainage improvement will increase irrigated boro area by about 40 ha. The monsoon water will be retained in the re-excavated khal for irrigation in the early dry season. This will improve residual soil moisture. Ground water table will remain unaffected.
1.4	Water quality	Stagnant surface water quality in khals and beel may deteriorate due to presence of agrochemicals drained from uplands during the monsoon season. It is not a serious problem at present. Groundwater pollution was not reported.	Extensive use of agro-chemicals will impact on the quality of surface water. It will be mitigated by IPM /ICM practice and balanced use and application at DAE recommended rates. Training and extension activities will be organized to ensure this. However, no surface pollution was reported.
1.5	Water logging and drainage	Land slope permits natural drainage, siltation process is active at the khal beds affecting the drainage efficiency.	Drainage efficiency of the khals will improve after re-excavation.
1.6	Erosion and siltation	Siltation in khals was reported. There is no erosion problem.	Subproject will not change siltation and erosion process.

Sl. No.	Selected IECs	Present Condition	Potential Impact
1.7	Soil characteristics/ fertility	The subproject area receives fresh silts in every monsoon season.	Subproject will not change soil characteristics and fertility level.

A 2.0	**Biological Environment**		
2.1	Wetland and aquatic habitat	Aquatic habitats of the subproject area include floodplain, rivers/khals, and non-cultivable low land, which are mostly seasonal water bodies.	Subproject will not change wetland characteristics.
2.2	Terrestrial habitat	No natural forest or ecological sensitive area exists in the subproject area.	There will be no impact on terrestrial habitat for the subproject implementation.
2.3	Natural and culture fishery	Culture-based fisheries in ponds and open water fisheries in khals and beels were reported.	Subproject will have no impact on culture fisheries. It may support to expand. Khal re-excavation may benefit open water fisheries. Judicious operation of regulator will be required to prevent any adverse impact on capture fisheries.
2.4	Wildlife and bio-diversity	Wildlife and biological diversity are moderate in the subproject area.	There will be no change in the existing wild life and biological diversity after the subproject
2.5	Unwanted aquatic weeds and hyacinth	Unwanted aquatic weeds and hyacinth population are not significant.	The subproject will bring no change to unwanted aquatic weeds population.
2.6	Natural forests and plantation	No natural forest was found. There are homestead plantations and bushes.	The subproject will create a limited scope for plantations along khals, roads and regulator site.
A 3.0	**Social Environment**		
3.1	Land acquisition/ land loss	Khals and its adjacent land are khas. The regulator will be built on khas land.	Implementation of the subproject will not involve land acquisition.
3.2	Agricultural development	Flood on a large scale, drought on a lesser scale affect agricultural production during the pre-monsoon season.	Rice production will increase by about 560 tons for the protection of boro crops from pre-monsoon flood and drought and increase in rice growing areas. This will contribute to agricultural development.
3.3	Waterways and road transport	The subproject area is approachable by all weather roads, which run along its boundary. However, movement within subproject area is on foot, or motor bikes. Boat communication is not common within the subproject area.	The subproject will have no impact on the existing communication in the area. The regulator will have to be designed allowing boat passing.
3.4	Employment scopes	During monsoon season employment, scope is limited.	Employment scope will increase in agriculture, fishery, duck farming, and various IGAs in post subproject condition. This will have favourable impact on employment and poverty alleviation.
3.5	Health and nutrition	The landless poor and destitute have poor health and nutritional status.	Increased crop production and fisheries development will improve nutritional status and health. This will have positive impact.
3.6	Community impact	The population mainly includes farmers, daily labourers, subsistence fishers and subsistence fish farmers.	No impact on professional community.
3.7	Culture and heritage	Cultural/heritage site is none inside the subproject area.	There will be no impact on culture and heritage.

4.2 Potential Impacts

Numerous potential environmental impacts for the construction works have been considered. Some undesirable impacts are likely during the construction phase and after the completion of construction works for changes in hydrology in Bazajan beel and Bamankhali and Solailakhali khals for floodwater control.

During Construction: Placing of spoil earth immediately adjacent to the khals may obstruct drainage from adjacent cultivated fields. Usually, farmers do not allow the spoil to be distributed over their crop lands. Accordingly, preventive measures should be taken so that the earthworks may not cause any changes on hydrology and ecology and land use. Attention should be paid to refrain from closure of khals or diversion of flow of khals during the construction of the regulator. The Project Management Unit (PMU) will supervise the construction and khal re-excavation works thorough it's Project Implementation Unit (PIU) at upazila and subproject WMCA. The major potential impacts are as follows.

Water Resources: Re-excavation of khals and construction of regulator will improve drainage and control floodwater in the pre-monsoon season. The monsoon water can be conserved in the re-excavated khals for irrigation in the early dry season. Re-excavation of khals will increase storage capacity.

Table 2: Impact Evaluation

Sl. No.	Selected IECs	Relative Impact					
		Positive Impact			Adverse/Negative		
		Unknown	Beneficial	No change	Small	Medium	Large
B 1.0	**Physical Environment**						
1.1	Regional hydrological regime, flood pattern			√			
1.2	Natural flushing			√			
1.3	Ground water table			√			
1.4	Water quality				√		
1.5	Floodwater drainage			√			
1.6	Erosion and siltation			√			
1.7	Soil fertility			√			
B 2.0	**Biological Environment**						
2.1	Wetland, aquatic habitat			√			
2.2	Terrestrial habitat			√			
2.3	Natural/culture fishery				√		
2.4	Wildlife and biodiversity			√			
2.5	Undesired aquatic weeds and hyacinth			√			
2.6	Natural forests and plantation			√			
B 3.0	**Social Environment**						
3.1	Land acquisition/loss			√			
3.2	Agricultural development		√				
3.3	Waterways and road transport			√			
3.4	Employment scopes		√				
3.5	Health and nutrition		√				
3.6	Community impact			√			
3.7	Culture and heritage			√			

Land Use: Present net cultivated area will remain the same. There will be no change in the land types. Drainage improvement will increase aman rice growing area by 3 ha on medium highland and boro rice growing area by about 17 ha on the medium lowland and 21 ha on the lowland. The water conservation in the khals will reduce droughty land by 24 ha in the boro cultivated area.

Crop Production: The subproject intervention will have no impact on crop patterns. It will increase boro and aman rice production. The increase will be resulted for protecting boro rice crop from drought stress and bring more area under cultivation

Fisheries: Flood management with judicious operation of regulator the in the pre-monsoon season will have no adverse impact on natural fisheries. Open water fishery resources will not be affected.

Socioeconomic: Subproject construction will generate temporary employment opportunity for the local farm labourers. Employment opportunity will increase for more boro and aman rice transplantation, harvesting and processing. Small farmer households will be specifically benefitted from increased crop production. Employment opportunities for local farm labourers will increase.

4.3 Mitigation Measures

LGED Upazila Engineer, subproject contractor including labour contracting societies (LCSs) and WMCA Management Committee will play a dominant role in execution of environmental mitigation activities. Training will be provided so that they can understand their responsibilities for undertaking and implementing environmental mitigation measures associated with subproject construction activities and structure operation. Best means for mitigating impacts are suggested to follow the agreeable work practice by adopting standard environmental codes of practice (ECP) during the construction phase. Special provisions should be set out to accommodate the needs of the workforce, including provisions for housing and sanitation. The contractor for concrete structures and earthworks in the subproject area should have a basic safety and health plan in place for workers. Workers will be required to wear personal protective equipments (PPE) suitable to the type of work they will be engaged. They should include trained and experienced labourers. Community health and safety should be addressed through the guidelines. Environmental specifications will need to be included in the bill of quantities (BOQ) and construction contract. During the subproject construction activities, the WMCA Management Committee should ensure that the contractor has taken preventative measures to avoid any degradation of cultivated land, loss of crop, changes in water quality and damage to vegetation and wildlife habitat during transportation of construction materials, stockpile and construction works. Obstruction to fish migration due to closing of khals by the ring dike or causeways during the construction of structures, incomplete structures, and delay in the installation of regulator gate could decrease the fisheries production in the subprojects areas. The contractor will provide adequately located and maintained latrines. Following handing over of the subproject infrastructure to the WMCA, the O&M subcommittee will ensure that the regulator and WRS are operated in order to maintain the water regime favourable to crop production and fisheries. The regulator and WRS operation with proper control of the timing, depth and duration of flooding will ensure growing condition for crops while allowing fish migration to and from spawning and feeding areas to effectively minimize impediments to growth of fish population. LGED will organize training for the WMCA O&M subcommittee on the operation of regulator to maintain the water regime without any impact on the local environment. The subcommittee will prepare regulator and WRS operation calendar. The O&M subcommittee members will participate in training on environmental management, which will improve their capability to recognize environmental risks and prepare mitigation plan. To mitigate assumed adverse environmental impacts which evaluated in previous table, an

Environmental Mitigation Plan (EMP) is included as part of this IEE and presented in Annex-C. The summary of beneficial and adverse impact is shown in the following table.

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Table 3: Summary

Sl. No.	Significant impact issue	Type of impact		Mitigation measures	Residual impact
		Beneficial	Adverse		
C 1.0	**Physical Environment**				
1.1	Water quality		√	Periodic analysis of representative water samples	Insignificant, acceptable
C 2.0	**Biological Environment**				
2.1	Natural & culture fishery		√	Operation of regulator in consultation with fishers to increase of culture fisheries.	Insignificant, acceptable
C 3.0	**Social Environment**				
3.1	Agricultural development	√			
3.2	Employment scopes	√			
3.3	Health and nutrition	√			

Note: The residual impact in right column shows the impact after executing mitigation measure.

4.4 Enhancement Plan

Currently, groundwater is the only source of irrigation water. Use of water khal water for irrigation was not reported. Re-excavation of khal could provide opportunity for water retention in the post-monsoon season. Productive use of this limited water resources can be taken into account. Overfishing and undersize fishing can be controlled to improve the resource. Tree plantation along the khal slopes and roadside can be included in the enhancement plan. WMCA responsibilities related to operation of regulator, maintenance of khals, improvement of water distributions systems and water sharing between farmers and fishers can be included in the training and extension programs.

4.5 Monitoring Activities

The environmental monitoring will lead to evaluate the physical performance and impact of the interventions inside and outside of the subproject area and to an understanding how the beneficiaries living in the subproject area responds technically, economically and socially to the environment to be created by flood control and drainage structures. PMU will take overall responsibilities of the monitoring through the PIU at Netrokona district and Kendua upazila and subproject WMCA. Project consultants (PC) will support the PMU. The monitoring will identify environmental impacts during the following stages:

I. Construction stage: Monitoring activities in this stage will include a) compliance and b) non-compliance. A checklist as provided in Annex-D will be used for the compliance monitoring. If non-compliance is registered, a checklist as provided in Annex-E will be used as corrective action request (CAR). The subproject construction contract document should specify that the contractor is obliged to test water samples as part of environmental baseline establishment before civil works construction starts. The selected indicators should include dissolved oxygen (DO) to measure the amount of gaseous oxygen dissolved and total suspended solids (TSS) or turbidity for determining sediment concentration in water samples collecting from the Bamankhali and Solailakhali khals in the subproject area. The test results should be explained to the WMCA Construction Monitoring Committee so that they are better able to understand what should be expected of the contractor by way of construction quality. The results should also be sent to the PMU through PIU at LGED upazila and district offices. Construction Quality or Assurance Supervision Engineer will support the monitoring activities at the construction phase.

II. Subproject operation: The subproject beneficiaries have agreed to form WMCA through which they will manage various subproject activities. These include monitoring of environmental issues which will help the beneficiaries to prepare subproject O&M plan to take advantage of flood control and drainage improvement and water retention and formulate practical recommendations to solve subproject induced and related problems. Following the completion of the construction of infrastructure the WMCA will undertake the overall responsibilities of environmental monitoring in the subproject area. WMCA O&M, Agriculture and Fisheries subcommittees will support the Management Committee in the monitoring. The monitoring will contribute to create a basis for water resources management in the subproject area through better understanding of the real impacts of the subproject on agricultural and fisheries resources, environment and economic development. In cooperation with Kendua Upazila Engineer, Agriculture and Fisheries officers the PMU will organize field trainings for WMCA members on environmental monitoring as well as on O&M activities, on-farm water management, sustainable environment friendly agricultural production and fisheries and overall environment management of the subproject. The WMCA monitoring indicators will include depth and duration of water in the khals and beels, sedimentation in khal water, water quality, fish migration to and from the subproject area, which reduces fish resources in the subproject area, encroachment of agriculture into beel, navigation and crop plantation and harvest time. These indicators will help to determine changes in water regime for the subproject construction. The O&M subcommittee should take the main responsibility of the monitoring activities at the operation stage.

III. Trend Monitoring**:** In addition, PMU will periodically monitor pH level, electrical conductivity (Eh), dissolved oxygen (DO), nitrate-N (NO_3-N), phosphate-P (PO_4^{-3}-P), arsenic (As), water hardness ($CaCO_3$), total dissolved solids (TDS) and Temperature (^{0}C) in water in the khals and beel in the subproject area. These are expected to reflect changes in the use of chemical fertilizers and pesticides, inputs from modern aquaculture practices and increased abstraction of ground water for irrigation.

4.6 Monitoring Plan

An environmental monitoring plan (EMoP) is proposed to monitor environmental parameters during the pre-construction, construction and post-construction or operation phases of the subproject (Annex-F). It will provide a delivery mechanism to address the adverse environmental impacts during its implementation to enhance water resources development benefits and introduce standards of good practice to be adopted for all construction works. The EMoP will be useful in detecting the development of any unwanted environmental situation and adopting appropriate control measures, define the responsibilities of the PMU at LGED headquarters and PIU at Netrokona district and Kendua upazila, subproject contractors, WMCA as environmental monitors and provides means of effectively communicating environmental issues among them, evaluate the performance and effectiveness of mitigation measures proposed in the mitigation plan, suggest improvements and identify training requirements.

4.7 Reporting

The PMU will be primarily responsible for the preparation of environmental monitoring report with the support of PC and WMCA. The report will focus on the implementation of environmental mitigation. Monitoring data to be collected during the pre-construction,

construction and operation periods through the PIU at Kendua upazila and Netrokona district and Bamankhali Khal subproject WMCA will be sent to the MIS system operated by the IWRM Unit at LGED headquarters. The IWRM Unit Environmental Section will organize, store and process the data to produce the reports. Pre-construction data will be treated as base line. The subsequent data will be used for comparison with the base line to evaluate the impacts, formulate the mitigation measures and produce reports.

The PMU and PCs will prepare monthly, quarterly and annual monitoring reports based on the data and information. The construction monitoring and quality control specialists and supervisors at PIU will monitor environmental aspects regularly during the construction period. They can issue two forms (Annex-C and Annex-D). This will be part of monthly subproject progress report. PMU and PC will use this information in preparation of quarterly environmental monitoring report for the project). The quarterly reports will be submitted to JICA and DoE and posted on the project website as part of its disclosure requirements. Furthermore, the quarterly reports will be compiled to include in the annual report.

5. INSTITUTIONAL ARRANGEMENTS

The Environmental Section of IWRM Unit, PMU, PC, construction monitoring and quality control team, district PIU, Upazila Engineer, contractor, LCSs and WMCA Management committee should participate in the mitigation and monitoring activities. IWRM Unit Environmental Section starts supporting during the subproject selection, detailed design and feasibility study stages. It ensures that EMP and EMoP are prepared. The district PIU and Upazila Engineer facilitates public consultation. During the construction period the PMU will take overall responsibilities of the mitigation and monitoring through the PIU at district and upazila levels. PC will support the PMU. Kendua Upazila Engineer will assist contractors and LCSs and ensure that proper and remedial actions are taken in time and proper mitigation actions are addressed. Construction monitoring and quality control team will support the Upazila Engineer. This will continue until the subproject is handed-over to WMCA. The WMCA monitoring and mitigation activities will be supported by Upazila Engineer during the subproject operation period. Upazila Engineer will also submit reports regularly to IWRM Unit Environmental Section through district PIU

6. COMMUNITY CONSULTATION AND DISCLOSURE

Consultations on the IEE were carried out through FGD and meeting with the local people, Balaishimul and Noapara union parishad and upazila parishad members. They endorsed that the subproject implementation will have no impact on soil erosion and siltation, road safety and air pollution. It will not require any land acquisition. However, local stakeholders expressed that they were willing to donate lands if any land acquisition required. According to the FGD participants the subproject will contribute to improve drainage and increase irrigation water availability. Construction of a water control structure on Bamankhali khal without restricting navigation will protect crop from early flooding. The summarized feedbacks and the attendance are attached (Annex-G). The findings as well as IEE will be made available at public locations including in the LGED Upazila Engineer Office at Kendua and Balaishimul and Noapara Union Parishad Complexes and disclosed to a wider audience via the LGED project websites. The consultation process will be continued and expanded during the subproject implementation period to ensure that stakeholders are aware of subproject environmental issues and fully participating in the development and implementation processes.

7. GRIEVANCE REDRESS

A grievance redress mechanism (GRM) will be set up by the PMU for the subproject to register grievances brought by people in the affected community regarding technical, social and environmental aspects. This grievance redress mechanism will ensure that any public grievances are addressed and adjusted quickly.

8. FINDINGS AND RECOMMENDATIONS

There is a situation in the subproject area where crop loss due to flash flood and water logging is a regular phenomenon. The floods together poor drainage restrict land productivity and reduce crop production in the subproject area. It is expected that construction of regulator and re-excavating of the Bamankhali khal and Solailakhali khal will control flood and improve drainage and protect boro and aman rice crops. The findings of the FGD showed popular support for the subproject. The predominance of landless, functionally landless, and marginal farmers among the total farm households of the subproject area provides opportunity for the subproject to support poverty reduction. Local people overwhelming believe that the subproject will have a favourable impact on the livelihood improvement. It was reported in the FGD that the local people were involved in various types of local organizations or institutional activities and indicated their willingness to support WMCA formation for subproject management and contribute to O&M fund.

9. CONCLUSIONS

The people interviewed fully understand the potential benefits of the subproject and there was overwhelming support for subproject implementation. There is evidence of leadership and general social and environmental awareness among the subproject people regarding development interventions. Any opposition to the subproject implementation was not noticed. In view of the benefits, the proposed subproject can be recommended for implementation. Adverse impact on the environment for the implementation of the subproject will be insignificant. This can be mitigated with strong monitoring responsibility of preventive measures. The subproject falls into the Orange-B category according to the Environmental Conservation Rules 1997, Bangladesh, and into the Category B according to the JICA Guidelines for Environmental and Social Considerations (2010). Accordingly, this IEE report can be considered as complete Environmental Impact Assessment (EIA).

Annex-A

Department of Environment (DoE) Environmental Checklist For Ecologically Restricted or Conservation Area

No.	Description	Yes	No
1.	Is the proposed subproject located within any conserved natural and/or planted forests on elevated lands (Barind/Garh) areas in Greater Dinajpur, Dhaka or Mymensingh Districts?		√
2.	Does the proposed subproject encroach on any conserved natural and/or planted forests on mountain valleys near the Indian border in Greater Sylhet District?		√
3.	Is the proposed subproject situated within any conserved natural and/or planted forests in Greater Chittagong District?		√
4.	Will the proposed subproject development intervene with any conserved and/or planted forests of the Sundarban area and south coast of the Bay of Bengal?		√
5.	Is the subproject within 10 km peripheral distance from the 762,034 ha Sundarbon reserve forest area in Bagerhat, Khulna or Satkhira Districts?		√
6.	Is the proposed subproject situated within the 10,465 ha conserved area containing sand rim, estuary, forest, wetland, etc, on both sides of the Cox's Bazar – Teknaf sea beach in Cox's Bazar District?		√
7.	Is the subproject proposal from Narikel Jinjira and/or Sonadia Ghoti Bhanga mouja/s (village/s) of Saint Martin Deep and the 4,916ha Sonadia Deep in Cox's Bazar District? No		√
8.	Are the subprojects located within the 18,383ha inundation zone of Hakaluki Haor in Moulvi Bazar/Sylhet District/s and the 9,727ha Tanguar Haor in Sunamgani District? No		√
9.	Is the subproject situated within the 200ha floodplain of Marjat Baor in Jhenaidan District? No		√
10.	Is the subproject located within any very sensitive aquatic ecosystem of the Ganges floodplain or the Meghna estuaries? No		√

Annex-B

Environmental Field Survey Questionnaire

A.1 Subproject area information
Name of the Sub-project: Bamankhali khal
Location (UP/Upazila/Dist): Upazila: Noapara, Kendua, Netrokona.
Area of the Sub-project: 480-ha, cultivated area: 432-ha
Villages/ Mouja:Jurail,Bejgaon,Balaishimul and Kumarura.
Population:3575.

A.1 Sub-Project Area Information (Sheet No)

A.1.1 Physical Environment

A1.1.1	Flood regime	Yes	No	Unknown
Q.1	May the sub-project implementation bring any change in the present water level and flow in any river/khal or existing flooding pattern		√	
	If yes, name the river/khal and give peoples comment about the present situation and expected changes. If no, justify the idea			
A1.1.2.	Ground Water Table			
Q.2	May the sub-project cause a fall or rise of ground water table inside and/or outside the area?		√	
	If yes, give your comments about the impact on drinking water well, STW, DTW, wetland, and low-lying agricultural lands. If no, justify the idea.			
A1.1.3	Water Quality		√	
Q.3	May the sub-project activity bring any change in surface water quality and ground water quality in the area?			
	If yes, give ideas about present status and expected changes in surface water and ground water quality. If no, justify your idea.			
	Note: The surface water of the subproject area is severely saline and fresh water plants and animals are almost endangered. Positive remarkable changes of water quality are expected due to protection of saline water intrusion by the construction of embankment around the project area. Farmer will follow IPM			
A1.1.4	Water logging and Siltation			
Q.4	May there be any water logging or siltation problem due to subproject activities?		√	
	If Yes, give the present status of soil fertility and put local people’s comments about the impact and mitigation suggestion, if any. If no, justify the answer.			
A1.1.5	Soil Characteristics / Fertility		√	
Q5	May the sub-project implementation obstruct natural replenishment of flood plain agricultural soil or require topsoil cut from fertile land?			
	If yes, give the present status of soil fertility and put local people's Comments about the impact and mitigation suggestion, if any.			
	Note: Natural replenishment of floodplain agricultural soil will remain, as flood regime will not change.			

A1.2 Biological Environment

		Yes	No	Unknown
A1.2.1	Wetland and Aquatic Habitat			
Q.6	May the subproject bring any change to the wetlands (beel/haor/depression/lake/river/khal) in the area?		√	
	If yes, name the wetland and it's present condition. Describe how it can be changed, mitigation suggestion, if any, in case of adverse impact. **Note:** Low areas in and around the subproject area are the wetlands. Construction of embankment around the Subproject will reduce adverse effect on saline environment.			
Q.7	Is there any habitat for aquatic lives, which can be affected by the subproject?		√	
	If yes, describe how it can be affected and give comments on possible impact species on habitat.			
A1.2.2	Terrestrial Habitat			
Q.8	May the subproject change ecosystem of any natural forest or significant terrestrial habitat for bird, animal etc.?		√	
	If yes, name the terrestrial habitat. Describe how it can be affected and mitigation suggestion, if any, in case of adverse impact.			
	Note: There is no forest or ecologically restricted area in the subproject area. No change of present terrestrial habitat affecting birds and other animals.			
A1.2.3	Fisheries			
Q9	May the subproject activities reduce natural fisheries production by preventing fish migration and/or disconnecting breeding ground for them?		√	
	If yes, give an estimate of the loss of production compared to the present situation include mitigation suggestion, if any, from the beneficiaries.			
	Note: Bagda shrimp is cultivated during January to June and Golda shrimp is cultivated during July to December. Other Natural fresh water fishery is critically endangered now. After the construction of embankment fresh water culture fishery mainly Golda will be cultivated in the subproject area. Golda production is comparatively in the subproject area.			
Q10	May the subproject activities directly or indirectly change artificial fisheries situation and its associated activities?		√	
	If yes, describe present situation of aquaculture. Give an estimate of the loss production and mitigation measure, if any, from the beneficiaries. **Note:** After the construction of proposed embankment, fresh water culture fishery will positively affect and production will increase (34 tons). Presently, people can not cultivate fresh water fishery (Rui, Katla) due to intolerable limit of salinity.			
A1.2.4	Biological Diversity			
Q11	May the subproject activities affect any rare, endangered, or threatened plant or wildlife species in and around the area?		√	
	If yes, name the species, describe present status and put suggestions how it can be protected or preserved. **Note:** The subproject is expected not to threaten plant and wild life species in the area.			
A1.2.5	Eutrophication			
Q12	May the subproject implementation create anaerobic condition or Eutrophication, in any of the water pools, ditches, borrows pits, etc.?		√	
	If yes, state local people's comment and suggestion about how it can be managed.			

A1.3 Social Environment

A.1.3.1	Land Acquisition	Yes	No	Unknown
Q 13	May the subproject implementation require land acquisition?		√	
	If yes, give the type and approximate area of land to be acquired as well as the number of landowners affected. **Note:** No land acquisition is required and government khas land is enough for re-excavation of khal.			
A1.3.2	Agricultural Development			
Q14	May the subproject implementation lead to more crop production with increased land for boro and rabi cultivation, crop diversification, etc.?	√		
	yes, per-monsoon flash flood, which damages standing HYV Boro at recurrent interval is the major constraint to crop production. Scarcity of irrigation water causes droughty stress in March- April which affects yield of Boro crop. Partial flood protection will ensure Boro crop from pre-monsoon flood damage and canal re excavation with a regulator at the outfall of Bamankhali khal will provide water conservation at the post-monsoon, which would bring more area under Boro cultivation. This will increase rice production by 570 tons annually, increased area of land and name of the crops. **Note:** Fresh water fish and Rabi crops production (1425 tons) will specially increase in a more secured fresh water supply in the subproject area.			
A1.3.3	Accessibility and Employment			
Q15	May navigation /boat communication system be interrupted by the Subproject activities?		√	
	If yes, give approx. length of present navigation route, expected changes and period of interruption.			
Q.16	May the subproject activity promote accessibility resulting in growth Center development and employment opportunity in the area?	√		
	If yes, During monsoon employment scope is limited. Employment scope will increase in agriculture, fishery, duck, farming and various IGAs in post subproject condition. Hence, impact is assessed positive.			
A1.3.4	Health and Nutrition			
Q.17	May there be any change in disease incidences in the area as a result of subproject implementation? Yes, Increased crop production and fisheries development due to subproject will facilitate improvement in nutritional status and health.		√	
	Note: Health condition and nutritional status will improve due to increase agricultural production. With the improvement of fresh water environment, water borne diseases are likely to be reduced.			
Q.18	May the subproject implementation directly or indirectly affect nutrition in the area?	√		
	If yes, give your comments about how it can be affected and to what extent. **Note:** Cropping pattern will be diversified on implementation of the subproject. So, nutritional status will improve due to increase agricultural production.			
A1.3.5	Community Impact			
Q.19	May the subproject cause increase in unemployment in any professional community?		√	
	If yes, name the community and their suggestion for mitigating the problem. No, the subproject would not cause unemployment to any sector.			
A1.3.6	Cultural Values			
Q.20	Is there any historical / archaeological site, or recreation / tourism spot which may be affected due to subproject implementation?		√	
	If yes, name the site and provide suggestion for mitigation. **Note:** There is no historical /archaeological site or tourism spot which may be affected due to implementation of the subproject.			

A.2 Adjacent Area Information (Sheet No)

Name of the Subproject: Bamankhali khal
Location (Up/Upazila/Dist): Noapara, Kendua, Netrokona
Name of the Village: Jurail,Bejgaon,Balaishimul and kumarura,
Area of the Subproject: 480 ha
Population: 3575

Q.1	Is the village a flood prone area? If yes, mention the period of last flood, its source, and consequences.
	সর্বশেষ বর্ষাকালীন বন্যা হয়েছিল ২০০৪। যা পাটকুরা নদী থেকে পানি বামনখালী খালে পতিত হয়ে উপ-প্রকল্প এলাকার সবকয়টি গ্রাম প্লাবিত হয় এবং আউস ফসলের ক্ষতি সাধিত হয়।
Q.2	Is there any disaster shelter center in the area? If yes, how many, where it is located, and did people take shelter during the last flood? Did they receive any flood disaster management training?
	উপ-প্রকল্প এলাকায় কোন দূর্যুগ ব্যবস্থপনা কেন্দ্র নেই।
Q.3	Give local people's comment in respect of any risk, like flood, water scarcity, obstacle to boat movement, epidemics, etc., or any other type which can appear as a result of sub-project implementation and their suggestions to mitigate any such problems.
	উপ-প্রকল্প এলাকায় শুস্ক মৌসুমে সেচ এবং পানযোগ্য পানির ব্যাপক অভাব দেখা দেয়,স্থানীয় জনগণ ৪০ফিট মাটির নিচে জল মটর স্থাপন করে ইরি/বোরো ফসলে সেচ প্রদান এবং খাবার পানি সংগ্রহ করেন। শুধ বর্ষা কালে নৌ চলাচল হয়। স্লুইচ গেইট নৌ চলাচলের ব্যবস্থা রেখে নির্মিত হলে, নৌ চলাচলের আর কোন সমস্যা থাকবেনা বলে স্থানীয় জনগণ মত প্রকাশ করেন।
Q.4	Give local people's comments in respect of any positive impact like, more Agricultural and fisheries production, better accessibility, employment opportunity, agro-industrial development that can be developed as the result of subproject implementation.
	স্থানীয় জনগণ বলেন বামন খালী খাল এবং সুলাইলা খালী খাল খনন করার ফলে খালের মধ্য পানি ধরে রেখে বোরো / রবি ফসলে সেচ প্রদান। খালের মধ্য পানি সংরক্ষণের ফলে উক্ত এলাকায় ভূর্গবস্থ পানির স্তর বৃদ্ধি পাওয়ায় টিউবয়েল এর খাবার পানি থেকে শুরু করে সেচ কার্যে ব্যবহারিত সেলু মেশিনে পানি উত্তোলণ সহজতর এবং বামন খালী খালের মুখে স্লুইচ গেইট নির্মাণের ফলে বোরো/রবি ফসল আগাম বন্যার হাত থেকে রক্ষা পাবে বলে স্থানীয় জনগণ ধারণা করেন। যার ফলে কৃষি, মৎস উৎপাদন বৃদ্ধিসহ , হাঁস/মুরগী খামার করার মাধ্যমে, ঐ এলাকার জনগণের কর্মসংস্থানের সুযোগ বৃদ্ধি পাবে।

Annex-C

Environmental Mitigation Plan (EMP)

A.	**Subproject Information**	Name	: Bamankhali Khal Subproject
		Type	: FMD
		Gross Area	: 480 ha
		Village/Mouza	: Jurail,Bejgaon, Balaishimul, Kumarura
		Union	: Balaishimul and Noapara
		Upazilla	: Kendua
		District	: Netrokona

B.	**Proposed Interventions**	Khal re-excavation/excavation	Bamankhali 1.85 km Solailakhali 1.95 km
		Construction of Regulator	1

C. Implementation Schedule

Name of the work/activities	Start	End
1. Structures Construction	2018	2019
2. Khal Re-excavation	2018	2019

D. Design Discussion Meeting including Environmental Mitigation Measures

Place: ....
Date: ....
Number of Project Affected People (PAPs) present: ……………………

E. Signing of Environmental Mitigation Plan (at the time of signing Implementation Agreement)

Place of Signing: …………………... Date of Signing: ………………

LGED	**WMCA**
(……..……………….)	(……..……………….)
Executive Engineer, LGED	President, WMCA

Steps for Preparing Environmental Mitigation Plan:

1. Finding of potential impacts and identification of adverse impact issues from environmental assessment study report (IEE/EIA).
2. Cross checking of identified adverse impact issues with PRA findings.
3. Identification of PAPs from both IEE/EIA and PRA reports.
4. Presentation of identified impacts and their best possible mitigation options in meeting with PAPs and collection of their opinion in implementing the program.
5. Finalization of EMP after detail discussion with PAPs and incorporation of recommended options in the engineering design.
6. Fixing of implementation schedule for finally accepted Mitigation Plan and endorsement of the document by the concerned LGED Executive Engineer, PAPs, and representatives from WMCAs.

Note: *All works/activities in the signed mitigation plan should be clearly mentioned in the Implementation Agreement of the concern subproject.*

Bamankhali Khal Subproject Environmental Mitigation Plan (EMP)

Sl.	Subproject Impact on Important Environment Components (IECs)	Mitigation Measures: During design	Mitigation Measures: During construction	Mitigation Measures: During O&M	No. of PAPs	Signature of PAP representative(s)	Responsible Entity/ Party
Physical Environment							
1.	Regional Flood Regime/Hydrology ☐ Increase flood intensity ☐ Change in river/khal water flow and flooding pattern ☐ Enhanced flood risk in adjacent areas ☐ Fall of ground water table	☐ Design to ensure no induced flooding ☐ Incorporation of adequate flow in design of hydraulic structures ☐ More recharge by increasing inundation area and period ☐ Increase in surface water irrigation	☐ Excavation & re-excavation of more ponds, ditches & water reserves	☐ Proper and timely opening / closing of regulator gates, maintaining gates and hoisting gears/systems in good operable condition, etc.			Design: FSDD Firm, Project Consultants (PC) Construction: O&M: WMCA, Upazila Engineer
2.	Drainage /Water-logging ☐ Create/increase drainage congestion ☐ Cause excessive/unwanted drainage (reducing permanent water body/affecting soil moisture) ☐ Water logging in low lying areas ☐ Partial drain out of the beel, water bodies, flood plain areas	☐ Design to avoid drainage congestion: in lower area inside or outside the subproject by draining upper/ inside areas, inside subproject area due to inadequate drainage path/ diversion channel during construction; ☐ Design to ensure no excessive drainage reducing permanent water body significantly; ☐ Design to provide adequate drainage facility ☐ Design to prevent significant seepage from irrigation canal	☐ To conserve water in newly excavated & re-excavated water reserves, ponds, ditches, dighis etc. ☐ Spoilages and wastes during construction should not be dumped or deposited in any water body or basin like depressed land	☐ Maintaining drainage channels clear of fish bundhs, water weeds/hyacinths, ☐ Maintain Seal of gates property and close gates properly/timely to prevent loss of water required to be conserved, ☐ O& M of regulator should consider water conservation in in reserves, ponds, ditches, dighis from khal, floodplain			Design: FSDD Firm, PC Construction: WMCA O&M subcommittee, Upazila Engineer (UE)
3.	Soil Characteristics / Soil Fertility ☐ Degradation of soil fertility due to: removal of top soil, intensive/ diversified agriculture (increased use of inorganic fertilizers, pesticides), preventing nutrient rich sediment deposition on lands ☐ Loss of soil fertility due to hindrance in natural replenishment of flood plain soil by flood water inundation. ☐ Gradual degradation of fertility by topsoil erosion due to lowering of soil moisture in land for not flooding in the SP area	☐ Design for provision for natural replenishment of flood plain soil by maintaining soil moisture contents ☐ Top soil erosion control by soil conservation planning through turf, addition of organic matter in the land, increase in plantation and vegetation in the subproject areas for increase in organic matter and moisture holding capacity to check top soil loss ☐ Suitable Soil Conservation methods should be designed to check fertility	☐ Ensure no top soil removal from fertile agricultural land (top soil to be excavated and kept reserved at one place, take soil for construction in shallow cutting from the land and spread the preserved top soil on land again; ☐ Turf and vegetation in the possible soil and land erosion occurring areas	☐ Training to farmers on IPM / ICM through DAE/SRDI support ☐ Analysis of soil samples (base data) of subprojects cultivated land and use fertilizer application at SRDI/DAE recommended doses ☐ Enhance use of organic manure by farmers			Construction: Contractor, Supervisor (CS)/Upazila Assistant Engineer (UAE) WMCA, Department of Agricultural Extension (DAE) and other Supporting Agencies

Sl.	Subproject Impact on Important Environment Components (IECs)	Mitigation Measures			No. of PAPs	Signature of PAP representative(s)	Responsible Entity/ Party
		During design	During construction	During O&M			
4.	Erosion and Siltation ☐ Increase sediment and loose soil deposit on land outside embankment, ☐ Erosion of loose soil from new earthwork (embankment/spoil) and deposit ion on agricultural land ☐ Increased siltation of river/khal bed due to construction of WRS/regulator ☐ Top soil erosion will occur due to lowering of soil moisture in the land for absence of flooding in the SP areas ☐ Deposition of silt and loose soil on the crop lands at the both banks of the khal due to re-excavation.	☐ Design to consider existing risk and cause no significant induced impact (provide close turf on top and side slopes of embankments, set sill levels of structures at lower levels or use other techniques to flush out most of sediment load; ☐ Top soil erosion control by soil conservation planning through turf on the slopes of the embankment, addition of organic matter in the land, increase in plantation and vegetation in the subproject areas for increase in organic matter and moisture holding capacity to check top soil loss ☐ Plantation and vegetation along the banks of khal /embankment	☐ Adopt appropriate construction management to minimize erosion of soil from excavations, embankments/spoil deposits, etc during rains; ☐ Turf and vegetation in the possible soil and land erosion occurring areas ☐ Quick disposal of wastes from the deposited lands	☐ Include in the O & M program special care taking of new earthwork structures under both routine and periodic for the initial 2-3 years to reduce erosion of soil during rain and deposition on nearby crop lands. ☐ Include in the O&M program removal of deposited silt from the channel bed upstream of weirs ; ☐ Periodic disposal of deposited silts and wastes from the khal beds ☐ Plantation and vegetation along the banks of embankment			Design: FSDD Firm, PC Construction.: Contractor, CS O&M subcommittee: WMCA, UE
Biological/ Ecological Environment							
5.	Terrestrial Habitat: ☐ Removal /cutting of trees and vegetation	☐ Design considering minimum removal / clearance of trees and vegetation ☐ Re-plantation, more vegetation and social forestation in the SP areas	☐ Do not undertake unnecessary clearance of vegetation/felling trees during construction ☐ Initiative for re-plantation, more vegetation, social forestation in SP areas	☐ Include social afforestation program on available land (roadside, khal bank, structure site, etc)			Design: FSDD Firm, PC tion: Contractor, CS, IWRMU. WMCA: Community Organizer (CO)
6.	Wetland Habitat: ☐ Drying up or drastic reduction of permanent water bodies/areas ☐ Significant reduction of seasonal floodplain area	☐ Design to avoid complete drying up of water bodies ☐ Design to minimize reduction of seasonal floodplain area	☐ Excavation & re-excavation of more ponds, ditches & water reserves	☐ Ensure compliance to the timely operation of gates of hydraulic structures (meant for water conservation) ☐			Design: FSDD Firm, PC Construction: WMCA O&M subcommittee, CO
7.	Fisheries: ☑ Decline in fish production ☐ Reduction of fish habitat ☑ Reduction of fish biodiversity ☑ Fish migration into the khal due to construction of regulator may be hampered ☐ Livelihood of the genuine, neo and subsistence fishers may be deteriorated	☐ Consider provision of fish-pass fish friendly operation to facilitate migration; ☑ Design for provision of fish shelter in khals, fish sanctuary in the Beels and fixing of fish net at the drainage structure to restrict out-migration of fish ☐ Provision for excavation & re-excavation of new water reserves, ponds, ditches, dighis for increase of culture fish production ☐ Provision for resettlement/ rehabilitation	☑ Should excavate, re-excavate fish shelter in the khals, fish sanctuary, water reserves, ponds, ditches and dighis for fish habitats ☐ Keep provision of fish-pass, fish friendly structure to facilitate hatchling and migration	☑ Utilization of all subproject wetlands for fish production. ☑ Fish-friendly gate operation schedule to facilitate in-migration of fish for breeding and spawning ☑ Training on improved fisheries technology, community based culture fisheries, hatchery and restocking programme			Design: FSDD Firm, PC Construction: WMCA O&M subcommittee, CO, Department of Fisheries (DoF)

Sl.	Subproject Impact on Important Environment Components (IECs)	Mitigation Measures			No. of PAPs	Signature of PAP representative(s)	Responsible Entity/ Party
		During design	During construction	During O&M			
8.	Biodiversity: ☐ Loss of biodiversity (due to decrease of aquatic and terrestrial habitat)	☐ Design to consider no drastic reduction in permanent water bodies, plant and forest area	☐ Preserve, excavate and re-excavate water bodies, ponds, dighis and ditches ☐ Develop plantation, vegetation and social forestation in the area	☐ Include social afforestation program on available land (roadside, khal bank, structure site, etc) ☐ Preserve water bodies, water reserves			Design : PC Construction: IWRMU O&M subcommittee, CO
Social Environment							
9.	Land Acquisition/Land Loss: ☐ Loss of small strips of agricultural land/homestead from embankment sides ☐ Dislocation of habitat ☐ Economic livelihood disruption of the genuine, neo and subsistence fishers ☐ A small piece of land to be acquired for construction of WMCA Office.	☐ Consider in the design avoidance/ minimization of land acquisition ☐ Provision for compensation and/or resettlement of PAPs ☐ Minimize disruption of livelihood and provide for compensation ☐ Involve the genuine, neo and subsistence fishers in culture fisheries and IGAs.	☐ Employ affected people in construction works	☐ Engage/employ affected persons in O&M and IGAs activities by WMCA ☐ Land losers along the toe of embankment may be given share of trees grown on embankment slopes under management of WMCA			Design: FSDD Firm, PC Construction: Contractor, CS O&M subcommittee, LGED
10.	Unemployment ☐ Unemployment / reduction of scope of employment of professional community (i.e. fisher, boat men, etc.)	☐ Identification of affected professional group and incorporation of in-kind compensation for losses in the sub-project planning ☐ Plan and design for different income generation activities(IGAs) development of culture fisheries with the help from to women, youths, fishers, boatmen and different professional groups	☐ Employ local people, especially women in construction works.	☐ Employ local people, especially women in O&M activities ☐ Involve in different income generation activities (IGAs), development of culture fisheries with the assistance from WMCA to women, youths, fishers, boatmen and different professional groups			Design: FSDD Firm, PC Construction: Contractor, CS O&M subcommittee
11.	Navigation / Boat Plying facilities ☐ Hindrance/obstruction to boat plying ☐	☐ Consider in the design boat-pass facility in hydraulic structure s, as far as possible.	☐ Preserve boat passing facility as per design	☐ Ensure compliance to operation of hyd. structures for boat pass ☐ Synchronize the opening and closure of the gate(s) and vent with boat passing			Design : FSDD Firm, PC Construction: IWRMU O&M subcommittee, CO
12.	Facilities for Workers: ☑ Water Supply and Sanitation Facilities for Workers ☑ Health and Safety Measures For Workers ☐	☐ Provision for adequate water supply and sanitation/toilet facilities for workers in the site areas and WMCA office	☑ Provide adequate water supply and sanitation/toilet facilities to workers and WMCA office ☑ Adopt appropriate safety measures, and provide first aid services ☐ Make workers aware of health risks	☐ Provide adequate water supply and sanitation/toilet facilities to workers in the site area and WMCA office ☐ Make workers aware of health risks and how to avoid these			Construction: Contractor, O&M subcommittee, CO

Sl.	Subproject Impact on Important Environment Components (IECs)	Mitigation Measures			No. of PAPs	Signature of PAP representative(s)	Responsible Entity/ Party
		During design	During construction	During O&M			
Other Environmental Attributes							
13.	☐ Air pollution through dust generation due to subproject works	☐	☐ Spray water regularly on dry work surfaces creating dust problems	☐			Construction: Contractor, CS O&M subcommittee, CO
14.	☐ Noise pollution from construction activities	☐	☐ Avoid unnecessary noise near the vicinity of homestead areas	☐			Construction: Contractor, CS O&M subcommittee, CO
15.	☑ Pollution of water from application of high doses of inorganic fertilizers/ pesticides. ☐	☐		☑ Periodic analysis of representative water samples (surface & groundwater) of subproject area			Construction: IWRMU/LGED District Executive Engineer O&M subcommittee
16.	☐ Environmentally sensitive area, Archaeological / Historical Sites ☐	☐ Avoid archaeological/ historical sites, environmentally sensitive areas (Ramsar Sites:Tanguar Haor and Hakaluki Haor; National Protected area: Laua Chhara Forest /other national reserve forest areas)	☐ Implement as per design avoiding archaeological /historical sites, environmentally sensitive areas	☐ Monitoring should be needed for those areas during O&M			Design : FSDD Firm, PC Construction: IWRMU O&M subcommittee, UE

Instructions to Complete the EMP format:
1. Put Tick (✓) in appropriate Box/Measure to confirm the action to be taken.
2. Complete only the IECs that are identified in the IEE to have adverse impacts
3. Any action/measure to be taken other then the mentioned ones should be described against the empty boxes and the box should also be ticked (✓).

Executive Engineer, LGED

WMCA Chairperson

Date of signing:...

Place of signing: ....

Annex-D

Environmental Impacts and Mitigation Checklist

[Put Tick (✓) in appropriate box to confirm compliance to the measure, and (x) for unsatisfactory or non-compliance]

Contractor's Name:
Subproject's ID No.: Subproject Name:
Village: Union: Upazila: District:

Possible Impact	Mitigation during design	Mitigation during Construction	Mitigation during Maintenance	Specific observation, if any
Soil Fertility ☐ Degradation of soil fertility due to removal of top soil		☐ No topsoil removal. Stockpile topsoil at 15 cm depth from construction campus site /stack yards and spread back the stockpiled topsoil on land once the camp and other installation is no longer required.	☐ Training to farmers on IPM / ICM through DAE/SRDI support ☐ Enhance use of organic manure by farmers	
Erosion and Siltation ☐ Erosion of loose soil from new earthwork ☐ Increased siltation of river/khal bed for construction ☐ Spoils from khal excavation		☐ Adopt appropriate construction management to minimize erosion of soil ☐ Take measures to reduce siltation ☐ Organize appropriate arrangements for spoils removal/deposit		
Terrestrial Habitat ☐ Removal /cutting of trees and vegetation		☐ Do not undertake unnecessary clearance of vegetation/felling trees during construction	☐ Include social afforestation program (plantation on (roadside, khal bank, structure site)	
Unemployment ☐ Reduction of employment scope for professional community (fisher, boatman)		☐ Employ local people, especially women in construction works.	☐ Employ local people, especially women in O&M activities	
Facilities for Workers ☐ Labor Camp Facility for Workers		☐ Provide hygienic labor camp facility to workers		
☐ Water Supply and Sanitation Facilities for Workers		☐ Provide adequate water supply and sanitation/toilet facilities		
☐ Health and Safety Measures For Workers		☐ Adopt appropriate safety measures at work, and provide first aid services ☐ Make workers aware of health risks and how to avoid		
☐ Management of wastes generated from labor camps to avoid pollution of surrounding water quality		☐ Maintain camp site waste disposal facilities by installing adequate garbage bins, and regular collections Prevent discharge of waste water from labor camps ☐ Prevent spills of oil and lubricants from equipments, machineries, vehicles,		

Inspection by: Name: Designation: Signature: Date:

Annex-E

Corrective-Action Request

(Non - compliance Reporting)

Contractor's Name:
Subproject's ID No.: Subproject Name:
Village: Union: Upazila: District:

Inspection of the subproject work was found to demonstrate non-compliance to some of the items of the contract Specification and Implementation of EMP.

The contractor is hereby requested to rectify the non-compliant works as tick (√) marked below within --------days.

Non-compliant works detail

- ☐ Construct environment friendly labor shed or workforce camp
- ☐ Provide sanitation facilities by installing sanitary latrine, urinal and bathroom (at least 1 no. of each separately for women and men).
- ☐ Provide adequate supply of arsenic-free water for drinking and other purposes by installing tube wells in workforce camp (at least 1 for women and 1 for men).
- ☐ Provide adequate first-aid facilities at workforce camp and construction site.
- ☐ Provide health safety gears like hand gloves, helmet and gumboots to the workforce to avoid health risk.
- ☐ Provide sufficient garbage bins for collection and safe disposal of wastes generated at camp site.
- ☐ Suppress dust pollution at camp site/construction area by spraying water at regular intervals.

Inspection by: Name: Date of Inspection:

Signature:

Designation

Annex-F

Environmental Monitoring Plan

Check the appropriate box for items to be confirmed on monitoring.

A. Pre-Construction Phase

Receptor	Location	Monitoring Method	Monitoring and Reporting Frequency	Monitoring Responsibility
◻ Ambient Air Quality	At subproject location	Particulate Matters (PM 2.5/10)	One month prior to construction start	LGED Upazila Engineer and Contractor
☑Surface water Quality	Khal and Beel within the radius of 2 km of the subproject site	pH, Total Suspended Solids (TSS), turbidity and Dissolved Oxygen (DO)	At least three samples prior to construction	LGED Upazila Engineer and Contractor
◻ Groundwater Quantity	Within the radius of 1 km the of subproject site. Water sources to be used for construction purposes	pH, Fe, toxic organic compounds (NO_3-N)	At least three samples from one location prior to construction	LGED Upazila Engineer and Contractor
◻ Noise Levels	At subproject location	For Background Noise Levels (using Noise meters)	Prior to construction.	LGED Upazila Engineer and Contractor
◻ Clearance of Trees	At subproject location	Inventory of trees likely to be cut and number of trees to be planted as part of compensation	Clearance of Trees	LGED Upazila Engineer and Contractor

B. Construction Phase

Receptor	Location	Monitoring Method	Monitoring and Reporting Frequency	Monitoring Responsibility
◻ Ambient Air Quality	At subproject location	Particulate Matters (PM 2.5/10)	During construction and dredging works	Contractor and WMCA Construction Monitoring Committee and reported to LGED Upazila Engineer
◻ Surface Water Quality	Water bodies on the same location where monitoring was done in pre-construction phase	Total Suspended Solids (TSS), turbidty, and Dissolved Oxygen (DO)	During construction and dredging works	Contractor and WMCA Construction Monitoring Committee and reported to LGED Upazila Engineer
◻ Groundwater Quantity	Water sources used for construction on the same location where monitoring was done in pre-construction phase	pH, Fe, toxic organic compounds (NO_3-N)	At least three samples from one location prior to construction	Contractor and WMCA Construction Monitoring Committee and reported on a weekly to LGED Upazila Engineer

Receptor	Location	Monitoring Method	Monitoring and Reporting Frequency	Monitoring Responsibility
□ Dredge spoil	Cultivated land	Visual observations	Daily during dredging works	Contractor and WMCA Construction Monitoring Committee and reported on a weekly to LGED Upazila Engineer
□ Noise Levels	At subproject location	Noise level monitoring, aachineries maintenance	At least once during construction and dredging works	Contractor and WMCA Construction Monitoring Committee and reported on a weekly to LGED Upazila Engineer
□ Solid waste Generation	At subproject location	Visual observations	Weekly during construction and dredging	Contractor and WMCA Construction Monitoring Committee and reported on a weekly to LGED Upazila Engineer
□ Wastewater Generation	At subproject location	Visual observations	Weekly during construction and dredging	Contractor and WMCA Construction Monitoring Committee and reported on a weekly to LGED Upazila Engineer
□ Oil wastes/spills	At construction site	Visual observations	Weekly during construction and dredging	Contractor and WMCA Construction Monitoring Committee and reported on a weekly to LGED Upazila Engineer
□ Soil Erosion	At subproject location	Visual observations	Weekly during construction and dredging	Contractor and WMCA Construction Monitoring Committee and reported on a weekly to LGED Upazila Engineer
□ Socio-Economics	At subproject location	Local people recruited for all manual labour and other job for which local skill are available	During construction and dredging works	Contractor and WMCA Construction Monitoring Committee and reported to LGED Upazila Engineer
□ Land	At subproject location	Restoration and rehabilitation through demolition of concrete structures and disposal of debris, removal of fencing and gates, and backfilling and closing of all on site disposal pits	At the end of the, construction and dredging works	Contractor and WMCA Construction Monitoring Committee and reported to LGED Upazila Engineer
□ Habitat Disturbance	Within the subproject site boundary	Visual Observation	At the end of the, construction and dredging works	Contractor and WMCA Construction Monitoring Committee and reported to LGED Upazila Engineer
□ Compensatory tree plantation	Tree plantation locations	Survival rate of tree saplings	At the end of the, construction and dredging works	Contractor and WMCA Construction Monitoring Committee and reported to LGED Upazila Engineer

C. Operation Phase

Receptor	Location	Monitoring Mechanism	Monitoring and Reporting Frequency	Monitoring Responsibility
☑Water regime	In khals, beels and floodplain within the subproject area	Measuring of water depth, duration of flooding in khal, beels and floodplain	In the monsoon season	WMCA Management committee and reported to LGED Upazila Engineer
☑Water quality	In khals and beels within the subproject area	pH, Eh, DO, NO_3-N, PO_4^{-3}-P, As, $CaCO_3$, TDS and Temperature	In the monsoon season	PMU/IWRM Unit, LGED
☑Sedimentation rate	In water in kahl, beels and cultivated alnd within the subproject area	Visual observation	In the pre-monsoon and monsoon season	WMCA Management committee and reported to LGED Upazila Engineer
☑Fish migration	Within the subproject area	Visual observation, fishermen report by WMCA Fisheries Subcommittee	In the pre-monsoon and monsoon season	WMCA Management committee and reported to LGED Upazila Engineer
☐ Crop growing period: plantation, transplantation, harvest time	On cultivated land within the subproject area	Field observation and report by WMCA Agriculture Subcommittee	In the pre-monsoon, monsoon, post-monsoon and dry season	WMCA Management committee and reported to LGED Upazila Engineer
☐ Encroachment of beel and khal beds	Within the subproject area	Visual observation and report by WMCA O&M Subcommittee	In the pre-monsoon, and dry season	WMCA Management committee and reported to LGED Upazila Engineer
☐ Navigation	In the khals within the subproject area	Visual observation and report by WMCA O&M Subcommittee	In the monsoon season	WMCA Management committee and reported to LGED Upazila Engineer

FGD and Upazila Meeting

Date: 25 and 30 January 2017

Four JICA Sub-project Survey

Summary of Interview

(Local/Community People)

1. Outline of Interview

Project Title			
Date and Time of Interview,	25/01/2017- 11-02pm 30/01/2017- 11-30m-2.30pm	Venue Jurail Bazar & Upazila Complex, Kendua, Netrokona	,
Name of District & Upazila	Kendua, Netrokona.		
Interviewer			
Interviewee(s)	স্থানীয় জনগণ বলেন,শুষ্ক মৌসুমে ভূগর্ভস্থ পানির স্তর অনেক নীচে নেমে যায় টিউবয়েল গুলিতে পানি থাকেনা, ৩০/৪০ ফুট মাটির নীচে জল মটর স্থাপন করে সেচের পানি সরবরাহ করা হয়। বামন খালী খাল ও সুলাইলা খালী খাল খননের মাধ্যমে গভীরতা বৃদ্ধি পাওয়ার ফলে পানি ধরে রেখে শুষ্ক মৌসুমে বোরো ধানে সেচ প্রদান। বামন খালী খালের মুখে নৌ চলাচলের সুবিদা রেখে স্লুইচ গেইট নির্মানের ফলে, নৌ চলাচলের সুবিধাসহ প্রায় ৪৩২ হেঃ জমির পাকা বোরো ধান আগাম বন্যার হাত থেকে রক্ষা পাবে। *** উপজেলা কৃষি ও মৎস কর্মকর্তা এবং স্থানীয় চেয়ারম্যান সাহেব বলেন যে, উপ-প্রকল্পটি বাস্তবায়িত হওয়া ঐ এলাকার কৃষকদের জন্য অত্যান্ত জরুরী। কারণ উক্ত এলাকায় শুষ্ক মৌসুমে সেচের ব্যাপক অভাব দেখা দেয় এবং বোরো ধান আগাম বন্যার ঝুকিতে থাকে। কাজেই উপ-প্রকল্পটি বাস্তবায়িত হলে ঐ এলাকায় কৃষি ক্ষেত্রে অভূতপুর্ব উন্নতি সাধিত হবে। উপজেলা কৃষি ও মৎস কর্মকর্তা আলাদা ভাবে মতামত পেশ করেন। যা সংযুক্ত করা হল।		
Form of Consultation	Focus Group Discussion (FGD)		

2. Environmental and Social Impacts of the Project (Negative and Positive)

(1) Perception of local people on environmental and social impacts of the project

Environmental:

(a) Drainage Congestion: বামন খালী খাল ও সুলাইলা খালী খাল ভরাট হওয়ার ফলে বর্তমানে বগাজান বিলের পানি নিষ্কাশনে সমস্যা দেখা দেয়, উপ-প্রকল্পটি বাস্তবায়িত হলে, জলাবদ্ধতা দুরিভূত হবে, কাজেই **Drainage Congestion** সামাজি কোন প্রভাব পড়বে না।

(b) Regional Hydrology/Flooding: বর্তমানে বৃষ্টির পানি সাইদুলি নদী থেকে পাটকুড়া নদী দিয়ে বামন খালী খালে প্রবেশ করে উপ-প্রকল্প এলাকায় ফসলের ক্ষতি করে। সুতরাং উপ-প্রকল্পটি বাস্তবায়িত হলে আঞ্চলিক বন্যার ক্ষেত্রে সামাজি কোন প্রভাব পড়বে না।

(c) Water Pollution: উপ-প্রকল্পটি বাস্তবায়িত হওয়ার ফলে পানি দূষিত হবেনা, বিধায় পানি দূষনের ক্ষেত্রে সামাজি কোন প্রভাব পড়বে না।

(d) Fishery: বামন খালী ও সুলাইলা খালী খাল খনন করে গভীরতা বৃদ্ধি করে পানি ধরে রেখে চাষের মাধ্যমে মাছের উৎপাদন বারানো সম্ভব। কাজেই মৎস চাষের ক্ষেত্রে সামাজিক ভাবে কোন প্রভাব পড়বেনা।

(e) Soil Erosion and Siltation: The sub-project will no impact on Soil Erosion and Siltation

(f) Landscape and Aesthetic:

(g) Road Safety: The sub-project will no impact on Road Safety

(h) Air Pollution: The sub-project will no impact Air Pollution.

(i) Land Acquisition and Resettlement: Implementation of the subproject will not involve land acquisition. If required, local stakeholders are willing to donate lands. so the sub-project will no impact Land Acquisition and Resettlement.

Social:

(a) Employment Opportunity: Employment scope will increase in agriculture, fishery, duck farming, and various IGAs in post subproject condition. Hence, impact is assessed positive.

(b) **Protection of Religious/Cultural Sites: The sub-project will no impact on Protection of Religious.**

(c) **Gender Issue/Development: The sub-project will no impact on Gender Issue.**

Agricultural Land Loss:

(2) Concerns and complaints in relation to environmental and social

Attendance Sheet: Focus Group Discussion

কেন্দুয়া উপজেলাধীন বামনখালী খাল উপ-প্রকল্পের Focus Group Discussion (FGD) এর উপস্থিতি - তালিকা।

স্থান:- দুগাইল, ইউনিয়ন-(মোজাফরপুর) বেকগাঁও। তাং-২৫/০১/১৭

১।	মো: আজহারুল ইসলাম		[illegible]
২।	মো: সাইদুল ইসলাম -		সাইদুল
৩।	মো: মাসুদ মিয়া -		মো: মাসুদ মিয়া
৪।	মো: রুকন মিয়া -		রোকন
৫।	ফারুক আহম্মদ -		ফারুক আহম্মদ
৬।	জোবায়ের আহমেদ -		[illegible]
৭।	মো: রতন মিয়া -		- রতন
৮।	মো: চিটন মিয়া -		- চিটন
৯।	মো: জুজু মিয়া -		জুজু
১০।	মো: সুজন মিয়া -		সুজন
১১।	মো: লিটন মিয়া -		লিটন মিয়া
১২।	মো: নয়ন মিয়া -		মো: নয়ন মিয়া
১৩।	মোহাম্মদ আলী -		মোহাম্মদ আলী
১৪।	মো: সফিকুল ইসলাম		সফিকুল
১৫।	মো: হাবলুর রহমান -		হাবলুর রহমান
১৬।	আবু ছালেক	- সাবেক মেম্বার -	আবু সালেক
১৭।	নরেন্দ্র চন্দ্র দাস -		নরেন্দ্র চন্দ্র দাস
১৮।	সুমন চন্দ্র দাস -		সুমন চন্দ্র দাস
১৯।	মো: দুলাল মিয়া -		[illegible]
২০।	মো: আব্দুল আজিজ		[illegible]
২১।	মো: বকুল মিয়া -		মো: বকুল মিয়া
২২।	মো: ইউনুছ সরদার -	বীর মুক্তি যোদ্ধা -	[illegible]
২৩।	মো: রেজুয়ান -	ঐ	[illegible]
২৪।	মো: নূরুল আমীন	ঐ	[illegible]
২৫।	মো: আমির উদ্দিন ভূঞা -	ঐ	[illegible]
২৬।	মোজাম্মেল হক খান চৌধুরী -	ঐ (সভাপতি)	[illegible]
২৭।	[illegible] -	কৃষক	[illegible]

Attendance Sheet: Upazila Meeting

নেত্রকোনা জেলার কেন্দুয়া উপজেলাধীন হাওর অঞ্চল [illegible] উপ-প্রকল্পের
FGD ও [illegible] অধিবেশন।

স্থান:- উপজেলা পরিষদ, কেন্দুয়া। তাং- ৩০/০৩/১৭

ক্রমিক নং-	নাম:	পদবী ও ঠিকানা	স্বাক্ষর
১.	মোঃ আল আমিন সরকার	উপজেলা প্রকৌশলী, কেন্দুয়া নেত্রকোনা	[signature] 30/3/17
২.	হাসান ইমাম	উপজেলা কৃষি কর্মকর্তা কেন্দুয়া, নেত্রকোনা	[signature] ৩০/৩/১৭
৩.	মোহাম্মদ শফিকুল ইসলাম	চেয়ারম্যান ৯নং [illegible] ইউপি	[signature] ৩০/০৩/১৭
৪.	মোঃ আবু [illegible]	[illegible] কেন্দুয়া প্রেসক্লাব	[signature] ৩০/৩/১৭
৫.	মোঃ সেলিম মিয়া	[illegible]	[signature]
৬.	মুহাম্মদ [illegible]	সিনিয়র [illegible]	[signature] ৩০/০৩/২০১৭
৭.			
৮.			
৯.			
১০.			

Feedbacks

নেত্রকোনা জেলার কেন্দুয়া উপজেলাধীন বামনখালী খাল উপ-প্রকল্প,

① রোয়াইলবাড়ী ইউনিয়ন, কেন্দুয়া, নেত্রকোনার কুতুবপুর, বেখাও, কুমারহাটা বেখাও গ্রামে অবস্থিত বামনখালি খালে খনন এবং রেগুলেটর নির্মাণ করা হলে সংশ্লিষ্ট গ্রাম সমূহের প্রায় ৪০০ হেক্টর আবাদী জমিতে সেচ সুবিধা এবং নিষ্কাশন ব্যবস্থা সুবিধা হবে। সুতরাং সেচের সুবিধার মাধ্যমে বোরো ফসলের উৎপাদন বৃদ্ধি পাবে বলে আশা করছি।

৩০/০১/২০১৭
(হাসান ইমাম)
উপজেলা কৃষি অফিসার
কেন্দুয়া, নেত্রকোনা

② বামনখালী খাল নওপাড়া ইউনিয়ন পরিষদের মধ্যে আবাদী জমি সেচ সুবিধা সহ নিষ্কাশন করার জন্য বা পানি ধারণ করার সুবিধা পাবে। বিষয়টি খুবই গুরুত্বপূর্ণ।

৩০/১/১৭
মোহাম্মদ সাফিকুল ইসলাম
চেয়ারম্যান
ইউনিয়ন পরিষদ
কেন্দুয়া, নেত্রকোনা।

③ বামনখালী খাল পুনঃখনন করলে এলাকায় সংস্কার হবে এবং জলাবদ্ধতা দূর হবে। ইহাতে সামগ্রিক আর্থসামাজিক উন্নয়ন হবে এবং ফসলের উৎপাদন বৃদ্ধি পাবে। অন্যদিকে Regulator সহ অন্যান্য অবকাঠামো নির্মাণ হলে [illegible] চলাচলের [illegible] [illegible] প্রাকৃতিক [illegible] বিবেচনা রাখতে হবে।

৩০/০১/১৭
[illegible]
কেন্দুয়া, নেত্রকোনা।