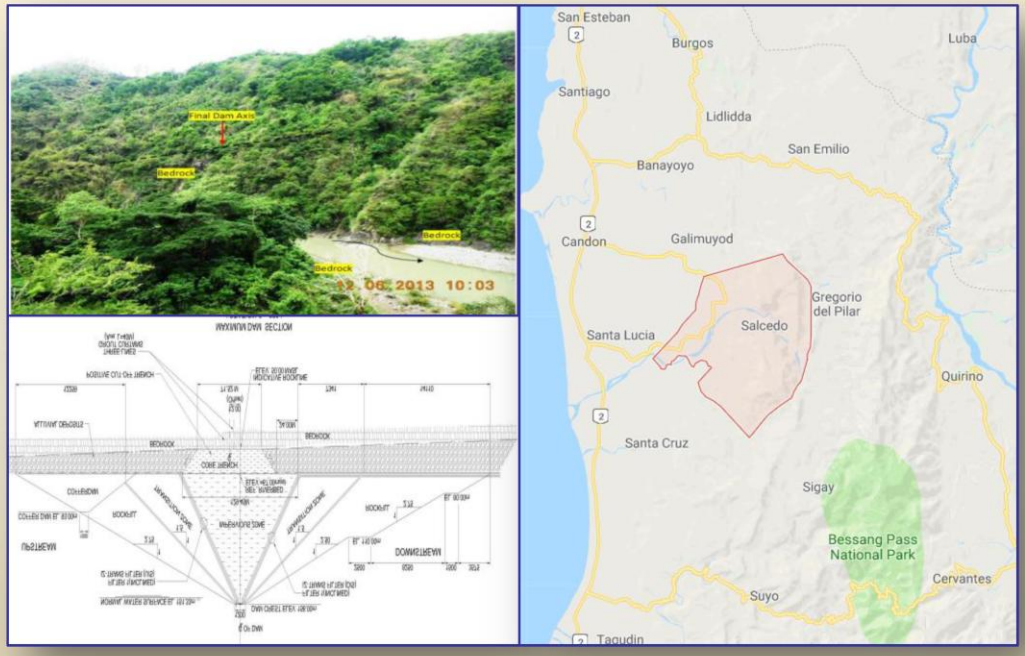
GREGORIO DEL PILAR IMPOUNDING PROJECT

Salcedo, Ilocos Sur



PROJECT DESCRIPTION

Lichel Technologies, Inc.

1403 Prestige Tower Condominium,
F. Ortigas Jr. Rd., Ortigas Center,Pasig City

National Irrigation Administration
NIA - Region I
Bayaoas, Urdaneta City, Pangasinan

March 2018

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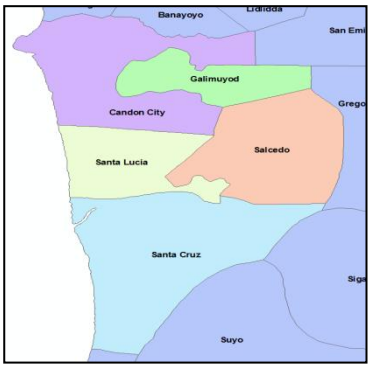
1 BASIC PROJECT INFORMATION

Name of Project:	**Gregorio del Pilar Impounding Project**
Project Location:	Candon City, Municipalities of Salcedo, Galimuyod, Gregorio del Pilar, Sta Lucia, and Sta Cruz, Province of Ilocos Sur.



Project Proponent:	**NATIONAL IRRIGATION ADMINISTRATION I**
Proponent's Address	National Irrigation Administration (NIA) Region I – Bayaoas, Urdaneta City
Contact Person:	**Vicente R. Vicmundo, Ph.D.**
Position/ Designation:	Regional Manager A
Contact No:	(075) 632 2776
Name of Consultant:	**LICHEL TECHNOLOGIES INC.**
Consultant's Address:	Unit 1403 Prestige Tower Condominium, F. Ortigas Jr. Road, Ortigas Center, Pasig City
Contact Person:	**Rachel A. Vasquez**
Position/ Designation:	Managing Director
Contact No:	02-633-00-94
E-mail Address	ravasquez@licheltechnologies.com
Estimated Project Cost	**Php 3,451,313,000.00**

Project Components	Project Description Summary	
1. Agriculture and Irrigation	Include Canals, Dams and Appurtenant Structures	
Service Area	New Service Area	1,800 ha
	Existing Communal Irrigation System	1,777 ha
	Sta Lucia-Candon Irrigation System	1,423 ha
	Total Service Area	**5,000 ha**
Dam	**Location:** 17° 08' 23"N 120° 34' 02"E **Type**: Zoned type of rock and earthfill dam **Height from River Bed**: 89 m **Normal Storage Capacity:** 86.54 MCM **Normal Reservoir Area**: 245.44 ha	
Spillway	**Length**: 175m **Width**: 80m	
Canals	Diversion Canal	1.5 km
	Main Canal	11.4 km
	Lateral	45.61 km
2. Flood Control	The project will minimize flooding in the areas where Buaya River passes through as it reduces peak flows during the occurrence of typhoons	
3. Water Supply	Domestic water supply for the Candon City Water District at 0.046 m^3/s	
4. Rockfill Quarry	6 possible quarry sites identified	
5. Service Roads	3.9 km of new roads; rehabilitation of existing roads	
6. Fishery	Fishery component consists of the construction and production of fixed floating cages in at least 22 hectares within the reservoir area	

2 PROJECT DESCRIPTION

2.1 Project Location and Area

2.1.1 Project Location

The Gregorio del Pilar Impounding Project is located in the Province of Ilocos Sur. The proposed dam is located across Buaya River in the Municipality of Salcedo while the reservoir area includes the Municipality of Gregorio del Pilar. The service area covers around 5,000 hectares in the Municipalities of Salcedo, Galimuyod, Sta Lucia, and Sta Cruz and the City of Candon all in the Province of Ilocos Sur of which 3,200 ha are covered by existing communal irrigation system and the Sta. Lucia-Candon Irrigation System while the remaining 1,800 ha are new service areas.

The Municipality of Salcedo is a 4th class municipality located in the mid-southern part of Ilocos Sur. The Municipality of Salcedo is bounded in the northwest by the Municipality of Galimuyod, on the northeast and east by General Gregorio del Pilar, on the southeast by Sigay, on the southwest by Santa Cruz, and on the west by Sta. Lucia and Candon City.

The proposed dam is located across Buaya River. The river originates from the hinterlands of the Municipalities of Gregorio del Pilar, San Emilio, Quirino, and Sigay and flows in a west-northwest and west-southwest direction. It flows through the Municipalities of Salcedo, Santa Lucia and Santa Cruz and drains to the West Philippine Sea. The river length at dam site is approximately 23.92 km with the highest elevation at 1,436 m above mean sea level.

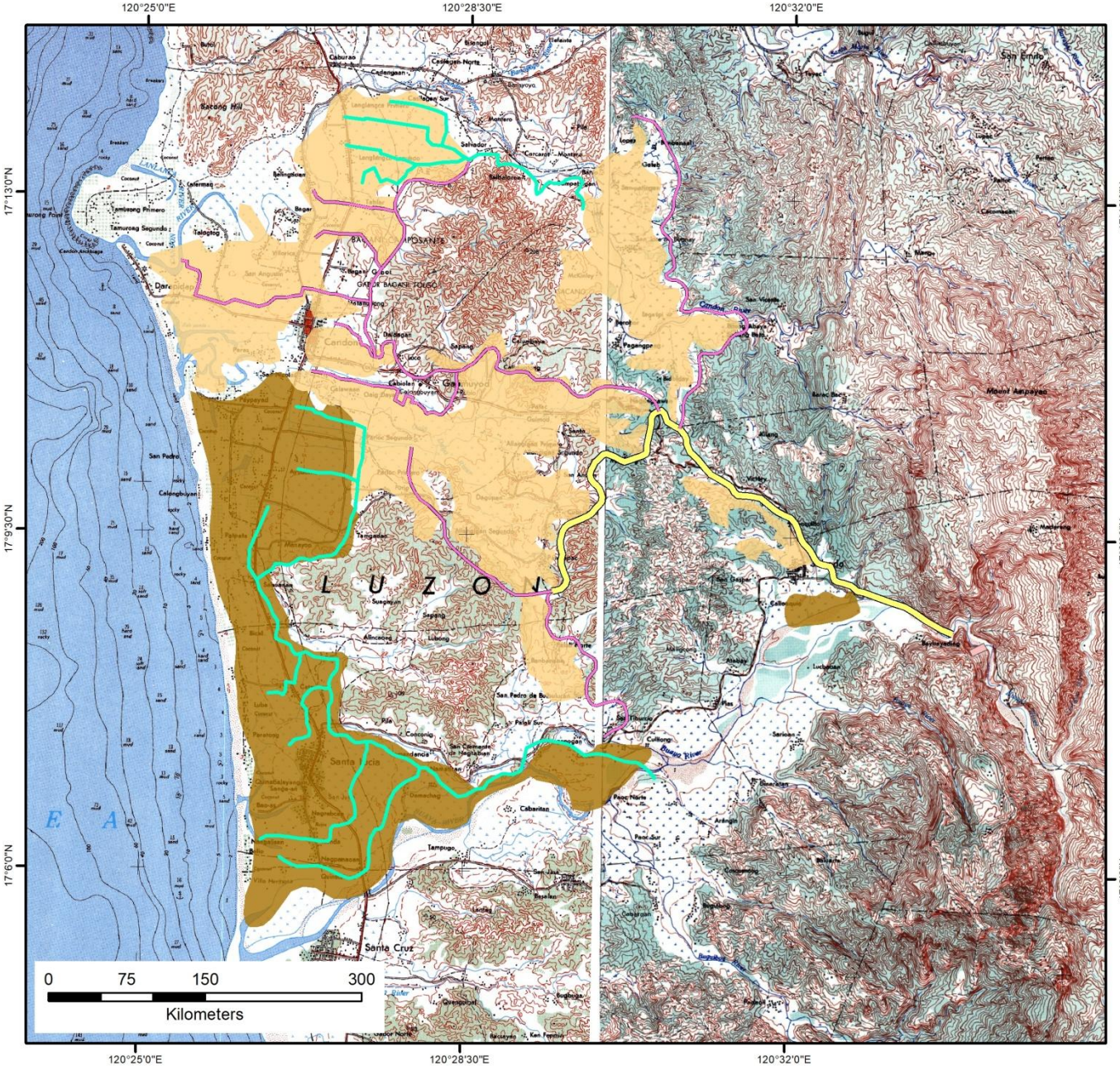
The proposed dam is located in the Municipality of Salcedo with coordinates 17° 08’ 23”N 120° 34’ 02”E. The Project location and layout is shown in **Figure 2-1**.

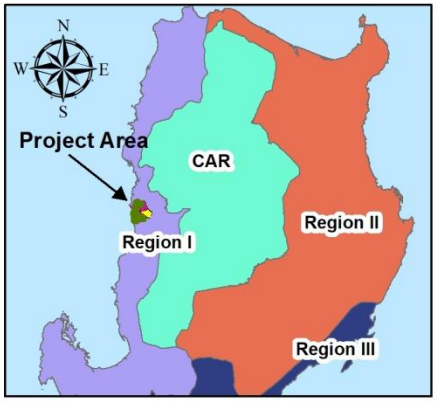
2.1.2 Accessibility of Project Site

The proposed dam site is about 3.2 kilometers upstream of the town proper of Salcedo. The Municipality of Salcedo can be reached through an 8-hour drive from Manila through first class road to Candon City, 45-minute ride on a concrete-paved rolling and winding provincial road till the onset of the rugged topography at the proposed dam site where Buaya river opens up westward into the flood plains of the Municipality of Sta Lucia and City of Candon. Public transport from the City of Candon to the Project site is readily available.

2.1.3 Direct and Indirect Impact Areas

Annex 3 of DENR Memorandum Circular 2010-14 provided the guidelines in the identification of Direct and Indirect Impact Areas (DIA and IIA). The DIA include areas where all project facilities are proposed to be constructed /situated and where all operations are proposed to be undertaken. This may also include mixing or buffer zone areas delimited by the point or isopleths where ambient standards/guidelines are met. The IIA, on the other hand, may be the area from the outer boundary of the mixing or buffer zone to the point or area where the baseline environmental quality is calculated or monitored to be met. The socio-cultural IIA shall be based on the area of influence of the biophysical IIA. Further, DAO 2017-05 provided guidelines on defining DIA for the impact on land, water, air and people.





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Legend

- Proposed High Line Canal
- Proposed Lateral Canal
- Existing Irrigation System
- Proposed Service Area
- Existing Service Area
- Proposed Dam

Source: NAMRIA;
National Irrigation Authority

Coordinate System: WGS 1984 UTM Zone 51N
Projection: Transverse Mercator
Datum: WGS 1984

Author: Lichel Technologies, Inc.

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FIGURE TITLE :

Location Map of the Project

FIGURE NO.:

2-1

Based on these guidelines, the direct and indirect impact areas were delineated. For impacts on land, this includes areas that may be inundated and may experience habitat disturbance (reservoir area). For water, this includes portions of water bodies that traverses the project (dam and high canals) and may be affected during construction. This includes the reservoir area and rivers that the canals will traverse (Buaya River, Candon River, Oaig-Daya River). For the people component, identified DIA are the barangays where the facilities are located and the settlements near/within the proposed facilities which may necessitate involuntary relocation and settlements that might experience competition in resource use with the project including the service areas. Considered as IIA in the assessment are the remainder of municipalities where the DIA barangays are located since the impacts (positive and negative) will have a corresponding effect on these municipalities.

2.2 Project Rationale

The project is expected to deliver the following benefits as a result of its implementation:

- Raise average annual farm income per household in the Project area from Php 18, 207 to 54,290 at 2013 prices by 2023.
- Increase annual irrigated rice area from 3,360 hectares to 5,000 ha.
- Raise the annual production of rice in the Project area from 20,385 tons without project to 52,500 t by 2023.
- Promote the production of fish using cage nets in about 22 hectares of the reservoir area, producing as much as 2,279 tons annually.
- The project will minimize flooding in the areas where Buaya River passes through as it reduces peak flows during the occurrence of typhoons.
- The project will also provide initial structures to allow a private proponent to put up power plant downstream of the dam to generate electricity from releases for irrigation.
- The project is also expected to provide domestic water supply for the Candon City Water District at 0.046 m^3/s.

2.3 Project Alternatives

2.3.1 Siting

Three possible sites were considered for the location of the dam. The main consideration used in determining the location of the proposed dam is the embankment volume at each site. Significant considerations also include topology, pedology, geology, reservoir size, surrounding structures and cost. The two sites considered are located upstream of the proposed dam site and would have yielded a higher reservoir size since it captures the flow from another tributary at the right of the Buaya River. However, due to the uneconomical embankment volume as a shown in the geotechnical investigation, the proposed site was adopted over the other two sites.

Main and lateral canals are usually laid along contours traversing hillsides or foot of the mountains, which in turn may cause artificial damming effect on most gullies. Thus, drainage crossings are strictly identified to be located on such areas.

2.3.2 Development Design

The main dam is proposed to be made of zoned earth-rock fill embankments for two reasons as follows:

i. Proximity of the site to the Abra Fault and Asin Fault as earthquake generators. Earthfill will be more flexible than concrete gravity dam;

ii. The dam will be of considerable height and cost for concrete is prohibitive; and,

iii. The cost of the earthfill dam is higher than the zoned rock-earthfill dam. (The estimated cost of the main dam and appurtenant structures for the zone earth-rockfill was P4.44 billion while that of the earthfill was P4.86 billion. The preliminary design considered slope stability analysis.)

2.3.3 Resource

Alternative Sources of Water

The main source of water in the project area is the Buaya River. The river provides the water needs for the Candon City Water District, the irrigation needs of the Sta Lucia-Candon Irrigation System and the other communal irrigation system in the area. During the construction phase of the project, this will also be the main water source for the project. Smaller tributaries and creeks such as Bato Creek and Ronquillo Creek may also be tapped to augment the water needs of the project during construction. Alternative sources of water such as deep wells and spring sources are also available in the project site and may also tapped for the project's water needs.

Alternative Sources of Power

The Ilocos Sur Electric Cooperative (ISECO) Inc. is the distribution utility that serves the Province of Ilocos Sur with franchise area covering 32 municipalities and 2 cities in the Province. ISECO maintains a 10 MVA substation located in Ayudante, Candon City to cater the power demands of consumers in the Municipalities of Galimuyod, Salcedo, Sta. Lucia, Sta. Cruz, Tagudin and Alilem and Candon City. During the construction phase, generator sets can be used to augment the power requirements of the project.

Alternative Sources of Rockfill materials

There are six (6) identified potential quarry site which will serve as source of clay and can also generate materials for the transition zone (random fill) within the saprolite/moderately weathered horizon after the removal of the low to medium plasticity clay at the upper soil horizon thence the rockfill material at depth.

2.3.4 No Project Option

Without the project, potential irrigable areas will not be realized and will lead to the under utilization of agricultural lands. In addition, potential benefits from fish propagation will also not be realized. The supply of reliable domestic water supply to the Candon City Water District may also be affected if the Project is not implemented.

The geodynamic processes within the Buaya River watershed such as erosion, mass movements and sedimentation will persist and will be accelerated during storm events. Without the dam, floods generated by major rain events or storms will not be stored for detention and will immediately and directly affect the main channel and immediate banks of Buaya River and will travel down gradient to the flood plain of Sta. Lucia and Sta. Cruz. The extent of flooding will depend on the duration and intensity of rainfall.

In the absence of proper management as proposed in the project, the Buaya River watershed will continue to degrade and lose its primary function of providing reliable water to the downstream areas and preventing regular occurrence of flooding and maintaining biodiversity. Under a status quo scenario, the service areas under the existing systems of NIA will continue to be irrigated and could potentially decline as the distribution network deteriorates and the available water is reduced over time. Agricultural production will remain the same or even decline with time. The potential agricultural productivity of the current and target service areas will not be attained.

2.4 Project Components

The Project is divided into several components. A summary of the project details is shown in **Table 2-1.** The development plan for the Project is shown in **Error! Reference source not found.** while the direct and indirect impact areas are shown in **.**

Table 2-1: Summary of Project Components

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2.4.1 Agriculture and Irrigation

2.4.1.1 Dams and Reservoir

The main dam is proposed to be made of zoned earth-rock fill embankments for two reasons as follows:

i. Proximity of the site to the Abra Fault and Asin Fault as earthquake generators. Earthfill will be more flexible than concrete gravity dam;
ii. The dam will be of considerable height and cost for concrete is prohibitive and
iii. The cost of the earthfill dam is higher than the zoned rock-earthfill dam. (Preliminary designs and cost estimates for both zoned earth-rockfill and earthfill dam embankments at the first dam location were made. The estimated cost of the main dam and appurtenant structures for the zone earth-rockfill was P4.44 billion while that of the earthfill was P4.86 billion. The preliminary design considered slope stability analysis.)

Figure 2-2 shows the main dam site development plan while **Figure 2-3** shows the reservoir map. Absence of high plasticity soils within the immediate vicinity of the dam for clay core was noted but presence of low to medium plasticity soils and abundance of rockfill and filters were observed. The laboratory results on plasticity confirmed the presence of low to medium plasticity soils that can be used in the dam construction and where the thickness and widths of the impervious core is to be made larger than usual, which has been addressed by making the dam base width equal to 1.5 times the height of the dam.

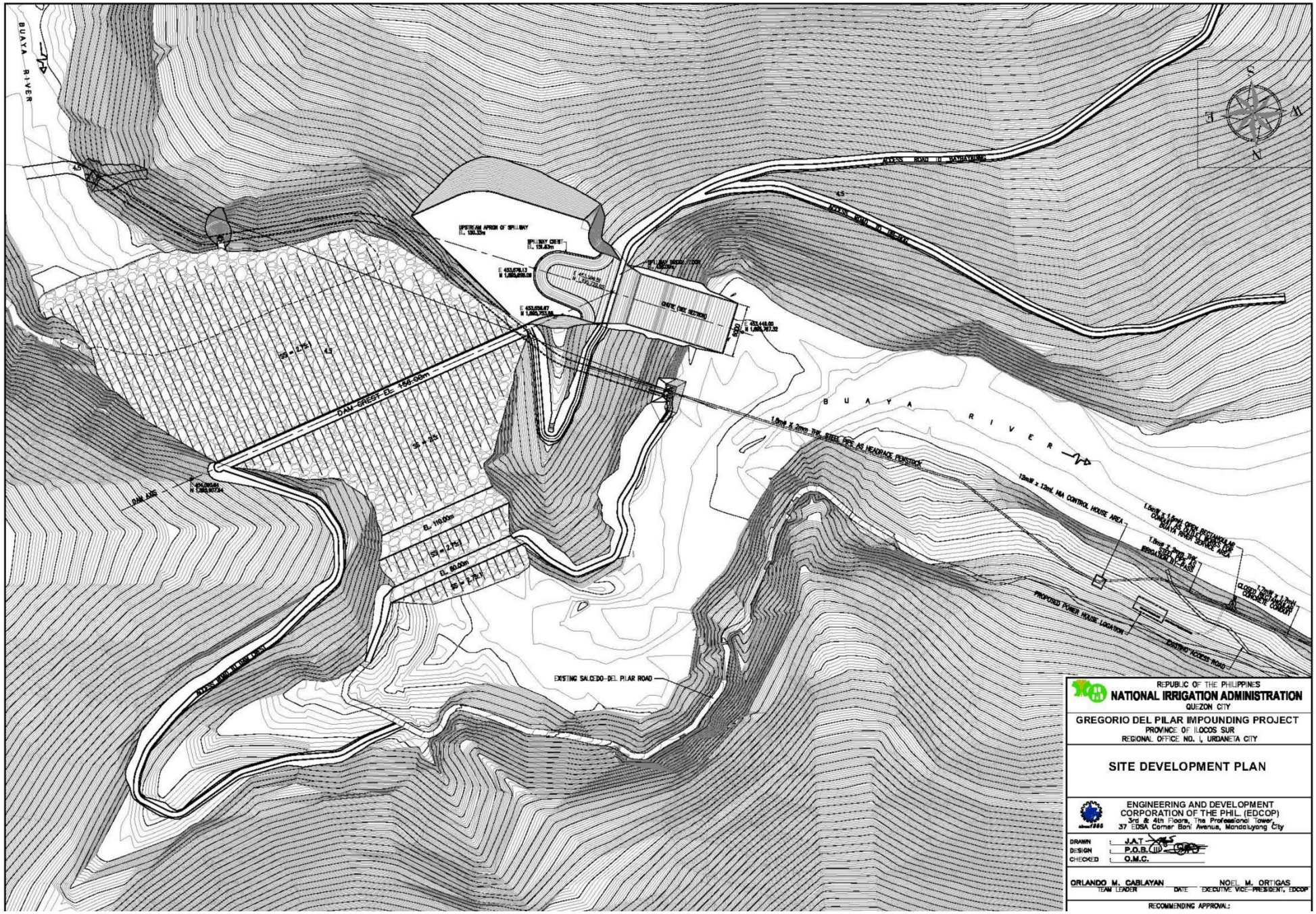

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FIGURE TITLE :

Dam Site Development Map

FIGURE NO.:

2-4

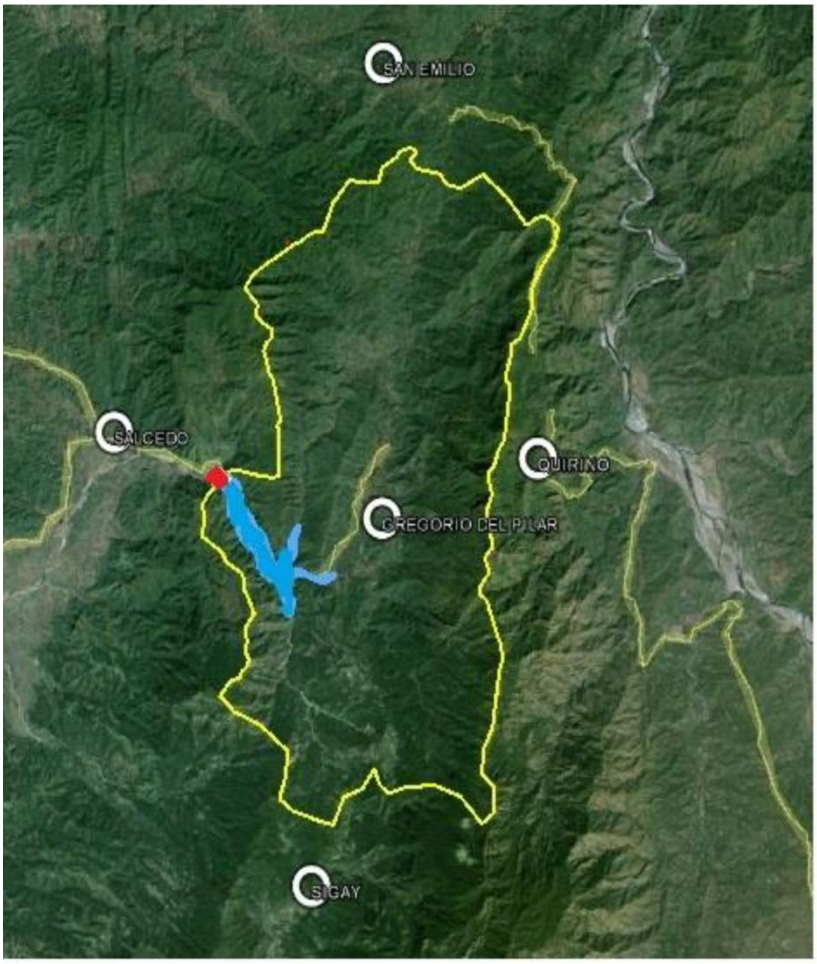
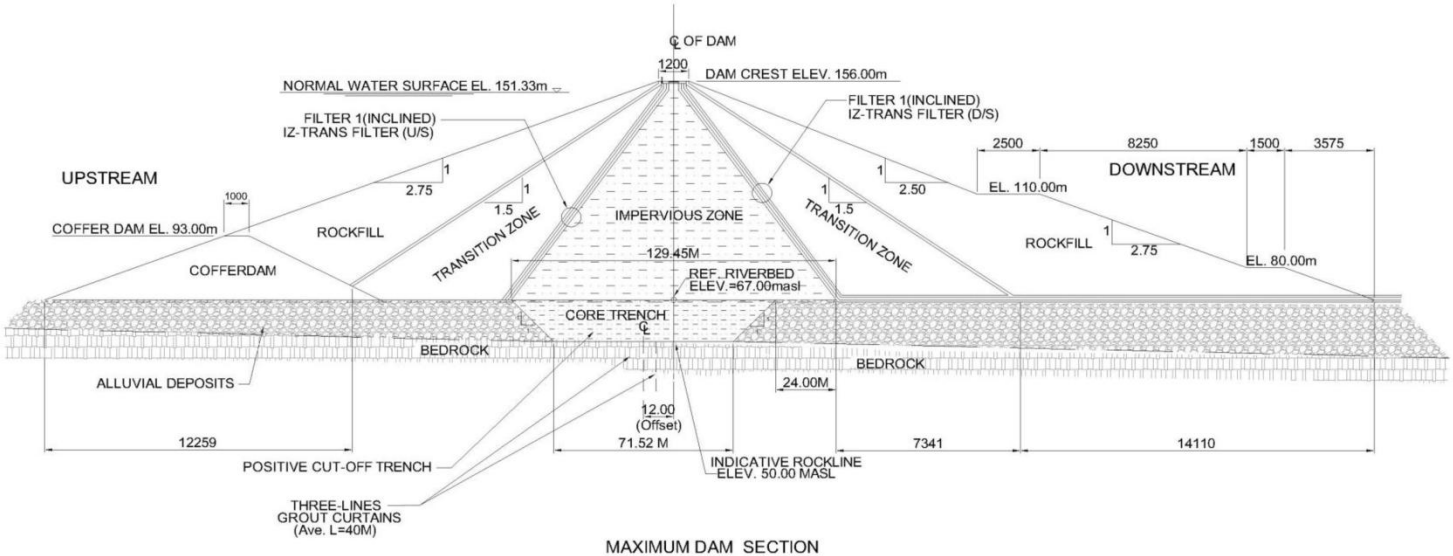


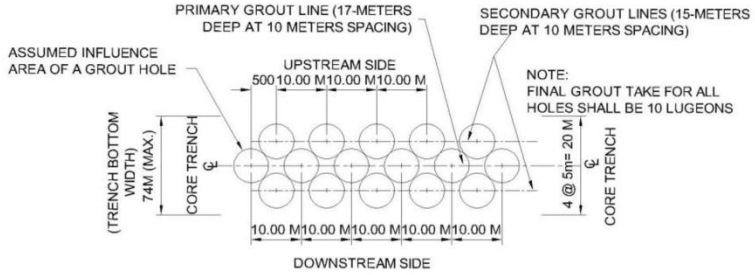
Figure 2-3: Reservoir Map

The impervious core of the dam will be extended up to the dam crest. It will be composed of clay materials with surface gradient of 0.74:1 (horizontal: vertical) for both upstream and downstream dam face up to the normal water surface elevation (**Figure 2-4**), after which the width of the core shall be maintained vertically up to the dam crest. The core will be cladded with a 3.0-meter thick filter of sand and gravel to prevent transport of fine materials into or out of this zone. The core will also be overlaid with a pervious inner shell of transition fill materials with surface gradient of 1.5:1 at both faces. At the upstream face of the embankment, a rockfill shall be provided with slope of 2.75:1 (H:V). At the downstream face of the embankment, rockfill with slope of 2.5:1 shall be provided additional counterweight: the upper berm at elevation 110.0 meters with 25.0 meters width; and the lower berm at elevation 90.0 meters and 15.0 meter width. The rockfill will offer a stronger resistance against sliding and protection against erosion. It shall also serve as an efficient energy dissipator for wave action and or water currents that may tend to scour portions of the embankment works. The counterweights are the most economical means to render the dam section safe against earthquake acceleration reaching up to 0.25g horizontal component and 0.20g vertical.

A combination of chimney drains and horizontal drainage blanket with rock toe shall be employed to intercept the line of seepage and convey it properly across the dam section so as to discharge it without causing piping or undermining of the structure. The chimney drains and horizontal drainage blanket shall be composed of a 2.2 meter thick three-layered filter. The outer layers of the filter will be 60-centimeter thick fine aggregate materials and the inner layer shall be 100-centimeter thick coarse aggregate materials.



MAXIMUM DAM SECTION
(STATION 0 + 220)



DAM FOUNDATION GROUT CURTAIN
HOLES TYPICAL LAYOUT PLAN

REPUBLIC OF THE PHILIPPINES
NATIONAL IRRIGATION ADMINISTRATION
QUEZON CITY

GREGORIO DEL PILAR IMPOUNDING PROJECT
PROVINCE OF ILOCOS SUR
REGIONAL OFFICE NO. I, URDANETA CITY

MAXIMUM DAM SECTION @ STATION 0+220 & DAM FOUNDATION GROUT CURTAIN HOLES TYPICAL LAYOUT PLAN

ENGINEERING AND DEVELOPMENT CORPORATION OF THE PHIL. (EDCOP)
3rd & 4th Floors, The Professional Tower,
37 EDSA Corner Boni Avenue, Mandaluyong City

DRAWN : J.A.T
DESIGN : E.A.C.
CHECKED : O.M.C.

ORLANDO M. CABLAYAN — TEAM LEADER — DATE
NOEL M. ORTIGAS — EXECUTIVE VICE-PRESIDENT, EDCOP

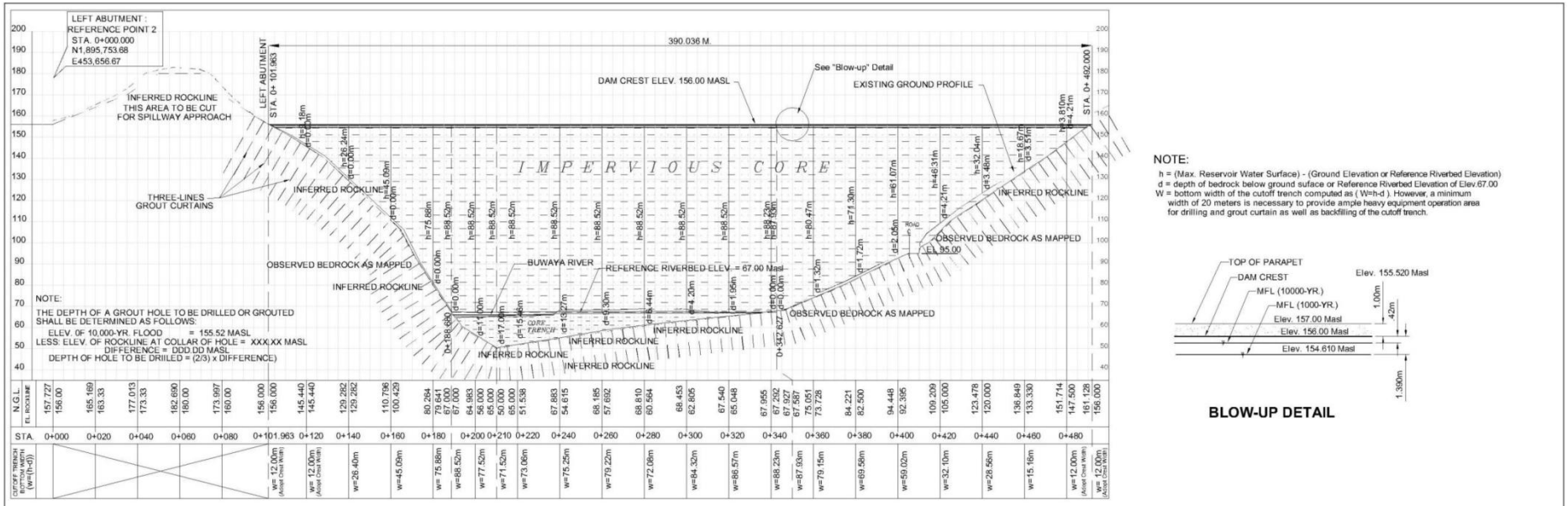
RECOMMENDING APPROVAL:

REGIONAL MANAGER — DATE — MANAGER, ENG'G. DEPT.

APPROVED

ERDOLFO B. DOMINGO
ACTING DEPUTY ADMINISTRATOR FOR ENGINEERING & OPERATIONS — DATE

GDPIP | DWG. NO. GDPIP --- | SHEET NO. ____ OF ____

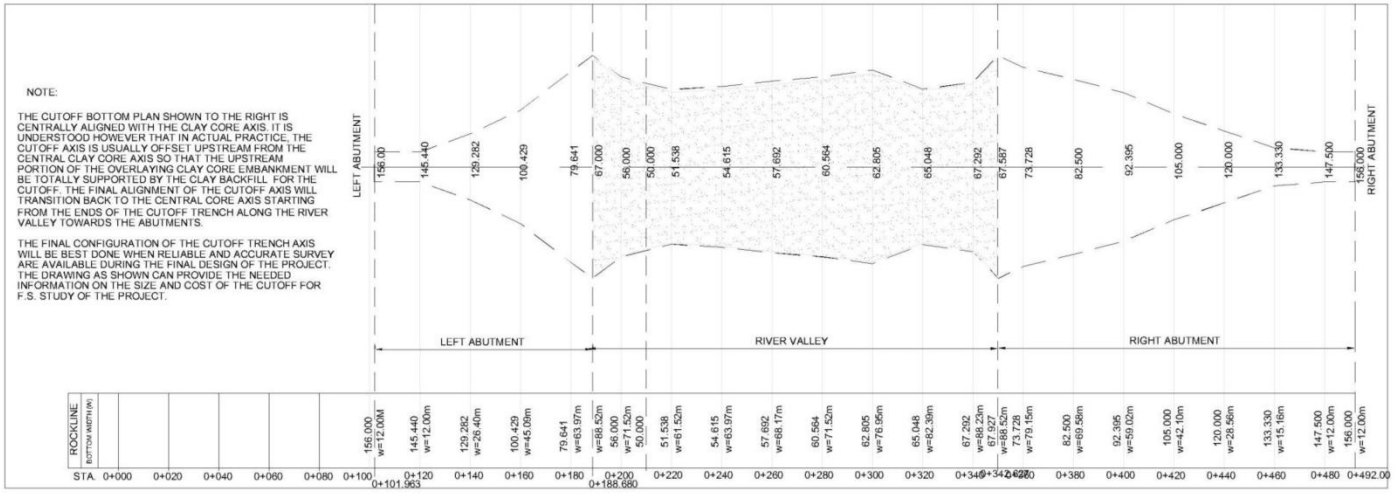


NOTE:

h = (Max. Reservoir Water Surface) - (Ground Elevation or Reference Riverbed Elevation)
d = depth of bedrock below ground suface or Reference Riverbed Elevation of Elev.67.00
W = bottom width of the cutoff trench computed as (W=h-d). However, a minimum width of 20 meters is necessary to provide ample heavy equipment operation area for drilling and grout curtain as well as backfilling of the cutoff trench.

BLOW-UP DETAIL

DAM SECTION ALONG DAM AXIS
(SHOWING GEOLOGIC PROFILE AND PROPOSED FOUNDATION GROUTING WORKS)



GENERIC PLOT OF THE CORE TRENCH BOTTOM FOOTPRINT
(SHOWING THE FIRM BEDROCK ELEVATION ALONG THE DAM AXIS)

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QUEZON CITY

GREGORIO DEL PILAR IMPOUNDING PROJECT
PROVINCE OF ILOCOS SUR
REGIONAL OFFICE NO. I, URDANETA CITY

DAM SECTION ALONG DAM AXIS & GENERIC PLOT OF THE CORE TRENCH BOTTOM FOOTPRINT

ENGINEERING AND DEVELOPMENT CORPORATION OF THE PHIL. (EDCOP)
3rd & 4th Floors, The Professional Tower, 37 EDSA Corner Boni Avenue, Mandaluyong City

DRAWN : J.A.T.
DESIGN : E.A.C.
CHECKED : O.M.C.

ORLANDO M. CABLAYAN, TEAM LEADER, DATE
NOEL M. ORTIGAS, EXECUTIVE VICE-PRESIDENT, EDCOP

RECOMMENDING APPROVAL:
REGIONAL MANAGER, DATE, MANAGER, ENG'G. DEPT.

APPROVED
ERDOLFO B. DOMINGO
ACTING DEPUTY ADMINISTRATOR FOR ENGINEERING & OPERATIONS
DATE

GDPIP | DWG. NO. GDPIP --- | SHEET NO. ____ OF ____

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FIGURE TITLE :

Dam Section along Dam Axis

FIGURE NO.:

2-7

2.4.1.2 Spillway

The spillway is configured for an ungated operation. The spillway ogee weir crest length as designed is 175 meters long and shall be laid on "Omega" shaped alignment. Its trough shall be about 83 meters long and 80 meters wide at the outlet (**Figure 2-6***).* The trough shall be about 9 meters deep. The maximum inflow flood used in determining the dimensions of the spillway was the 1,000 year flood – 3,306.74 m^3/sec. This was checked against the 10,000 year flood. The maximum outflow rate for the 10,000 was computed at 4,085.4 m^3/sec. The additional flood surcharge would be 0.91 meter above the 1000-year flood surcharge, giving a total flood surcharge of 4.19 meters, lower than the total freeboard.

The spillway ogee weir facing of half meter thickness shall be directly seated on hard rock at the left abutment of the embankment so that there shall be no need to use rubble masonry for the main body of the spillway weir. However, the facing will be provided with steel anchorage into the underlying bedrock foundation to withstand negative pressures which tend to peel off the facing during excessive and turbulent flows over the crest. Also, contact or consolidation grouting will be undertaken for the weir facing.

2.4.1.3 Diversion Conduit and Cofferdam

Diversion Conduit. The flood routing computations using a 10-year return flood, showed that one row of 8.0-meter diameter circular conduit is needed to divert said flood in combination with a 26-meter high cofferdam. A single row conduit was chosen to lower the cost, compared to 2 rows of 6-meter diameter conduits. The conduit shall have a slope of 0.013 meter drop for every 500 meters horizontal run. Its outlet invert elevation shall be the same as the river bed elevation at such same point. The conduit shall be composed of an 80-cm thick reinforced concrete tunneled through hard rock and installed with bulkhead gate to facilitate subsequent plugging (Figure 2-7).

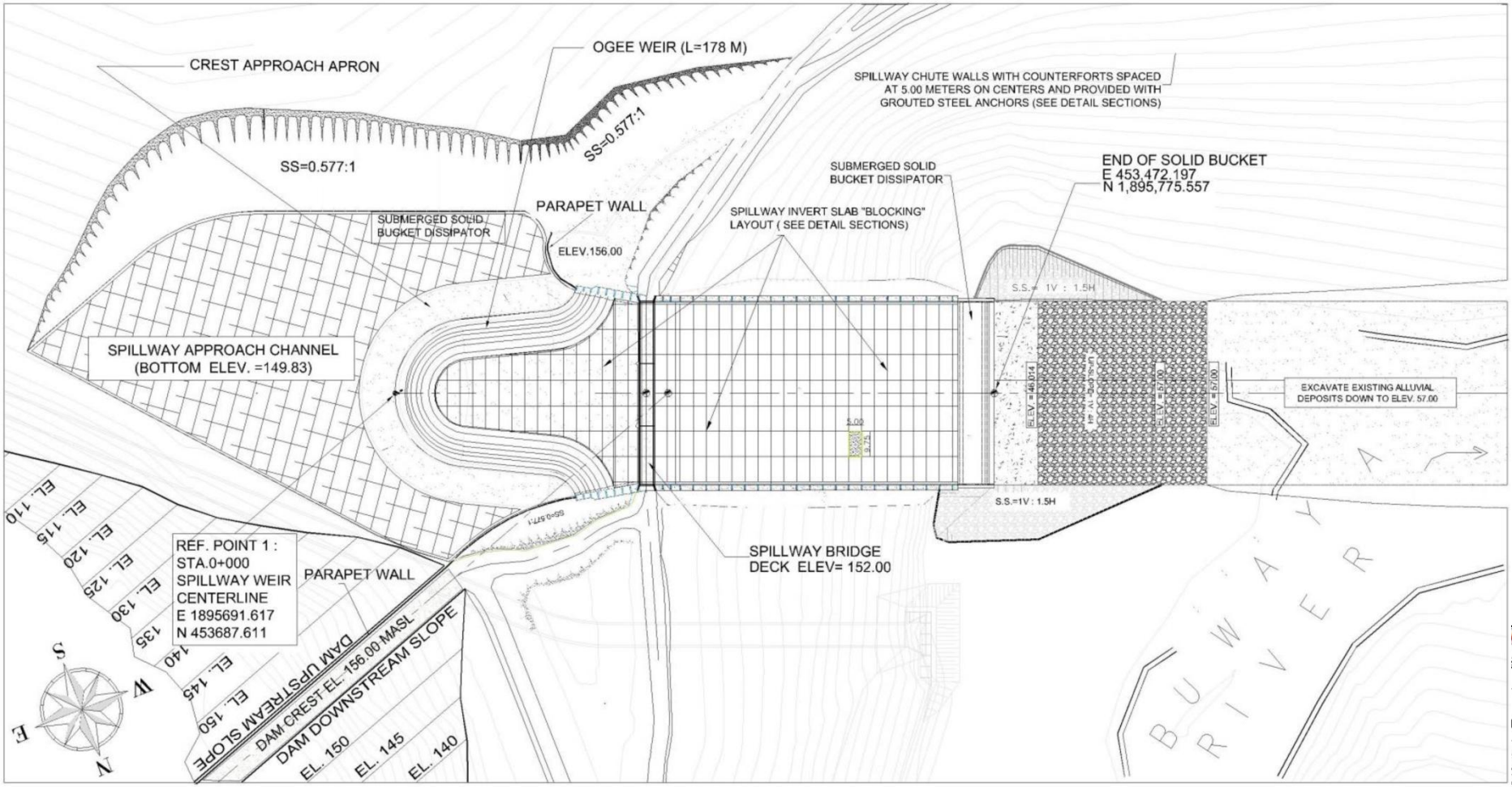
Cofferdam. A 26-meter high cofferdam at the upstream side of the dam axis shall be constructed and shall be integrated to the transition fill of the dam body. It shall have a gradient slope of 1.5:1 on both faces and a 10-meter top width. It shall be designed to protect construction works against inundation from a 10-year return flood.

2.4.1.4 Irrigation Network and Canal Layout

The new canal system of the Gregorio Del Pilar Impounding Project will be composed of: a 1.5 km diversion canal; 11.4 km main canal; a total of 45.61 km lateral/sub-lateral canals; farm level facilities such as main and supplementary farm ditches. Figure 2-8 shows the plan and profile of the main canal while Figure 2-9 shows the schematic diagram of irrigation network. Service roads shall be provided on one side along main and lateral canals to enhance the transport of farm inputs to and produce from the service area. New canals are proposed to be unlined due to high cost which could impact on the viability of the project. The assumed 50% irrigation efficiency in the reservoir simulation takes care of the losses due to unlined canals. Concrete lining may be considered in the future. Deep cuts are anticipated to be encountered along the municipality proper of Salcedo, Bidbiday in Galimuyod, and Sto Tomas in Candon City for the main canal. Deep cuts are also anticipated to be encountered in Galimuyod for Lateral B. **Table 2-2** shows the details of the 5,000 hectares service area, existing and new.

Table 2-2: Summary of Service Area

Proposed Irrigation Canals	Service Area (ha)				
	New Area	Existing NIS	Existing CIS		Total
			Name	Area	
Main Canal Upstream Turnouts	125.4		Nabucaan - Salcedo	100.0	225.4
Main Canal Mid-stream Turnouts	29.3				29.3
Main Canal Downstream Turnouts	66.1				66.1
Lateral A	213.2		Sabangan-Bato	55.0	268.2
			Pagangpang-Legaspi	39.0	39.0
			Sacaang Mckinley	38.0	38.0
Lateral B	1,008.6		Kalimugtong	37.0	1,045.6
			San Nicolas	105.0	105.0
			Caoplasan	540.0	540.0
Lateral C	32.1		Alangigan #2	80.0	112.1
Lateral D	70.2		Alangigan #1	125.0	195.2
			Tolentino	17.0	17.0
Lateral E	153.7		Oaig Daya	75.0	228.7
			Palacapac	77.0	77.0
Lateral F	101.5				101.5
Subtotal	1,800.0			1,288.0	3,088.0
Irrigation systems taking water from Buaya River, no supplemented by new canals					
Sta. Lucia - Candon Irrigation System		1,423.0			1,423.0
			Pias-Pila	78.0	78.0
			Cadamortisan	9.0	9.0
			Nagconventuan	180.0	180.0
			Pantar	10.0	10.0
			Pias-Cadaratan	94.0	94.0
			Sorian	50.0	50.0
			Cabugbugan-Cabluan	40.0	40.0
			Ubbog	28.0	28.0
Subtotal		1,423.0		489.0	1,912.0
Total	**1,800.0**	**1,423.0**		**1,777.0**	**5,000.0**



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QUEZON CITY

GREGORIO DEL PILAR IMPOUNDING PROJECT
PROVINCE OF ILOCOS SUR
REGIONAL OFFICE NO. I, URDANETA CITY

GENERAL PLAN OF THE
ROPOSED GREGORIO DAM SPILLWAY

ENGINEERING AND DEVELOPMENT CORPORATION OF THE PHIL. (EDCOP)
3rd & 4th Floors, The Professional Tower
37 EDSA Corner Boni Avenue, Mandaluyong City

DRAWN : J.A.T.
DESIGN : E.A.C.
CHECKED : O.M.C.

ORLANDO M. CABLAYAN — TEAM LEADER — DATE — NOEL M. ORTIGAS — EXECUTIVE VICE-PRESIDENT, EDCOP

RECOMMENDING APPROVAL:

REGIONAL MANAGER — DATE — MANAGER, ENG'G. DEPT.

APPROVED

ERDOLFO B. DOMINGO — ASTRID DEPUTY ADMINISTRATOR FOR ENGINEERING & OPERATIONS — DATE

GDPIP | DWG. NO. GDPIP --- | SHEET NO. ___ OF ___

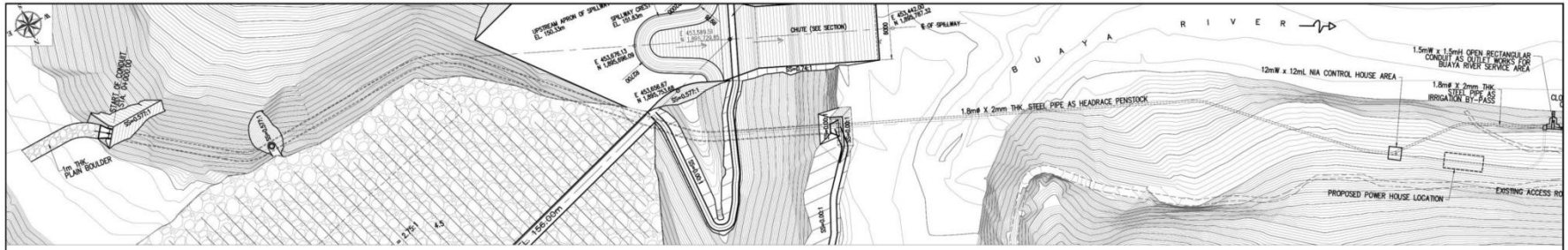
Lichel Technologies, Inc.
Unit 1403 Prestige Tower Condominium
F. Ortigas, Jr. Road, Ortigas Center, Pasig City

FIGURE TITLE :

Spillway Plan

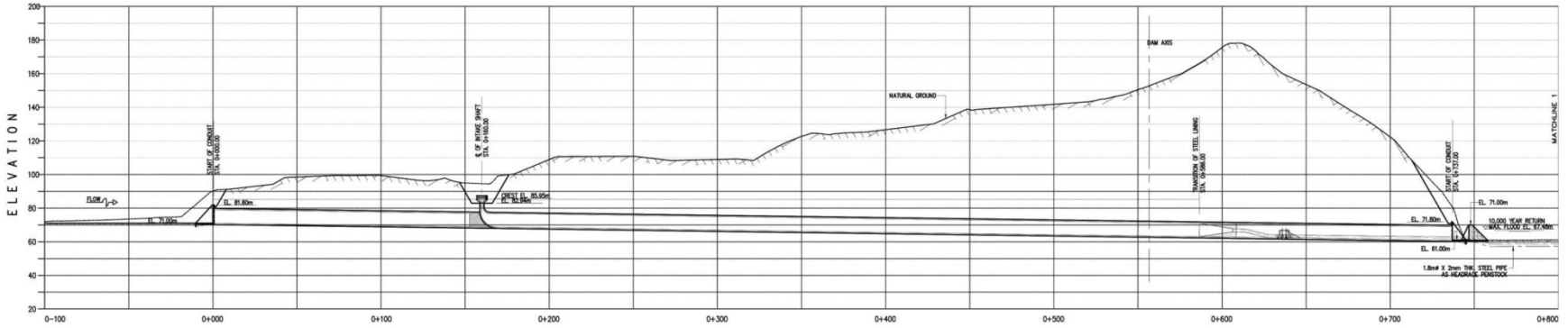
FIGURE NO.:

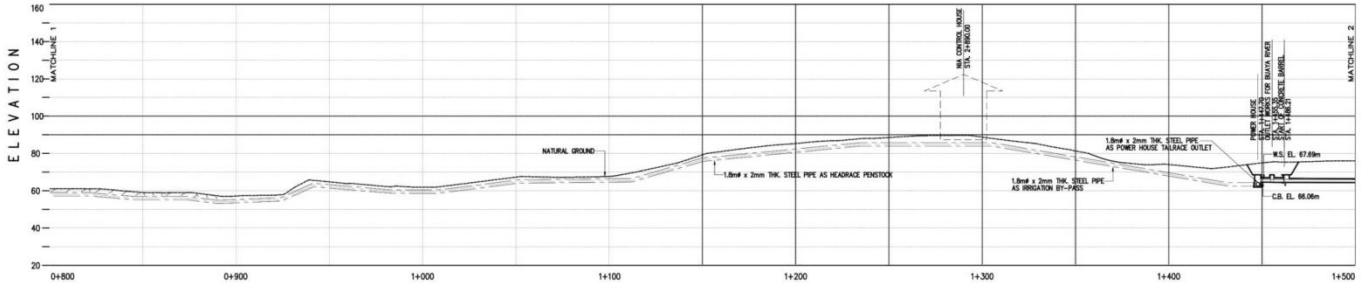
2-8

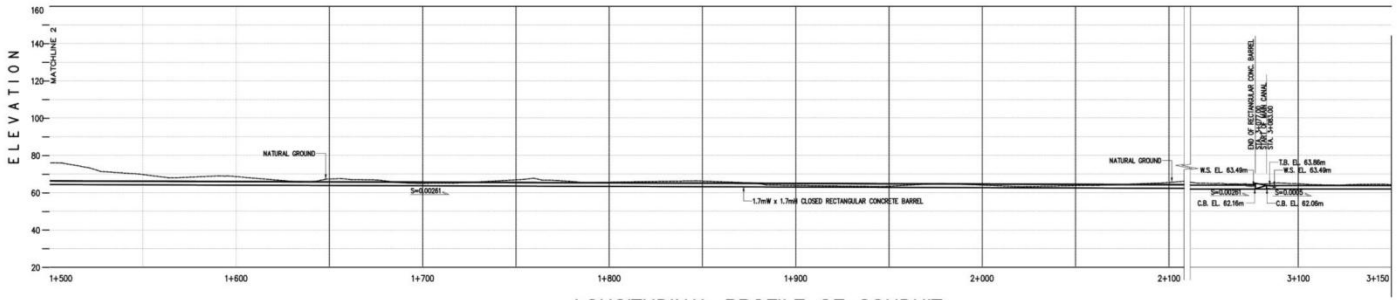


PLAN FROM DIVERSION CONDUIT TO RECT. CONDUIT

SCALE 1:4,000 M







LONGITUDINAL PROFILE OF CONDUIT

SCALE 1:2,500 M

REPUBLIC OF THE PHILIPPINES
NATIONAL IRRIGATION ADMINISTRATION
QUEZON CITY

GREGORIO DEL PILAR IMPOUNDING PROJECT
PROVINCE OF ILOCOS SUR
REGIONAL OFFICE NO. I, URDANETA CITY

PLAN AND LONGITUDINAL PROFILE OF DIVERSION CONDUIT, HEADRACE PENSTOCK AND CONCRETE BARREL

ENGINEERING AND DEVELOPMENT CORPORATION OF THE PHIL. (EDCOP)
3rd & 4th Floors, The Professional Tower,
37 EDSA Corner Boni Avenue, Mandaluyong City

DRAWN : J.A.T
DESIGN : P.O.B. (III)
CHECKED : O.M.C.

ORLANDO M. CABLAYAN
TEAM LEADER

DATE

NOEL M. ORTIGAS
EXECUTIVE VICE-PRESIDENT, EDCOP

RECOMMENDING APPROVAL:

REGIONAL MANAGER DATE

ERDOLFO B. DOMINGO
MANAGER, ENG'G. DEPT.

APPROVED

ROBERT C. SUGUITAN
ACTING DEPUTY ADMINISTRATOR FOR ENGINEERING & OPERATIONS

DATE

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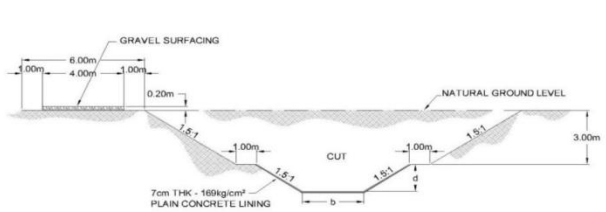
F. Ortigas, Jr. Road, Ortigas Center, Pasig City

FIGURE TITLE :

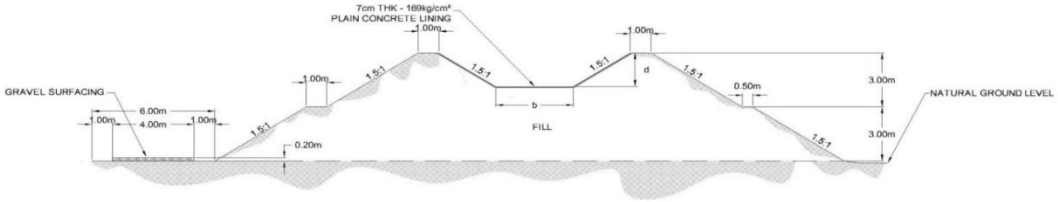
Diversion Conduit Plan and Profile

FIGURE NO.:

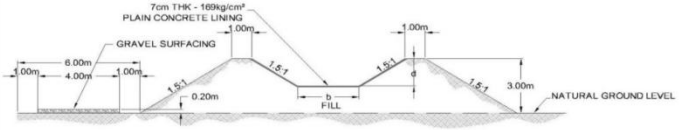
2-9



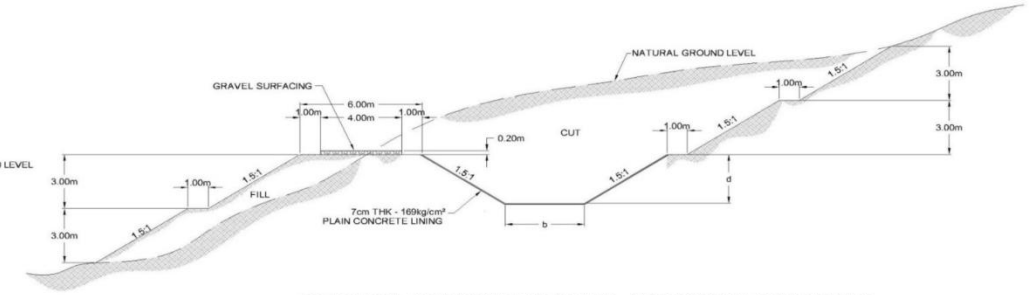
TYPICAL OPEN CANAL SECTION I - ON CUT
NTS



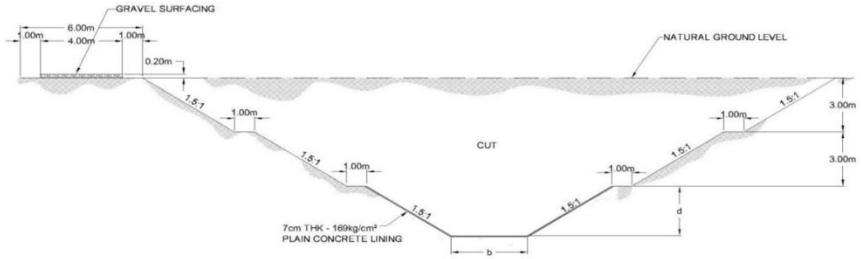
TYPICAL OPEN CANAL SECTION IV - ON HIGH FILL
NTS



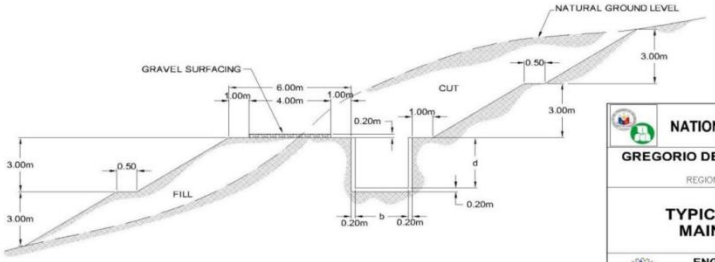
TYPICAL OPEN CANAL SECTION II - ON FILL
NTS



TYPICAL OPEN CANAL SECTION V - TRAPEZOIDAL ON SIDE HILLS
NTS



TYPICAL OPEN CANAL SECTION III - ON DEEP CUT
NTS



TYPICAL OPEN CANAL SECTION VI - RECTANGULAR ON SIDE HILLS
NTS

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NATIONAL IRRIGATION ADMINISTRATION
QUEZON CITY

GREGORIO DEL PILAR IMPOUNDING PROJECT
PROVINCE OF ILOCOS SUR
REGIONAL OFFICE NO. I, URDANETA CITY

TYPICAL CANAL SECTIONS
MAIN / LATERAL CANAL

ENGINEERING AND DEVELOPMENT CORPORATION OF THE PHIL. (EDCOP)
3rd & 4th Floors, The Professional Tower,
37 EDSA Corner Boni Avenue, Mandaluyong City

DRAWN: J.A.T.
DESIGN: P.O.B.(JR)
CHECKED: O.M.C.

ORLANDO M. CABLAYAN — TEAM LEADER — DATE
NOEL M. ORTIGAS — EXECUTIVE VICE-PRESIDENT, EDCOP

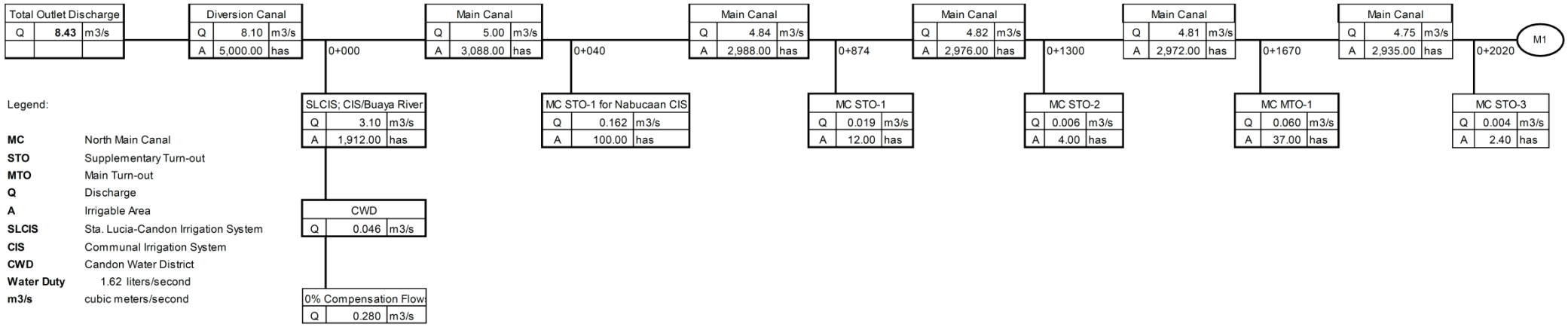
RECOMMENDING APPROVAL:

REGIONAL MANAGER — DATE — MANAGER, ENG'G. DEPT.

APPROVED

ERDOLFO B. DOMINGO
ACTING DEPUTY ADMINISTRATOR FOR ENGINEERING & OPERATIONS — DATE

GDPIP | DWG. NO. GDPIP --- | SHEET NO. ____ OF ____



Legend:

MC	North Main Canal
STO	Supplementary Turn-out
MTO	Main Turn-out
Q	Discharge
A	Irrigable Area
SLCIS	Sta. Lucia-Candon Irrigation System
CIS	Communal Irrigation System
CWD	Candon Water District
Water Duty	1.62 liters/second
m3/s	cubic meters/second

Lichel Technologies, Inc.
Unit 1403 Prestige Tower Condominium
F. Ortigas, Jr. Road, Ortigas Center, Pasig City

FIGURE TITLE :

Schematic Diagram for Irrigation and Drainage Network

FIGURE NO.:

2-11

2.4.2 Flood Control

The project will minimize flooding in the areas where Buaya River passes through as it reduces peak flows during the occurrence of typhoons. Data from 1990-2006 show that the annual average damages to agriculture nationwide was P12.43 billion with: 70.3% caused by typhoons; 17.9% by drought; and 5% by flood. The damages occur during the southwest monsoon or the wet season cropping, which is primarily when mostly rice are grown. The average area planted to rice nationwide during this season in the period 1994-2006 was 2.27 million hectares. The damages due to flood was, therefore, estimated to average about P273/ha. The average farm gate price of palay nationwide in 1990-2006 was P8.00/kg while the average farm gate price in 2012 was P15.28. Limiting the benefit due to flood control to the rice areas in Sta. Lucia and Sta. Cruz (4,286 hectares), the annual economic benefit due to flood control was estimated at about P2.94 million per year.

2.4.3 Domestic Water Supply

The project guarantees the availability of water supply for the CWD 100% of the time. In the months of December to April, the daily discharge at the dam site which is just a few kilometers upstream of the CWD, averaged 0.120 liters/second to 610 liters/second. Based on generated streamflows, there are years when the average daily discharge in these months could be as low as 50 liters/second. There are competing uses of water in these months, increasing the risk of low supply for domestic consumption. With more reliable water supply, it is assumed that CWD will be able to expand its customer's network, improve its services and be able to utilize 100% of its water rights (46.127 liters per second) by 2020. The average pumping rate in 2012 was 14.88 liters per second. It is assumed that the incremental benefits in the future will be equivalent to the water district's water rights during the dry months of December-April as the streamflows during these months are inadequate to supply the competing demands. The total production for the 5-month period was estimated at 641,000 cubic meters. Considering unit price of P31.90 per cubic meter, the incremental annual economic benefit due to assured domestic water supply was estimated at P20.46 million.

2.4.4 Service Roads

At about 360 meters downstream from the dam axis, the new access road shall start to ascend from the existing road at the right bank of Buaya River and connect to the right abutment of the dam crest. The length of the new road shall be 900 meters.

From the left abutment of the dam crest, a new road shall be developed to connect to the existing road leading to Barangay Baybayading. The new road shall be about 2.26 kilometers long. From said road, another new road branching out to Barangay Ubbog shall be constructed with a length of 750 meters.

The proposed design specifications details for both roads are:

Road width – 7 meters
Surfacing materials – combination of sand and gravel
Surfacing dimensions – 0.20 meter thick x 6 meters wide
Crown slope - 2%
Maximum road slope – 20%
Fill side slope - 1.5:1
Cut side slope – 60 degrees from horizontal
Bench height - 5 meters
Bench width – 0.50 meter

Road structures shall be constructed for the reconstruction of existing road. Based on field investigation, for cost estimation purposes, the required structures shall include the following:

Road structures at right bank access road:

(a) 4 sites – 2 rows 1.2-meter diameter x 12-meter reinforced concrete pipe culvert
(b) 1 site – 3 rows 3-meter x 3 meter x 9meter reinforced concrete box culvert

Road structures at left bank access road:

(c) 6 sites – 2 rows 1.2-meter diameter x 12- meter reinforced concrete pipe culvert

2.4.5 Fisheries

This component consists of the construction and production of fish in fixed floating cages in at least 22 hectares within the reservoir area. The main beneficiaries of this component will be the residents in the immediate vicinity of the dam and reservoir, and holders/owners of the agricultural land and home lots that would be affected by the construction of the project.

Fish Cage Belt Area. The area intended for the fish culture was based on the designed water level of the reservoir and physical conditions of the area. The normal water level at the reservoir is elevation 152.75 meters while the minimum water level is 92.62 meters. To prevent the reservoir from pollution, Bureau of Fisheries and Aquatic Resources (BFAR) allows not more than 10% of the body of water for fish cage culture. The normal required water depth of a fish cage is 6-10 meter. Given these requirements, it was estimated that fish cage area of 22 hectare could be put up in the reservoir when the water level is at elevation 140.0 to 152.75 meters.

Fish Sanctuary Area. Five hundred meter stretch from the dam axis going upstream will be designated as the sanctuary area. The Fishermen are strictly prohibited to catch fish within the sanctuary area. Likewise, nobody will be granted permit to establish fish cage in any portion within the sanctuary area.

Number of Fish Cage Operators. A typical design of a fish cage has a dimension of 6 m (W) x 10 m (L) with 6 meter height of net provided with bamboo floaters. Each of the interested families will be allocated one (1) unit or more unit modules or clusters consisting of six (6) units of grow-out or fattening fish cages. Two (2) units of nursery or rearing cages with dimensions of 6 m x 10 m x 3 m will be used in rearing small fingerlings for about 15 days before transferring to the grow-out cages. These rearing cages are put inside the grow-out cages and are removed after the fingerlings are transferred. Each cluster is spaced at 5 to 10 meters apart to provide navigational spaces for the fish cage operators. A cluster shall consist of 4-8 fish cages installed and kept at least one (1) meter between units.

Permit to construct/operate fish cages shall be granted only within the designated 22 hectare fish cage belt area. Each of the individual operators will be granted an area of not more than 1,200 m^2 and not more than 25,000 m^2 for cooperatives/associations or corporations. No fish cage shall be constructed within the identified navigational channels or at river outlets. With these conditions, about 80 units of fish cage could be established per hectare and a maximum of 1,760 fish cages within the fish cage belt area of the reservoir in a year. The Ilocos Sur IMO shall take charge of granting permits to cage operators in coordination with the local government units. The detailed procedures in granting permits shall be drawn before the completion of the project in coordination with all concerned stakeholders.

2.4.6 Power Generation/Outlet Works and its Appurtenances

While the project is primarily for irrigation, limited structural provisions for power shall be put in place to encourage private sector to design, build and finance the power plant.

Vertical Intake Shaft. A 1.5-meter diameter concrete vertical intake shaft shall be installed at the outer diversion conduit. At its inlet rim, it shall have a 4-meter diameter circular inlet weir with the "Morning Glory" configuration. The morning glory inlet weir shall be a 0.7-meter high ogee with six anti-vortex piers making it a 6-bay inlet structure. The 6-bay inlets shall be 0.8 meter high and 1.5 meters wide with fixed trash racks. At a minimum head of 1.0 meter from the inlet crest, the inlet weir shall be capable of allowing the 10 m_3/sec maximum irrigation diversion requirement. The 1.5-meter diameter shaft shall converge to the 8-meter diameter conduit within 5 meters horizontally via a 90-degree transitional bend.

Guard Gate Chamber and Adit. At about 100 meters from the outlet portal of the conduit line, a guard gate chamber shall be constructed to control the flow coming from the vertical intake shaft. It shall be provided with a series of 2 sets of 1.8-meter diameter bonneted vertically sliding guard gate valve which can be operated mechanically or manually. Their main function is to close or open the distribution. The upstream guard gate is open most of the time and shall be closed only for the maintenance of the downstream guard gate or for any situation where the downstream guard gate fails to close. A 1.8-meter diameter steel penstock shall be connected to the aforementioned guard gate and will run for about 100 meters inside the 8.0 m concrete conduit and 540 meters outward crossing Buaya River until the control house at the right bank. The guard gate chamber shall be accessible through the outlet portals of the 8-meter diameter tunnel.

Control House and Devices. At about 660 meters from the outlet portal of the diversion conduit, a control house shall be constructed. It shall be located at a higher elevation above the 10,000 year flood tailwater elevation, which is at El.66.54 meters. The control house shall shelter the (1) distribution gate valves for irrigation and power generation, (2) the control panels for the opening and closing of the guard gates (3) the switches for lighting of the reservoir area and its essential spaces, (4) the standby power generator, (5) the base facility for communication (6) the monitoring equipment for dam instrumentations and lastly (5) the dam keeper. It shall be accessed via existing road converted into an access road.

By-pass Distribution Line Appurtenances. From the control house, a 1.8-meter diameter steel conduit will run for about 140 meters to the stilling pool to be constructed at the start of the diversion canal. Another 1.8-meter diameter steel pipe will run for about 10 meters to the concrete junction box from which the power developer will connect. Flows for each 1.8-meter diameter penstocks will be regulated by 1.8-meter diameter butterfly gate valves inside the control house. The power developer shall design, build and finance the power house and connect to this box without interfering with the irrigation operation. The tailrace of the power house to be constructed by the power developer will discharge back to the irrigation distribution line via a by-pass pipe line. At the starting point of the diversion channel, a gated outlet to the Buaya River shall be constructed with spillweir device. The discharge through the gated outlet shall supply the irrigation requirements of all existing systems deriving water supply from Buaya River, the water right of the CWD and compensation flows of the river for ecological purposes. With this scheme, the need for a new diversion dam is eliminated.

2.4.7 Rockfill Quarry

The clay embankment will be of low to moderate plasticity soils which could be sourced upstream of the dam, within the topographic highs of the area towards Gregorio del Pilar. The identified potential quarry sites for clay sourcing can also generate materials for the transition zone (random fill) within the saprolite/moderately weathered horizon after the removal of the low to medium plasticity clay at the upper soil horizon thence the rockfill material at depth. Table and Figure 2-10 shows the description and location of possible quarry sites, respectively.

Table 2-3: Description of Proposed Quarry Sites

Location	Coordinates		Description
	N	E	
Salcedo			
S-1	120˚33'28.5"	17˚08'38.3"	**Gravelly Sand with silt** , non-plastic, moderate to highly weathered tuff/agglomerate consisting of intercalated tuff and bouldery agglomerate near with boulders exhibiting differential weathering with presence of corestones, brown to cream in color, coarse fragments can be reduced further by hammer pressure
S-2	120˚34'3.3"	17˚08'31.3"	**Silty Sand with clay, and gravel**, with low plasticity, moderate to highly weathered tuff/agglomerate consisting of intercalated tuff and bouldery agglomerate, talus materials along the road, brown in color.
S-3	120˚32'45.7"	17˚08'51.4"	**Silty Sand with clay and gravel**, low to medium plasticity, moderate to highly weathered sediments consisting of intercalated sandstone, siltstone and claystone, brown to cream in color, mostly laminar and angular in fragments.
San Emilio			
S-1	120˚33'42.5"	17˚12' 58.6"	**Silty/Clayey Sand with Gravel**, low to medium plasticity, moderate to highly weathered material derived from sediments consisting of intercalated sandstone, siltstone and claystone. Coarse fragments can be broken down to smaller pieces by hammer pressure to simulate compaction by vibratory roller. Site is along topographic highs within the back road from San Emilio to Gregorio del Pilar. This belongs to the Laoag Formation, apparently uplifted relative to the outcrops from Galimuyod and Salcedo.
S-2	120˚33' 43.2"	17˚12' 58.2"	**Silty/Clayey Sand with Gravel**, low to medium plasticity, moderate to highly weathered material derived from sediments consisting of intercalated sandstone, siltstone and claystone. Coarse fragments can be broken down to smaller pieces by hammer pressure to simulate compaction by vibratory roller. Site is along topographic highs within the back road from San Emilio to Gregorio del Pilar. This belongs to the Laoag Formation, apparently uplifted relative to the outcrops from Galimuyod and Salcedo.
S-3	120˚33'58.7"	17˚13'18.9"	**Silty/Clayey Sand with Gravel**, low to medium plasticity, moderate to highly weathered material derived from sediments consisting of intercalated sandstone, siltstone and claystone. Coarse fragments can be broken down to smaller pieces by hammer pressure to simulate compaction by vibratory roller. Site is along topographic highs within the back road from San Emilio to Gregorio del Pilar. This belongs to the Laoag Formation, apparently uplifted relative to the outcrops from Galimuyod and Salcedo.

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F. Ortigas, Jr. Road, Ortigas Center, Pasig City

FIGURE TITLE :

Location of Proposed Quarry Sites

FIGURE NO.:

2-12

2.4.8 Waste Management System

The contractor and proponent should implement proper waste management. Installation of Material Recovery Facility (MRF) for waste segregation and compost pits may be provided in the construction and workers campsite/bunkhouses.

Waste storage facilities such as septic tanks or portable toilets may be installed on site during construction. The contractor should ensure that no untreated human wastes should be allowed to enter any water course where this will affect downstream water quality, aquatic environment, and human health. Change in aesthetic character of the area can be minimized by disposing of excavated materials as soon as possible to designated temporary dump sites. Likewise, the contractor must undergo proper clean up and abandonment of the site such as removal of temporary bunkhouses, stock yard and other unnecessary structures after completion of the construction activities.

Hazardous wastes from vehicles and heavy equipment such as leakage of fuel, oil and grease should be contained and handled properly. DENR accredited third party disposal should oversee that all hazardous wastes (either solid or liquid) are primarily contained.

Sources of hazardous liquid wastes are the oil and grease from vehicles and heavy equipment. Periodic maintenance of these vehicles should be conducted in all phases of the Project to prevent leakage.

Hazardous waste such as waste oil, spent lubricants and solvents including contaminated materials resulting from leakage of oil and fuel should be collected and stored in designated containers. Areas designed for the storage of hazardous materials are to be clearly designated by HAZCHEM signage, and the storage of such materials outside these areas is strictly prohibited. All hazardous materials are to be transported by and disposed thru DENR accredited third party service provider.

Areas designated for storage of hazardous liquids, fuel, oil and other chemicals shall have a compacted base and be surrounded by a bund to contain 110% of any spillage. Large fuel storage facilities (>5,000 L) shall be covered by a root to minimize the potential for infiltration and contamination of runoff. Alternatively, ventilated containers and individual spill pallets should be used, depending on the volume of hazardous materials. All fuel and lubricant storage sites shall drain into an oil and water separator. All oil and water separators are to be maintained after any rainfall event of >20 mm.

The selection soil disposal and storage site will be part of the construction management program of NIA and its contractors. Nonetheless, the following should be considered in the selection of such areas during construction:

- Distance from water bodies
- Site drainage
- Slope stability of the site
- Potential flooding
- Proximity to settlements/sources of livelihoods

2.5 Process Technology

2.5.1 General Development Scheme

The scheme of development aims to utilize the waters of Buaya River primarily for irrigation. It also guarantees the availability of water for the CWD up to its current water rights. The project is envisioned to provide year round irrigation to about 5,000 hectares.
The project involves the construction of a dam across the Buaya River to impound water and release the water through the outlet works for irrigation and to meet the water rights of the CWD. The water released for irrigation, and excess water during the wet season may also be used to generate electric power if and when a private proponent put up a power plant downstream of the dam after the outlet works. A private proponent for the power component may be selected competitively during or after the construction of the dam.

A new diversion canal from the outlet works, main canal and laterals will be constructed to irrigate new areas of about 1,800 hectares and augment water supply to existing communal irrigation systems deriving water from rivers and creeks other than the Buaya River. The existing facilities are in good shape and no new capital investments were included for these facilities. Operation and maintenance must, however, be improved.

The 5,000 hectares service area is located at the right side of the Buaya River and is composite of new service areas, the existing SLCIS, and several CISs.

The topography of the service area is such that the lower portions of flat lands near the coast line, about 1,423 hectares, are served by the existing SLCIS. The upper portion of the service area is burdened by three groups of un-irrigable highlands. The service area is traversed by two big rivers, namely, Candon River and the Banayoyo River. The service area is also delineated by a seemingly circumferential road (Candon-Salcedo-Sta. Lucia route) which connects to the National Highway (Appendix 11-8). Given this general topographic situation, the canal system shall be laid out to skirt around said highlands and across waterways in a most economical fashion while considering easy operation and maintenance of said irrigation appurtenances. It is desired to irrigate lands as far as the Caoplasan CIS in Candon City.

Twelve (12) existing CIS deriving water source from creeks and rivers other than the Buaya River, covering about 1,188 hectares but irrigating only 50 hectares during the dry season, will be integrated into the project. Water supply to this system shall be augmented from the project during dry season. Link canals shall be constructed to the existing main canals of said CIS's, to be provided with gates to ensure proper control of water deliveries. Water supply during the wet season may also be augmented when needed.

The SLCIS and eight (8) existing CISs deriving water from Buaya River shall be provided with water from the reservoir all year round via an outlet from the diversion canal. The outlet from the diversion canal shall directly discharge to the Buaya River to supply the water needs of these systems, the Candon City Water District for domestic supply, compensation flows required to maintain ecology of the Buaya River.

2.5.2 Slope Stability Analysis

The Slope Stability Analysis was conducted as part of the Feasibility Study for the Project. Highlights of the Slope Stability Analysis are presented in this section. The preliminary design of the zoned embankment was modelled and analyzed using the RocScience Slide software (**Figure 2-11**).

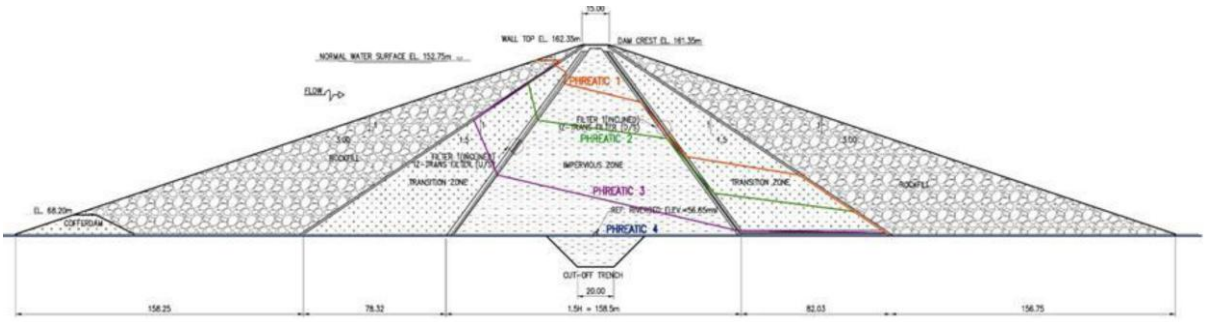


Figure 2-11: Preliminary Design

Considering past experiences, four (4) assumptions were made on the phreatic lines along the maximum dam section representing the steady seepage state or long-term serviceability of the dam at maximum reservoir level.

Phreatic Line 1 represents the near-100 % saturated condition, while phreatic line 4 represents the nearly dry condition. Phreatic lines 2 and 3 portray the in-between partially saturated conditions between these two extremes which are the most likely conditions that will be encountered with the provision of 3-partitioned filters along the transition-rockfill interface, and that of the transition-clay core interface. Viewed in another perspective, Phreatic line 2 could be more than 50% clay core and transition fill saturation while phreatic line 3 could be less than 50 % saturation within the dam cross section. Case 1 assumed a friction angle of the transition zone of 20 degrees. Case 2 is essentially the same as Case 1 but the friction angle of the transition zone was increased from 20 degrees to 25 degrees.

Case 2 was adopted as the final reference and used in the sensitivity analysis in the dam stability analysis. The clay core and other design parameters were taken from the geotechnical investigation results.

The dam stability analysis is basically a sensitivity analysis on the various phreatic lines and various seismic loadings in both the horizontal and vertical components. The vertical seismic loading was introduced since it was inferred that there could be a vertical component of the seismicity because the Central Cordillera is thrusted against the Ilocos basin. The dam stability was analyzed up to the maximum credible earthquake (MCE) on rock foundation that is 0.36g. However, the ordinary or design basis earthquake (OBE) was set at 2/3 of the MCE as being practiced, which is about 0.25g for the horizontal acceleration. This was deemed as the upper limit of external seismic force and test for dam stability. Vertical seismic component of 0g, 0.10g, and 0.20g were made in combination with the horizontal seismic component. The cut-off value for a safe or stable dam was set at a static factor of safety (FoS) of at least 1.5, and at least 1.0 for pseudo-dynamic condition. Results for the static condition are greater than 2.0 which is over and above the FoS = 1.5 lower generally acceptable limit.

Initial results for the original design showed inadequacy of dam stability for the downstream side at the OBE of 0.25g and zero vertical components. The upstream side is stable by virtue of a natural mountain slope restriction in both valley sides. To address the inadequacy, weighting berms were integrated in the design by extending the rockfill footprint by about 25 meters (**Figure 2-12**).

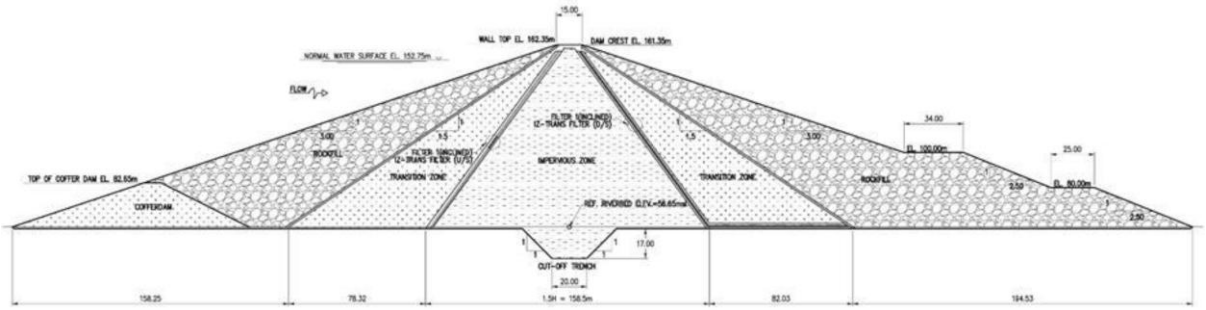


Figure 2-12: Dam Section Showing Weighting Berms at Downstream Face of Embankment

The results of the slope stability analysis for phreatic lines 2 and 3 are presented in **Table 2-4** and **Table 2-5**. Results show that the FoS for the static condition is greater than 2.0 which are over and above the threshold of 1.5.

Table 2-4: Dam Stability Analysis (Slope Upstream and Downstream 1:2.5) (Janbu Simplified)

Seismic Force (N.g)		Factor of Safety Phreatic Line 2				Factor of Safety Phreatic Line 3			
		Global Minimum		Probable Slip Circle		Global Minimum		Probable Slip Circle	
H	V (-)	US	DS	US	DS	US	DS	US	DS
0	0	1.90	1.57	1.91	1.85	1.94	1.66	1.94	1.66
0.25	0.1	0.73	0.77	0.77	0.98	0.74	0.86	0.83	1.02
0.25	0.2	0.65	0.70	0.77	0.98	0.66	0.79	0.80	0.98
0.	0	1.86	1.44	1.86	1.57	1.90	1.59	2.02	1.68
0.25	0.1	0.79	0.72	0.86	0.78	0.74	0.77	0.83	0.98
0.25	0.2	0.649	0.642	0.694	0.78	0.67	0.72	0.78	0.95

Table 2-5: Dam Stability Analysis (Slope Upstream 1:2.75 and Downstream 1:2.5) (Janbu Simplified)

Seismic Force (N.g)		Factor of Safety Phreatic Line 2				Factor of Safety Phreatic Line 3			
		Global Minimum		Probable Slip Circle		Global Minimum		Probable Slip Circle	
H	V (-)	US	DS	US	DS	US	DS	US	DS
0.00	0.0	2.09	1.59	2.09	1.59	2.11	1.63	2.11	1.63
0.25	0.1	0.89	0.77	0.96	1.05	0.83	0.86	0.85	1.02
0.25	0.2	0.74	0.70	0.78	0.95	0.75	0.78	0.75	0.98
0.00	0.0	2.06	1.44	2.06	1.65	2.10	1.59	2.10	1.59
0.25	0.1	0.77	0.67	0.80	0.87	0.78	0.77	0.79	0.89
0.25	0.2	0.70	0.64	0.72	0.81	0.71	0.71	0.73	0.85

The tabulated results above are the most likely FoS for phreatic levels 2 and 3. If the dam stability criteria are met in phreatic line 2, then the dam will be more stable in phreatic lines 3 and 4 because of the reduction in pore pressures. The tables listed the global minimum FoS on a grid radius which sometimes gives unrealistic slip plane geometry like being too flat and/or encroaching the upstream embankments for the downstream slip plane and vice versa. Thus, another column representing the most probable slip plane was introduced in the analysis which was the basis altogether for declaring dam stability at pre-determined lower limits which is the practice in the industry. Further, this forced slip plane or probable slip plane likewise gives the FoS for the same slip plane at various loading conditions otherwise not possible for the global minimum, thus the values are directly comparable.

The dam stability results in the tables above are for simplified Janbu's but the simplified Bishop method was also applied. The former gives lower FoS compared to Bishop's and, in fact, is the lowest among the different methods of analysis available in the software since it does not include inter-slice shear forces but only inter-slice normal forces otherwise included in other methods. Hence, simplified Janbu's is a conservative method to adopt for dam stability to cater to possible unfavourable

modifications in assumptions. Looking at the values presented by results under phreatic level 2 and at the probable slip planes, it can be seen that the weighting berm enhancement in the dam design and geometry passed the factor of safety criteria of at least of 1.5 for the static condition and at least 1.0 for the dynamic conditions up to horizontal acceleration of 0.25g, and 0.10g for the vertical component. The results for a greater vertical component of 0.20g showed acceptable values until the horizontal seismicity of 0.20g but short for the 0.25g. Nevertheless, this could be deemed acceptable in view of conservative assumptions introduced (i) for phreatic line 2, which is more than 50 % saturation, (ii) that of the material properties like a zero cohesion for the granular materials, and (iii) the method of stability analysis.

2.5.3 Dam Section Dimensions

Dam Height. The total height of the dam shall be 89.0 meters, excluding parapet wall of 1.0 meters. The total freeboard is computed at about 6.17 meters including the 1.0-meter parapet wall, consisting of the following:

a) Surcharge height - Is taken as the corresponding height of the peak inflow of the design flood of the spillway for 1000-year return period and was found during flood routing to be 2.78 meters.

b) Height of wave due to wind or due to earthquake, whichever is higher:

i. Height of wave due to wind computed at 0.90 meter using the Molitor Stevenson formula shown below:

$$h_w = (0.032\,(FV)^{1/2} + 0.763 - 0.271\,(F)^{1/4})Sf \text{ for } F < 32 \text{ km}$$

where:

h_w = wave height measured between trough and crest, meters
V = wind velocity, assumed 150 kilometer per hour
F = reservoir fetch, 1.10 kilometer
Sf = slope factor, 1.5

ii. Height of wave due to earthquake - The height of wave during earthquake was computed using the Seiichi Sato formula, shown below and is equal to 1.0 meter.

$$h_e = 1/2\ k\ T\ /\ \Pi\ (2\ g\ h)^{1/2}$$

where:

he = wave height due to seismic effect (m)
h = spillway crest elevation – river bed elevation (m)
k = constant (0.15)
T= 1.00 second
Π = 3.1416
g = 9.80 m/sec^2

c) Freeboard due to settlement = 1.89 meters

The total freeboard was checked against the flood surcharge if 10,000 year flood occurs. The flood surcharge under this case was computed at 4.19 meters, which is less than the total freeboard.

Core Trench Width. The core trench bottom dimensions shall be primarily influenced by the space requirement for grouting works of the rock foundation which is perceived very likely needed by the structure. Adopting three lines of grout holes spaced at 5 meters is considered, a 20-meter wide core trench is deemed sufficient. The top width of the cut-off trench at the river bed was made 54 meters and the depth is about 18 meters where bedrock formations were encountered. As such, the cut-off trench is technically a positive cut-off.

Core Base Width. The minimum base width of the clay core shall be equal to the height of the embankment.
In formula, the dam height H is computed as follows:

H = (Crest Elevation) – (River Bed Elevation)
Where:
Crest elevation = 156 meters (exclude 1-meter parapet wall)
River bed elevation = 67 meters – meter excavation

Thus, H is equal to 90 meters, which should be the minimum core base width. The design core base width is 129.5 meters, providing safety net for low to medium plasticity quality of clay core materials.

Core Top Width. The core top width is set at 4 meters and is at the same elevation as the dam crest to be safe against the 1 in 10,000 year flood.

Embankment Top Width. Several formula were tried to determine the crest width as shown below:

	Formula	**Crest Width (meters)**
Trautwine	Wc = 0.6 + 1.1 H ½ Where: H = effective height of the dam (excludes parapet wall)	10.98
ICOLD	Wc =3.6 H 1/3 – 3	13.07
USBR	Wc =3.6 H 1/3 – 1.5	14.57
G.T.C. instructions	Wc =5/3 H 1/2	15.72
USBR	Wc = H/5 + 10 (in feet)	8.47

2.5.4 Spillway and Appurtenances

The spillway and appurtenance structures are composed of the inlet weir, transition section, control section, spillway chute, energy dissipator and a bridge. The spillway is configured for an ungated operation. Flood routing runs were made varying the width of spillway. The summary results of the runs are shown in **Table 2-6**.

Table 2-6: Flood Surcharge at Various Spillway Lengths

Design Flood Return Period (Years)	**Spillway Length (meters)**					
	100	**125**	**150**	**175**	**200**	**225**
	----------Flood Surcharge in meters ----------					
1,000	5.36	4.44	3.78	3.28	2.90	2.59
10,000	6.85	5.67	4.82	4.19	3.70	3.31

Transition Section. This is composed of a tapering chute section with a width of 80 meters starting at the downstream end of the "omega" configured weir and ends at the upstream edge of the bridge abutments where the chute invert width is 70 meters. The wall heights vary from 16.40 meters to 9.8 meters (invert to wall top) along its 10.70 meters span. Due to its height, the transition walls needs to be provided with lateral wall counterforts where steel anchors embedded into the adjoining mountain side will be provided.

Spillway Bridge. The spillway bridge is a 4-span Reinforced Concrete Deck Girder (RCDG) bridge with total clear span of 70 meters between the abutments. The bridge deck is 6 meters wide and is 12.42 meters above the spillway chute floor slab. The bridge will be designed for a standard highway loading designation of AASHTO H-20-44. The bridge abutments will also be provided with steel anchors due to its height of about 15 meters from the backwall top down to the top of its foundation.

Control Section. A control section having a constant width of 70 meters and a length of 8.33 meters long starting immediately from the bridge downstream side was provided to serve as a monitoring section to determine if such a flow in the spillway is at the critical stage or not. The designed Critical Flow level which will be permanently marked along the control section walls will be at Elevation 145.940 masl. The critical depth (dc) which was computed to be 6.362 meters deep will be marked at the walls at Elev. 139.578. The required freeboard above the Critical Depth level was computed to be 1.827 meters making the top of the wall along the Control Section to be at Elev. 147.767.

Spillway Chute. The spillway chute with a uniform chute width of 70 meters has a total horizontal length of about 109 meters starting from the end of the Control Section until it connects with the Submerged Solid Bucket dissipater located below the riverbed. The total length of 109 meters is divided into a 78 meters long modified parabolic vertical curve starting from the end of Control Section and followed by a 31 meters long straight tangent inclined at 37 degrees from the vertical until it connects with the energy dissipater at Elevation 48.758 Masl. The invert slab convex vertical curvature was designed as a modified vertical parabolic curve with an equation specified by USBR as follows:

$$Y = X\tan\text{Ø} + (x^2) / K(4(d+hv)(\cos^2\text{Ø}))$$

Where;
X = the distance of the point to be considered from the start of the vertical curve
Y = the vertical offset from the start of the vertical curve to the point (- or down).
Ø = slope angle of the spillway floor upstream from the start of the curve
K = factor equal or greater than 1.5
d = velocity of flow at the point being considered
hv = velocity head at point being considered

The longitudinal section of the spillway was included in the submitted drawings where plots of the Chute invert, the top of the chute walls as well as the depth of flow for 10000-yr. Flood were plotted to scale. From the plots, it can be seen that the depths of flow becomes shallower but the freeboard becomes higher as flow goes down towards the end of the spillway. However, the height of the walls generally becomes lower. The height of the wall at any given point in the spillway invert is equal to the sum of the depth of flow at the point plus the required freeboard at the point.

Spillway Chute Walls. All the spillway chute walls including those for the Transition and Control sections will be designed as an inverted "T" configuration having variable footing widths and thickness as the walls also varies in heights. The remaining space between the actual excavation line and the completed chute walls on both sides of the spillway chute starting from the weir crest line at the end of the "omega" shape alignment down to the control section are to be backfilled by lean concrete or cement treated sand to form as an impermeable zone where seepage from the reservoir will be prevented. Use of impermeable materials such as clay may be considered but provision of lateral wall

counterforts with steel anchorage is necessary. From the Control Section down to the end of the Spillway chute, the remaining space between the completed walls and the actual excavation line may be partially backfilled with granular backfill to some extent but provision of lateral wall counterforts and steel anchorage for the walls is needed. The walls and the steel anchorage are to be designed to withstand unexpected loadings due to rockfalls and slides. The footings of chute walls on both sides of the spillway chute and along the vertical curve and straight tangent down to the dissipater shall be provided with 3 lines of steel anchors to prevent the walls from sliding down the very steep downslope of the spillway. All construction joints (contraction or expansion) for the walls and its footings shall be provided with appropriate waterstops. Joints of the footing with the Spillway chute slab shall be articulated and also provided with appropriate waterstops.

Spillway Invert Slab or Floor. The entire spillway floor from the weir area down the dissipater interconnection shall be half meter thick and shall be concreted in controlled blocks with thickened articulated joints and provided with waterstops. Intermittent relief drains or filters may be required at the interface between the foundation and the concrete floor. However, the need for such drain can be confirmed as soon as the fine grading of the foundation has been done and thorough geotechnical evaluation points to the need for such relief drains Due to the very steep slope of the spillway, provision of shear bars cum tie-down steel anchors of sufficient embedment to the rock foundation shall be provided for the spillway floor along the entire vertical curve and the straight tangent down to the interconnection to the submerged solid bucket dissipate.

From the above result, the ultimate scour depth is 47.90 meters below the tailwater level which will be at Elev. 19.58 Masl or some 25.42 meters lower than the level of the bedrock formation. Since excavating lower beyond the bedrock level is surely not acceptable, limiting the depth of the plunge Pool to the existing level of the bedrock formation will result to incomplete energy dissipation of the flow which may results to sloughing, erosion and turbulence in the river channel further downstream of the site. With the demerits of adopting the Flip Bucket–Plunge Pool Scheme another scheme is presented.

Submerged Solid Bucket Dissipater. At the site of the energy dissipater where the existing riverbed is at Elev. 60.00 masl, the bedrock formation as per drilling exploration conducted was about 15 meters below or at Elev. 45.00 masl. Due to the very steep slope of the river, bank which is also a bedrock formation, it would be very difficult and expensive to construct a flip bucket to be seated to an excavated bench in the adjacent mountain slope some vertical distance from the design tailwater level which was established at Elev. 67.48 masl. Therefore, a solid bucket roller type dissipater is adopted. This is designed with the least bucket radius determined so that the corresponding minimum tail water depth (submersion distance of the invert of the solid bucket from the designed tail water level) required for its optimum and complete energy dissipation is attained and adapts to the limitations of the actual bedrock formation of the riverbed. The tailwater elevation as derived in the tailwater rating curve is at Elev. 67.48 masl and the indicative bedrock formation at the river bed at the dissipater area is at Elev. 45.00 masl with a vertical distance of 22.48 meters. Placing the solid bucket invert with a minimum concrete thickness of 3 to 4 meters over the prepared bedrock foundation, the required minimum submergence of the solid bucket will be more or less 19 meters. The proposed dissipater structure as submitted was designed for a minimum tailwater depth of 18.46 meters and with a bucket radius of 7.00 only. However, the width of the spillway chute was made to 70 meters so as to provide flexibility for the final tailwater depth. The solid bucket dissipater structures are to be provided with sufficient steel anchorage to the adjacent mountain as well as tie-down cum shear bars at the bottom of the structure.

Stilling and Exit Channel Pool. An adequate sized stilling pool where the solid bucket will be permanently submerged will be provided so that complete dissipation of energy of the turbulent spillway.

2.6 Project Size

The Project will irrigate 5,000 ha of farmlands during the wet season and around 4000 ha of farmlands during dry season. The project will involve the construction of an 89 m dam across Buaya River including appurtenant structures. It will also involve construction of a spillway, main and lateral canals, diversion conduit, and rehabilitation of existing and construction of new roads. **Table 2-7** shows the project size and scale.

Table 2-7: Project Size and Scale

Components	Wet Season		Dry Season
Irrigated Areas	5,000 ha		4,000 ha
Dam Type	Zoned type of rock and earthfill dam		
Dam Height (Structural)	89 m		
Reservoir Area	245.44 ha		
	Length (km)	**Width**	**Area (ha)**
Spillway	175m	80	12 ha
Main Canal	11.4 km		
Lateral Canals	45.61 km		
Roads	3.9 km	7 m	
Fisheries			22 ha

2.7 Development Plan, Description of Project Phases and Corresponding Timeframes

2.7.1 Pre-Construction Phase

The project shall be completed within six years from the start of detailed engineering and design, and land acquisition and resettlement. The first year shall be devoted to the preparation of detailed engineering and design. After the completion of the design, the next year shall be devoted to the procurement of contractor for the main civil works and preparatory activities.

Procurement for key large civil works, like main dam and appurtenant structures, shall be undertaken at the Central Office. Smaller works within the delegated authority of the RIO shall be procured at the regional office.

2.7.2 Construction/ Development Phase

The construction of major works is scheduled for a total of four (4) years. The major components of the Project include the construction of the dams, canals, road improvements and others. Project implementation starts at the mobilization of staff and heavy equipment. Each component will have separate crews and equipment. The major components shall include the following:

The construction of the dam shall commence on the 4th year. These will involve clearing, grubbing and stripping activities which should be started before the onset of the rainy season. Excavation works will also commence for the construction of the dams and would need pre-determined disposal areas to prevent siltation.

After the Right-of-Way (ROW) has been cleared and construction drawings completed, construction of structures may commence. Prior to start of wet season, clearing, grubbing and excavation of the foundation of the canals should be initiated. All spoils should be disposed through pre-determined disposal sites to avoid siltation.

Material transport and soil moving activities will also be involved in the construction of the dams. Location of stockpiles and storage areas should be determined prior to the activity to minimize

siltation. Also, vehicles should be properly maintained during construction as these may become sources of pollution which may contaminate the Panay River, Its tributaries and the soils within the Project area.

Temporary facilities such as camps should have proper solid waste and sewage disposals to prevent water pollution and contamination of the Panay River and other tributaries.

Construction activities are expected to be finished after 4 years through which operations may commence. Prior to operation, storage sites and solid wastes should be properly disposed off through third party disposal. It should be ensured that solid and liquid wastes are collected so as not to pollute immediate water bodies in the construction site.

2.7.3 Operation Phase

The NIA, through its regional irrigation office in Region 1 (RIO 1), will be responsible for the implementation of the project. Given the scale of the project, a Project Management Office (PMO) shall be created to be directly responsible for the implementation of the project. The PMO will be adequately staffed to ensure effective management of the project.

2.7.4 Operation of Irrigation System

The new system is a reservoir-supported system. The operational principle for the system, therefore, is demand-based water management. This means that water supply for irrigation from the reservoir will be released only when needed, when there is no rain or when rainfall is inadequate to meet crop needs. This is very important to be able to store excess water during the wet season for the dry season crop. Water supply for the CCWD will be 100% of the time. Since the spillway is designed for ungated operation, excess water will automatically flows out through the spillway.

The system's organization shall be primarily responsible for the operation and management of the dam and reservoir, the new diversion canal, the new main canal, and the diversion dam and main canal of the existing SLCIS. The water to meet the irrigation needs of the SLCIS and CISs deriving water supply from Buaya River shall be discharged to the Buaya River. Water to augment water supply to other beneficiary CISs shall be released through the new canal systems to a point just after the headgate of the main canal of each CISs in accordance with water delivery schedules and the service agreements.

Cropping pattern and irrigation delivery schedules shall be prepared, discussed and disseminated to IAs before the start of first cropping and updated prior to the second cropping as appropriate.

Operation at the farm level is through the turnout service area group (TSAG). Depending on their collective decision or agreement within the TSAG, water distribution among the different farms could be simultaneous or rotational. The most common water distribution method adopted at this level is rotational during the land soaking and land preparation period and simultaneous during the crop maintenance stage. Rotational irrigation in reservoir system has the potential of maximizing effective rainfall and, therefore, enhancing the reliability of the water supply from the reservoir.

Monitoring and evaluation of operation and maintenance shall be established. During operation the following items will be monitored:

1. Reservoir water level – daily water elevation data at the reservoir will be collected and recorded on appropriate forms.

2. Discharge – daily discharge data at established monitoring stations would be collected. These stations will be established during the first year of operation.

3. Operating water levels – the operating water level at established monitoring points on the rice area would be collected to indicate whether full supply discharge has been attained or not. Together with the discharge monitoring stations these points will be established during the first operation year.

4. Water situation – this indicates water sufficiency or shortage in each turnout, head of sub-laterals, and head of laterals. Water shortage would be treated as urgent, requiring immediate attention.

5. Rainfall data from established stations. The establishment of these stations would be considered during the first year of operation.

6. Farming activities in each turnout service area (TSA) – this is the basis for the preparation of report on list of irrigated and planted area (LIPA). Training of the TSA representatives would be undertaken prior to commencement of first year of operation.

7. Problems affecting operation – indicates defects or problems on irrigation facilities preventing smooth operation.

Operation data from IA:

8. Weekly LIPA by TSA

9. Weekly ISF collection report during collection period

10. Daily discharge monitoring at the heads of main and lateral canals

11. Problems affecting operation – as necessary, usually when there are defects preventing smooth operation or when there are damages from calamities such as typhoons.

12. Report on water shortages – to be treated as urgent, especially when age of crops is critical.

2.7.5 Maintenance of Irrigation System

The main objective of maintenance and repair program is to ensure good operating condition of the system at all time to obtain maximum use and life of the system at reasonable cost and without major rehabilitation. It aims to attain a reasonably priced sustainability in the O&M of the system. **Table 2-8** lists the typical maintenance and repair activities.

Table 2-8: Typical Maintenance Activities in Irrigation Systems

Structure/ Facility	Maintenance Activities
1. Diversion dam	○ Clearing of debris from sluice channel, ogee crest and intake gates. ○ Periodic inspection and exercise of sluice and intake gates. ○ Repainting and lubricating gates and lifting mechanism. ○ Repainting and recalibration of staff gauge. ○ Restoration of upstream and downstream protection walls. ○ Cleaning and landscaping around the dam tower and intake areas.

Structure/ Facility	Maintenance Activities
	○ Repairs or rehabilitation of gatekeeper's quarter. ○ Regular maintenance inspection and exercise of lifting engines and mechanism.
2. Diversion channel/ Main canal	○ Repainting and recalibration of staff gauges. ○ Removal of debris from intake and outlet of structures and proportional weirs. ○ Clearing of vegetation from embankments. ○ Resurfacing and grading of service roads. ○ Desilting of canal prism and declogging of conveyance structures. ○ Reconstruction or restoration of inlet and outlet transitions of structures.
3. Lateral and sub-lateral canals	○ Repainting and recalibration of staff gauges. ○ Removal of debris from intake and outlet of structures and proportional weirs. ○ Clearing of vegetation from embankments. ○ Resurfacing and grading of service roads. ○ Desilting of canal prism and declogging of conveyance structures ○ Reconstruction or restoration of inlet and outlet transitions of structures.
4. Turnouts, MFD, SFD, farm drains	○ Clearing of vegetation from embankments. ○ Desilting, reshaping and restoration of embankments. ○ Restoration or repainting of turnout gates.
5. Main and lateral drains	○ Desilting, removal of debris, restoration of embankments, and declogging of structures. ○ Resurfacing and grading of service roads

2.7.6 Organization

The organization at operation stage will be headed by an Irrigation Superintendent or Manager. The organization shall consist of several units as follows:

- Dam and Reservoir Unit – will be responsible for operation and management of the dam and reservoir, including monitoring of activities of fish cage operators and activities in the watershed;
- Operations Unit – will be responsible for: preparing irrigation delivery schedules; supervising, monitoring and evaluation water distribution; and training, monitoring and assisting irrigators associations;
- Maintenance Unit – will be responsible for: preparing repair and maintenance schedules; monitoring physical status of facilities; and undertaking repairs as necessary to ensure functionality of the irrigation facilities;
- Administrative services unit – shall be responsible for providing administrative and financial services to the organization, including among others irrigation service fee billing and collection.

In the light of the IMT policy and rationalization of NIA, the existing IAs shall be strengthened and new IAs shall be developed to enable them to tend to their farms properly and still actively participate in the operation and management of secondary and tertiary facilities. The IAs shall be responsible for distributing water among farmer-members, and other roles that will have to be specified in their IMT contracts.

The system organization and the IAs other than those in existing CISs shall negotiate and enter into service agreement or contract with the IAs of the beneficiary CISs, considering among others: the current obligations of the IAs with NIA relative to previous investments in their CISs, if any; water supply augmentation procedures and schedules to the CISs; and financing the operation and maintenance of the new system.

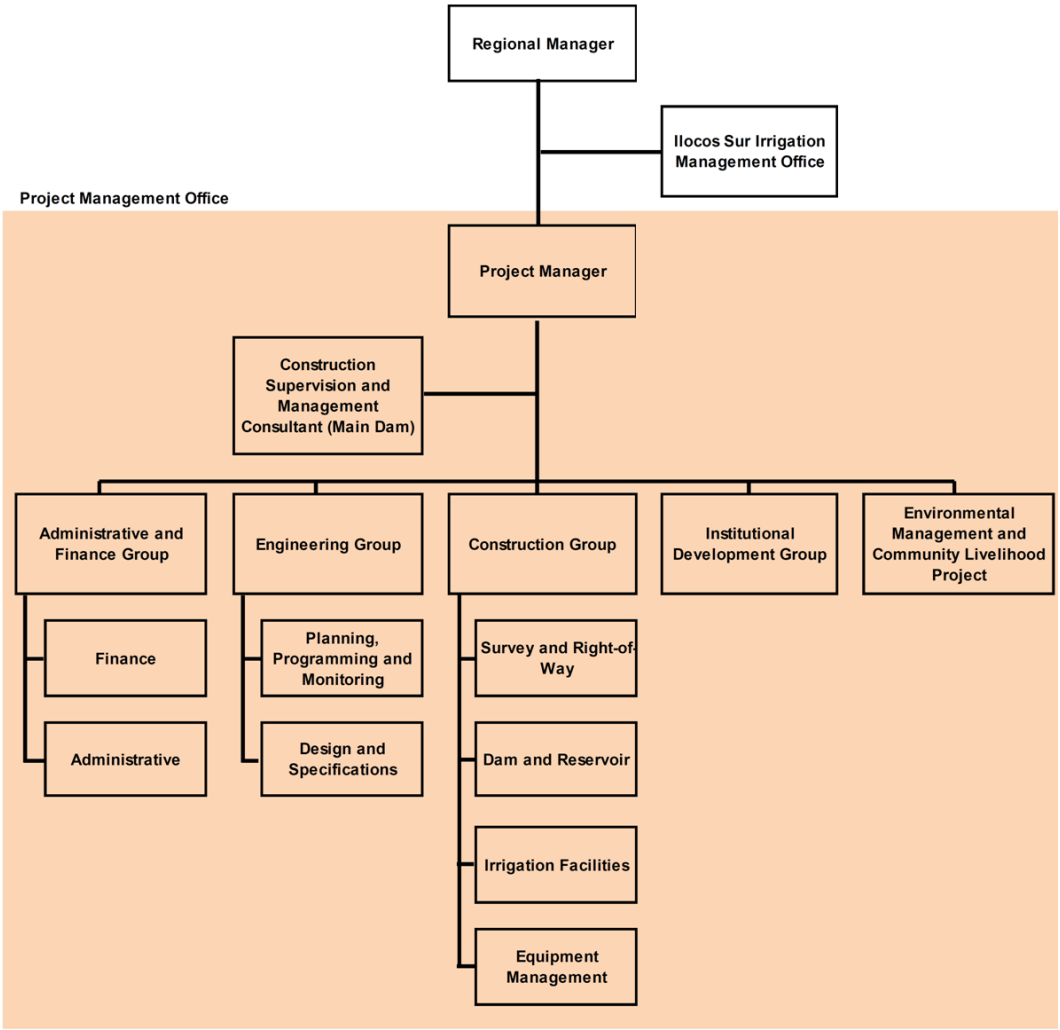


Figure 2-13: Proposed Organizational Structure

2.7.7 Abandonment Phase

The exposed earth structures may require regular rehabilitation to prevent soil erosion. Otherwise, the dam structure will remain standing indefinitely. Abandonment shall cover the temporary structures used during pre-construction and construction phases such as storage yards, camp house, and temporary staging areas.

In case abandonment is imperative due to force majeure or any other reasons, the structures, equipment and other related facilities may be used for other applications. Otherwise, the removal of

structures, equipment and machineries from the existing site will be done to minimize possible threats to the surrounding environment.

An abandonment plan shall be formulated with consideration of the following:

- Advice and properly compensate affected employees; separation fees or compensation fees will be provided to any displaced employees;
- Machines / Equipment dismantled will be sold to interested parties;
- Removal of Solid, Liquid and Hazardous Wastes within the site through a DENR-certified Waste Transporter/ Treater; and
- Clean up and possible remediation of the site, if future evaluations and testing suggest such activity is applicable.

Several transfer models of the Irrigation Management Transfer Program may be implemented by NIA and include the following:

Model 1
NIA manages the entire irrigation system but transfers to the IA some specific operation and maintenance (O and M) activities; canal maintenance, discharge monitoring, preparation of list of irrigated and planted areas, distribution of irrigation service fee (ISF) bills and campaign for ISF payment by farmers. Actual ISF collection may be added as a responsibility depending on the capacity and willingness of the IAs.

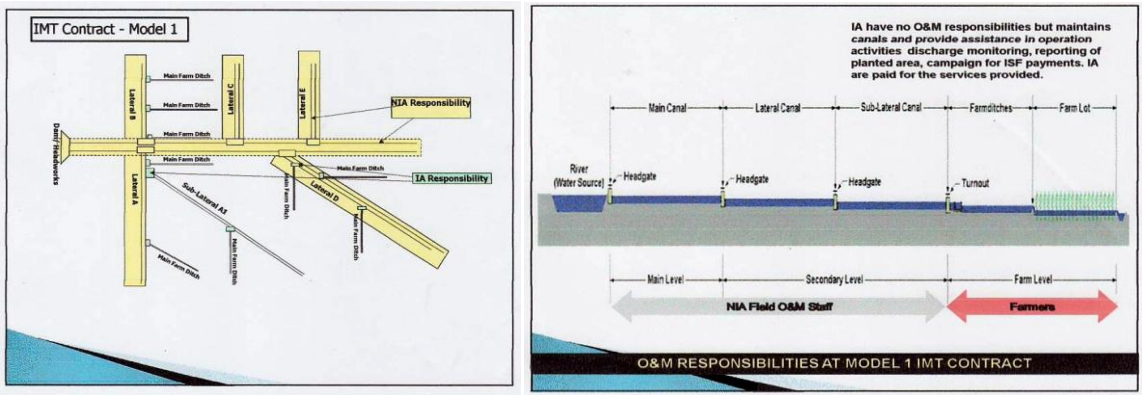


Figure 2-14: Transfer Model 1

The IA compensation/share is as follows:

The compensation for canal maintenance will be negotiated by NIA and IA and shall be based on standard labor capacities in clearing/maintaining canal and wage rate promulgated by the Regional Wage Board. The incentive will be based on actual improvement on the NIA and IA agreed base ISF level. The suggested base ISF collection level is 55%. Once the collection level is agreed, the IA will start to have a share of ISF collection above the agreed level. The maximum IA share is 15%, if collection is 100 %.

Model 2
NIA manages the main system from head works to the main canal down to the head gates of lateral canals and transfers to the IA, the management of the laterals, sub-laterals and terminal facilities.

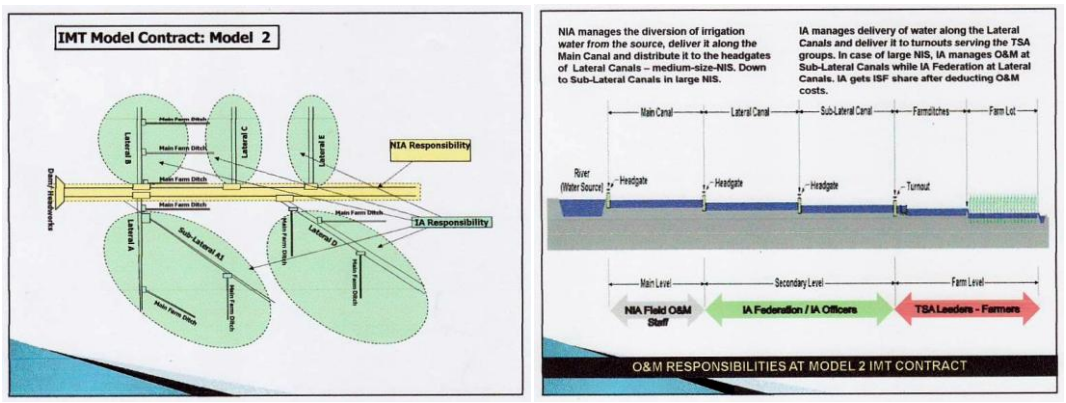


Figure 2-15: Transfer Model 2

The IA compensation/share in ISF collection is as follows:

The IA share from the current account collections for gravity systems shall be subject to negotiation with NIA based on the concept of fair sharing of responsibilities (burden) and benefits. For pump systems, the sharing of ISF collections in excess of the energy cost to be negotiated by the IA and the NIA will be based on the concept of fair sharing of burden and benefits.

Model 3
NIA manages the head works and portion of the main canal up to the junction of the first lateral canal and transfers to the IA the management of the rest of the system downstream of the specified junction.

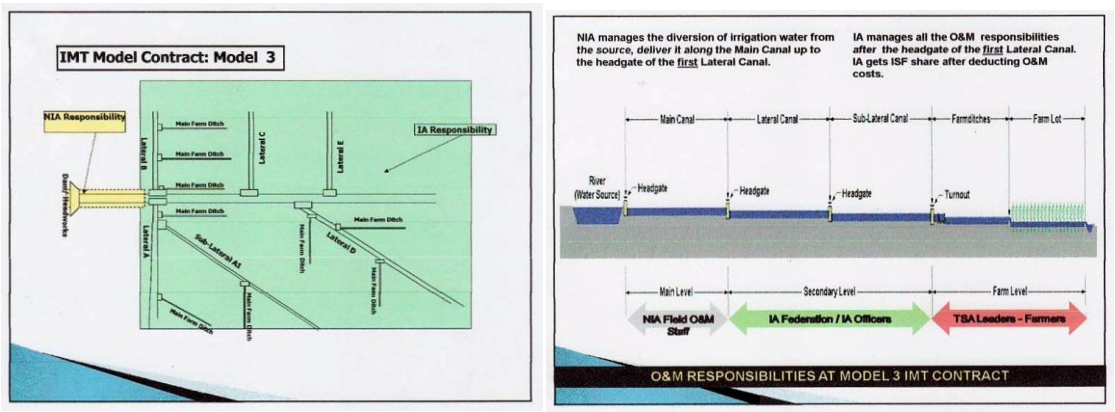


Figure 2-16: Transfer Model 3

The IA compensation/share for both gravity and pump systems are the same in Model 2.

Model 4
NIA completely transfers to the IA the management of the entire system including the head works and stops all its activities on the management of the system except monitoring and evaluation, and technical supervision as may be requested by the IA.

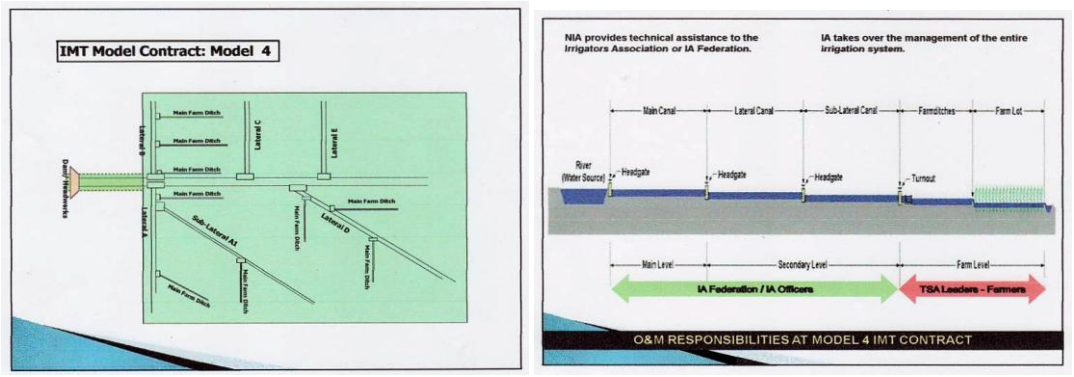


Figure 2-17: Transfer Model 4

The IA pays a System Rental Fee (SRF) equivalent to the money value of 1.50 cavans (75 kg) of dry paddy computed at government support price at the time of billing per hectare per year based on the Firmed Up Service Area (FUSA) of the system. SRF covers the cost of technical assistance and the cost of using the irrigation facilities. SRF may be paid by IA in 2 equal instalments.

Other Transfer Strategy Options

The NIA shall consider, on a case to case basis, other emerging possibilities on IMT. Such options may include:

1. Tripartite agreement among NIA, IA and LGU; and/or
2. Long-term lease contract; or management by competent third parties.

These options are subject to the recommendation of the Head of the responsible organization within NIA that handles the IMT Program and approval of the Administrator or the Board of Directors.

2.8 Manpower Requirements

Around 128 workers will be needed during the the construction phase of the project while around 14 wil be needed during the operation phase of the project. NIA will include in the contract provision with its contractors/suppliers to prioritize local residents in training and hiring personnel. NIA may also coordinate with local cooperatives and/or the local Public Employment Services Office to ensure wider dissemination of possibly available jobs for its proposed project. Qualification is not dependent on gender.**Table 2-9** shows the manpower requirements during construction and operation of the Project.

Table 2-9: Manpower Requirements

Project Phase	Position	No. of Personnel
Construction Phase	Laborers	≈120
	Foreman	4
	Supervisor	4
	Total	**128**
Operation Phase	Field Engineer	2
	Office Clerk	2
	Utility	2
	Driver	2
	Institutional Development	6
	Total	**14**

2.9 Project Investment Cost

The indicative Project Investment Cost is estimated at **Php 3,451,313,000.00**.

2.10 Project Schedule

The overall implementation schedule will take six (6) years including two years preparatory works and pre construction activities **Table 2-10.**

Table 2-10: Construction Implementation Schedule

Work Items	Preparatory Works		Construction			
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
1. Pre-construction						
Right-of-way and Damages						
Access Roads						
Civil Work Packaging						
Detailed Engineering Designs/						
Project Facilities						
Resettlement Implementation						
2. Tendering Contracts						
3. Dam Construction						
4. Main Canal Construction						
5. Laterals and On-Farm Construction						
6. Fishery Component						
7. Agricultural and Institutional Development						
8. Test Run for Constructed Facilities						
9. Rectification of Project Works						
10. Project Commissioning and Completion						

3 PUBLIC SCOPING MATERIALS

3.1 List of Invitees for Public Scoping

Proposed invitees for the Public Scoping:

Local Government Units:

- Hon. Ryan Luis Singson, Governor, Province of Ilocos Sur
- PPDO, Ilocos Sur
- Hon. Leopoldo Gironella Jr, Mayor, Salcedo, Ilocos Sur
- MPDO, Salcedo, Ilocos Sur
- Hon. Juanito Balingsat, Mayor, Galimuyod, Ilocos Sur
- MPDO, Galimuyod, Ilocos Sur
- Hon. Ferdinand Hernaez, Mayor, Santa Lucia, Ilocos Sur
- MPDO Santa Lucia, Ilocos Sur
- Hon. Henry Gallardo, Mayor, Gregorio del Pilar, Ilocos Sur
- MPDO Gregorio del Pilar, Ilocos Sur
- Atty. Virgilio Valle, Mayor, Santa Cruz, Ilocos Sur
- MPDO Santa Cruz, Ilocos Sur
- Hon. Ericson Gacula Singson, Mayor, Candon City, Ilocos Sur
- CPDO Candon City, Ilocos Sur
- Hon. Severino P. Galanga, Mayor, Banayoyo, Ilocos Sur
- MPDO Banayoyo, Ilocos Sur

Irrigator's Association:

- Nabucaan-Salcedo IA
- Sabangan-Bato IA
- Pagangpang- Legaspi IA
- Sacaang Mckinley IA
- Kalimugtong IA
- San Nicolas IA
- Caoplasan IA
- Alangigan #1 IA
- Alangigan #2 IA
- Tolentino IA
- Oaig Daya IA
- Palacapac IA
- Pias-Pila IA
- Cadmortisan IA
- Nagconventuan IA
- Pantar IA
- Pias-Cadaratan IA
- Sorian IA
- Cabugbugan- Cabluan IA
- Ubbog IA

Barangays

- Bulala-Leguey
- Ubbog
- Balidbid
- Baybayading
- Madarang

3.2 Draft Invitation Letter

05 March 2018

Hon._____
Mayor
_____, Ilocos Sur

Dear Hon. _____,

RE: Invitation to attend the Public Scoping for the proposed Gregorio del Pilar Impounding Project of the National Irrigation Administration 1

The National Irrigation Administraiton Regional Office 1 intends to develop the **Gregorio del Pilar Impounding Project** ("Project") to be located in the Municipaltiies of Salcedo, Gregorio del Pilar, Galimuyod, Santa Cruz and Santa Lucia, and the City of Candon, all in the Province of Ilocos Sur. The Project will involve the construction of an 89-m high zoned type earth fill dam, development of spillways, and canals. The project also involves the development of fisheries for livelihood, water supply for domestic consumption, service and access roads, quarry for the dam construction and flood control.

In line with the proposed Project, we would like to invite you to attend the Public Scoping scheduled on:

DATE : _____

TIME : _____

VENUE : _____

The Public Scoping will be a venue for the proponent to provide an overview of the proposed project, and for the stakeholders to raise their issues, questions and concerns regarding the proposed project. The concerns that will be gathered will be considered in the Environmental Impact Assessment that will be conducted, the objective of which is to identify the possible environmental impacts of the proposed projects and to formulate appropriate and effective mitigating measures for the perceived negative impacts and enhancement measures for the perceived benefits of the Project.

For moredetails, you may contact the EMB Regional Office at telephone number _____.
Thank you and we look forward to your participation.

Sincerely yours,

ATTY. MICHAEL DRAKE P. MATIAS
OIC, Chief
Environmental Impact Assessment and Management Division (EIAMD)

3.3 Draft Program for Public Scoping

Project Title: **Gregorio del Pilar Impounding Project**
Project Location: **Municipalities of Salcedo, Greogorio del Pilar, Santa Cruz and Santa Lucia, City of Candon, all in the Province of Ilocos Sur**
Project Proponent: **National Irrigation Administration Regional Office** 1
Date and Time of Scoping: _____
Scoping Venue/Address: _____

Time Allotted	Program of Activities	Person Responsible
7:30-9:00 am	Registration	LTI NIA1
9:00 – 9:15 am	Opening Prayer	LGU
	National Anthem	LGU
	Welcome Remarks	LGU Mayor
9:15-9:30 am	Introduction of Participants, Overview, Objectives and Expectation Setting of the Scoping	LTI NIA1
9:30 – 9:40 am	Overview of the Scoping Guidelines; Mechanics of the Scoping for the project,	DENR-EMB EIAMD Personnel/EMB Casehandler
9:40 – 10:00 am	Brief Presentation of Proposed Project, and EIA Process	LTI NIA1
10:00-11:00 am	Open Forum and Raising of Issues to be addressed by the EIA Study	LTI NIA1
11:15-11:30 am	Synthesis and Integration/ Summary of Issues and Agreements on Scoping	LTI NIA1 EIA Division Representative
11:30-12:00 nn	Closing Remarks, and Next Steps in the EIA Process	EMB RO EIAMD or representative

3.4 Presentation Materials for Scoping

Proposed presentation material for the Public Scoping si attached as

Annex 1**.**

4 PROOF OF CONDUCT OF IEC

The intial IEC for the Project was conducted last February 19, 2018 in Candon City. A total of 36 particpants from the five Local Government Units, twenty Irrigator's Association and five barangays attended the IEC activity. The presentation used for the IEC is attached as Annex 2 while the attendacnce for the said activity is attached as Annex 3. Letters to Local Government Units is attached as Annex 4. The IEC focused on the proposed project and the EIA process that will be undertaken. An open forum followed where the participants were able to raise their concerns about the project. Issues and concerns rasied during the IEC activity is shown in **Table 4-1** below while the photodocumentaiton of the said activity is shown in **Figure 4-1.**

Table 4-1: Issues and Concerns during the IEC Activity

Stakeholder	Issues/Concerns Raised
LGU have Salcedo raised concerns on how the project may affect the proposed infrastructure of the LGU if the proposed irrigation project is implemented.	LTI explained the concept of the Resettlement Action Plan and the Social Development Plan. LTI explained that while it will be impossible to recreate their current living condtion in the community to the relocation site, it is important that there is available information aobut the living standards of the possibly affected communities prior to project implementation to ensure that if the project proceeds, there is available information on the current living standards to serve as basis of comparison should relocation be necessary. As for the Social Development Plan, it is aprt of the study to formulate the said plan in anticipation of the possible social impacts should the project be implemented. The SDP will be formulated to complement and/or coincide with the plans of the LGUS an the needs of the communities specially those that may be affected by the project. LTI further explained that the securing of the Environmental Compliance Certificate does not guarantee project implementation. Rather, it is an asusarance to stakeholders that environmental studies have been conducted for the project and the potential environmental impacts of the project has been identified and appropriate measures would be in place should the project push through.
LGU Salcedo also expressed concern on the possible loss of land/asset due to the inundation (reservoir area).	
Brgy. Captain of Bulala Leguey expressed his concern on the proposed possible relocation as a result of the project. He maintained that it is difficult to recreate and/or replace the assets that will be lost (i.e., planted trees, crops, housing, etc.)	
Representative from Lowland IAs expressed support for the Project and experessed gratitude to upland Barangay representatives for allowing the conduct of the study.	

Figure 4-1: Photodocumentation of IEC Activities

(A) Engr. Eddie Alonso of NIA 1 giving welcome message.

(B) Mr. Mark Abrenica of LTI presents the Project and the EIA Process

(C) Open Forum

Annex 1: Presentation Material for Public Scoping

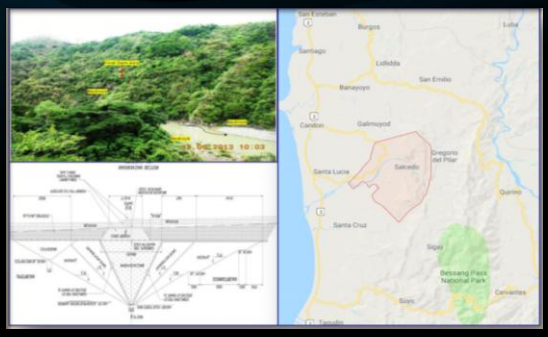
Annex 2: Presentation during the IEC Activity

Annex 3: Attendance Sheet February 19, 2018 IEC

Annex 4: Letters to Local Government Units

Annex 5: ECC Application Screening and Scoping Form

GEN. GREGORIO DEL PILAR IMPOUNDING PROJECT



PUBLIC SCOPING
(*DATE*)
(*VENUE*)

PROJECT INFORMATION

Project Name	**Gen. Gregorio del Pilar Impounding Project**
Project Type	Infrastructure Project (Flood Control, Irrigation, Water Supply, Fisheries and Hydropower)
Project Location	**Province of Ilocos Sur** --Municipalities of Salcedo, Galimuyod, Gregorio del Pilar, Sta Lucia and Sta Cruz --City of Candon
Nature of Project	Irrigation and Dam Project
Project Size/Scale	5,000 hectares

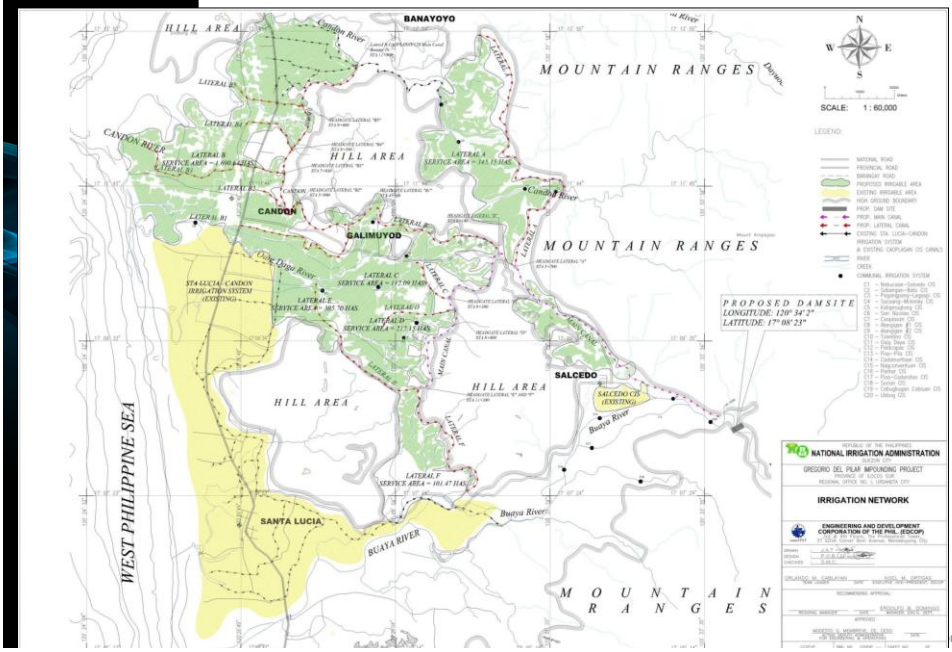
PROJECT COMPONENTS

Project Components	Project Description Summary	
1. Agriculture and Irrigation IncludeS Canals, Dams and Appurtenant Structures		
Service Area	New Service Area	1,800 ha
	Existing Communal Irrigation System	1,777 ha
	Sta Lucia-Candon Irrigation System	1,423 ha
	Total Service Area	5,000 ha
Dam	Location: 17° 08' 23"N 120° 34' 02"E Type: Zoned type of rock and earthfill dam Height from River Bed: 89 m Normal Storage Capacity: 86.54 MCM Normal Reservoir Area: 245.44 ha	
Spillway	Length: 175m Width: 80m	
Canals	Diversion Canal	1.5 km
	Main Canal	11.4 km
	Lateral	45.61 km

PROJECT COMPONENTS

2. Flood Control	The project will minimize flooding in the areas where Buaya River passes through as it reduces peak flows during the occurrence of typhoons
3. Water Supply	Domestic water supply for the Candon City Water District at 0.046 m3/s
4. Rockfill Quarry	6 possible quarry sites identified
5. Service Roads	3.9 km of new roads; rehabilitation of existing roads
6. Fishery	Fishery component consists of the construction and production of fixed floating cages in at least 22 hectares within the reservoir area

PROJECT LOCATION



PROJECT BENEFITS

- Raise average annual farm income per household in the Project area from Php 18, 207 to 54,290 at 2013 prices by 2023.
- Increase annual irrigated rice area from 3,360 hectares to 5,000 ha.
- Raise the annual production of rice in the Project area from 20,385 tons without project to 52,500 t by 2023.
- Promote the production of fish using cage nets in about 22 hectares of the reservoir area, producing as much as 2,279 tons annually.

PROJECT BENEFITS

- The project will minimize flooding in the areas where Buaya River passes through as it reduces peak flows during the occurrence of typhoons.
- The project will also provide initial structures to allow a private proponent to put up power plant downstream of the dam to generate electricity from releases for irrigation.
- The project is also expected to provide domestic water supply for the Candon City Water District at 0.046 m3/s.

Philippine EIS System ayon sa DENR Administrative Order No. 30, Series of 2003 (DAO 2003-30)

Ang Philippine EIS System ay ipinagtibay ng PD No. 1586 (1978)

Nasasaad sa Seksyon 4 na "*walang sinumang tao o korporasyon ang maaaring magsagawa o magpatakbo ng anumang proyektong deklaradong ECP o proyekto sa deklaradong ECA nang hindi kumukuha ng Environmental Compliance Certificate (ECC).*"

<u>Ang ECC ay hindi permit</u>, kundi isang patunay na ang isang proyekto ay nagdaan sa masusing pagsusuri at ang mga nasasaad na "mitigating measures" sa isang dokumento ay magiging epektibo kung ipatutupad ang mga ito nang maayos at naaayon sa "Environmental Management Plan" o EMP

Hindi nangangahulugan na kapag nagsagawa ng isang EIA ay matutuloy na ang isang proyekto

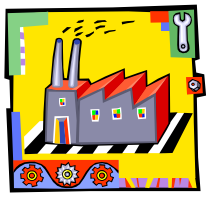
Ang mga resulta ng EIA ay magagamit ng…

-Project Proponent sa pagdisenyo ng mga akmang “mitigating measures” at sa pagdesisyon kung saan at papaano ipapatupad ang isang proyekto

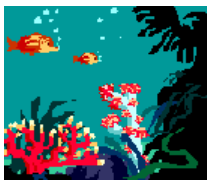
- LGU at mga apektadong sektor sa mga desisyon may kinalaman sa proyekto

Nasasakupang Proyekto ayon sa PP No. 2146 (1981)

- **Environmentally Critical Projects (ECPs)**



- **Projects located in Environmentally Critical Areas (ECAs)**



Environmental Impact Assessment (EIA)

Proseso ng pagtaya ng maaaring maging epekto ng isang proyekto sa kapaligiran, at pagdisenyo ng mga akmang pamamaraan o "mitigating measures" upang maiwasan o mabawasan ang masasamang epekto ng proyekto

Ano ang mga nilalaman ng isang EIA Study

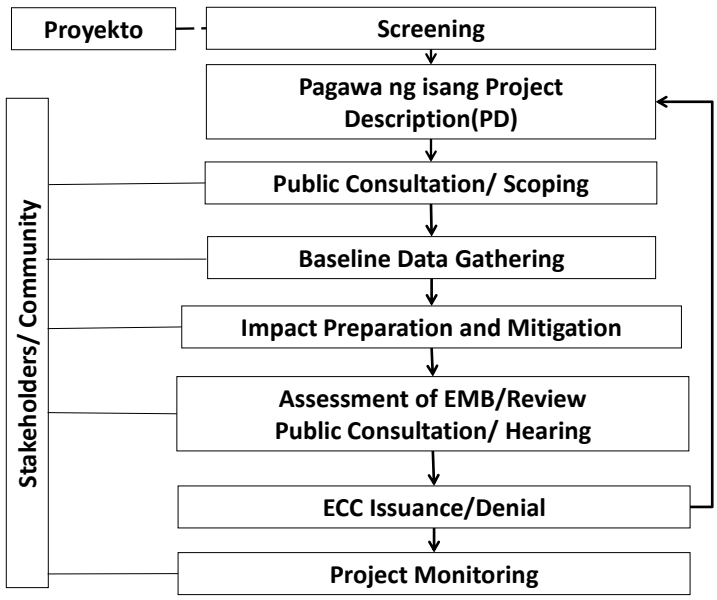
Ang dokumento o report na resulta ng EIA na…

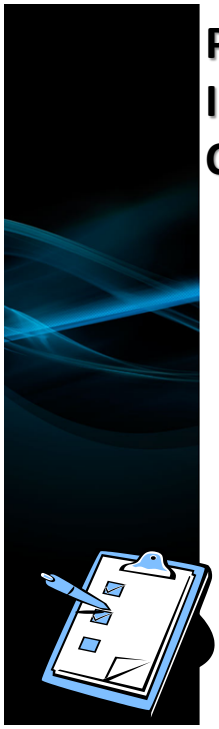
- **Nagtutukoy sa binabalak na proyekto**
- **Nagtutukoy sa kasalukuyang kalagayan ng kapaligiran**
- **Nagtutukoy sa mga maaaring epekto ng proyekto sa kapaligiran**
- **Nagtutukoy sa mga gawaing maaaring makababawas sa mga masasamang epekto o magpapalawig ng mga makabubuting epekto ng proyekto (mitigating and enhancement measures)**

Anu-ano ang mga Bahagi ng EIA?

- IEC (Information, Education and Communication)
- Scoping /Public Consultation
- Baseline Characterization
- Impact Assessment and Mitigation
- EIA Preparation
- EIA Review
- Public Hearing/Consultation
- Decision on ECC issuance
- Monitoring

Proseso ng Pagsuri sa EIA





Pagpapalawig ng Impormasyon (IEC-Information, Education and Communication) at Scoping

Ang bahagi ng proseso ng EIA kung saan ang impormasyon ukol sa proyekto ay ipinakakalat sa iba't ibang sektor at kinakalap ang iba't ibang isyu at inaalam ang mga kinakailangang pag-aaral o pagsisiyasat na dapat isama sa pagsasagawa ng EIA

Anu-ano ang mga Layunin ng Scoping?

- **Mapag-ugnay ang DENR at ang Proponent**
- **Pakinggan ang mga isyu at agam-agam ng mga taong maaapektuhan ng proyekto**
- **Matukoy ang mga isyu at alternatibong dapat suriin**
- **Matukoy ang mga batas na dapat sunurin at bigyan pansin sa pagsasagawa ng proyekto**

Sinu-sino ang Kasama sa Scoping?

- Kinatawan ng DENR mula sa EMB Central o Regional Office
- Miyembro ng EIA Review Committee (EIARC/RevCom)
- Project Proponent
- EIS Preparer
- Kinatawan ng LGU
- Kinatawan ng NGO/PO
- Kinatawan ng iba pang maaapektuhang sektor

Baseline Characterization

Ang bahagi ng EIA kung saan susuriin o pag-aaralan ang kasalukuyang kondisyon o antas ng iba't ibang aspeto ng kapaligiran (lupa, halaman, hayop, tubig, hangin at tao) bago isagawa ang proyekto

Baseline Characterization

Ito ay magsisilbing gabay upang matukoy ang anumang pagbabago sa kapaligiran na maaaring maganap bunga ng pagsasagawa ng isang proyekto

Baseline Characterization

- Geology and Topography
- Soil and Land Use




Baseline Characterization
Water Quality Freshwater

Baseline Characterization

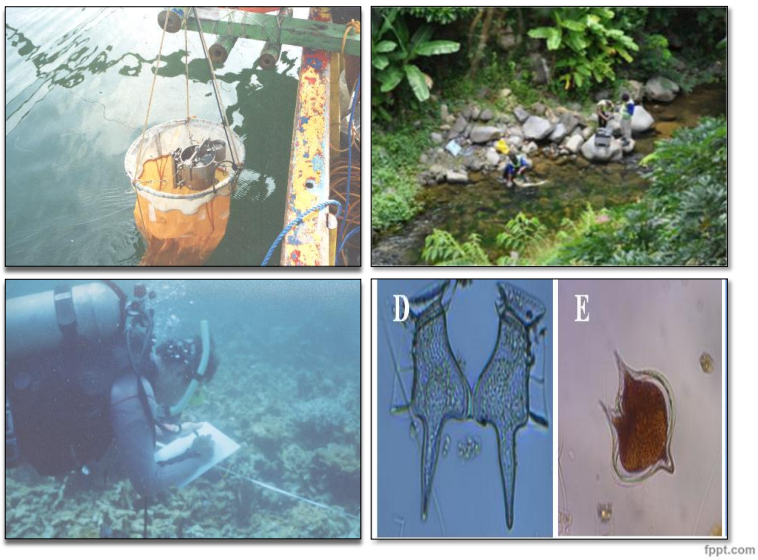
- Terrestrial Biology

Baseline Characterization

- Air Quality and Noise

Baseline Characterization

- Freshwater and Marine Biology



Baseline Characterization

- Socio-Economic and Culture



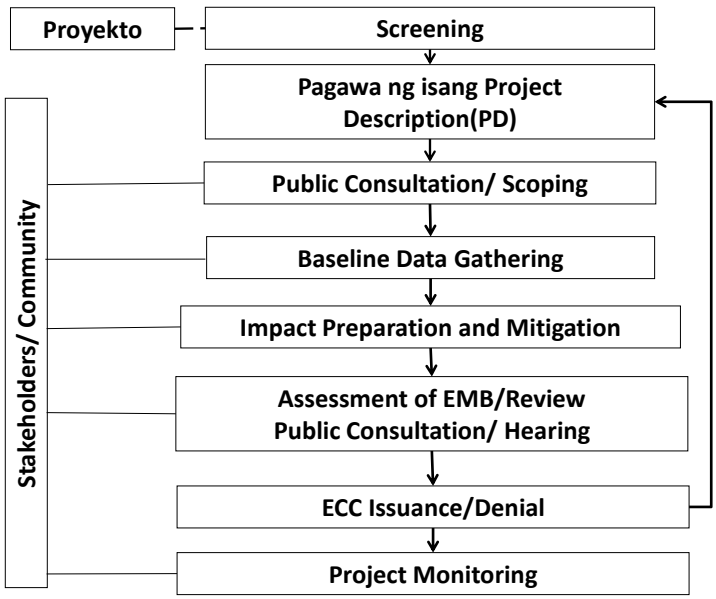

Impact Prediction, Assessment and Environmental Management Plan

- Pagtaya ng maaaring maganap na mga epekto ng proyekto sa kapaligiran
- Pagmungkahi ng mga alternatibo at pamamaraan upang maiwasan o mabawasan ang maaaring masasamang epekto ng proyekto
- Paghain ng mga alternatibong susuriin upang mapanatili ang antas ng kapaligiran at masiguro ang maayos na kabuhayan ng mga mamamayang maaapektuhan

Mga Plano at Programa Upang Masiguro ang Pag-alaga sa Kapaligiran

- **Environmental Management Plan (EMP)**
- **Environmental Monitoring Plan (EMoP)**
- **Social Development Plan**
- **Self-Monitoring Report (SMR)**

Proseso ng Pagsuri sa EIA



Kahalagahan at Benepisyo ng Public Participation

Ang "public participation" ang pinaka-epektibong proseso ng pagtukoy sa mga sumusunod

- **Makatutulong sa pagtukoy at pagtugon sa mga isyu at agam-agam ng maaapektuhang sektor**
- **Pagtutok sa mga pangunahing isyu**
- **Matukoy ang mga alternatibo**
- **Makapagmungkahi ng mga experto**
- **Mapalawig ang tiwala**
- **Mapag-ibayo ang paraan ng pagpapasya**
- **Maisulong ang responsibilidad ng lipunan sa pangangalaga ng kapaligiran**

Saan Naipapatupad ang Public Participation?

Ang partisipasyon ng mga apektadong sektor ay makikita sa…

- **IEC**
- **Scoping at Public Consultation**
- **Baseline Characterization**
- **Public Hearing o Public Consultation**
- **Monitoring**
- **Pagbuo ng SDMP**

ANNEX 2: PRESENTATION FOR IEC

GEN. GREGORIO DEL PILAR IMPOUNDING PROJECT

PROJECT BRIEFING/IEC
FEBURARY 19, 2018
ALOHA NUI HOTEL, CANDON CITY, ILOCOS SUR

Lichel Technologies, Inc.
1403 Prestige Tower Condominium,
F. Ortigas Jr. Rd., Ortigas Center,Pasig City

National Irrigation Administration
NIA - Region I
Bayaoas, Urdaneta City, Pangasinan

PROJECT INFORMATION

Project Name	**Gen. Gregorio del Pilar Impounding Project**
Project Type	Infrastructure Project (Flood Control, Irrigation, Water Supply, Fisheries and Hydropower)
Project Location	**Province of Ilocos Sur** --Municipalities of Salcedo, Galimuyod, Gregorio del Pilar, Sta Lucia and Sta Cruz --City of Candon
Nature of Project	Irrigation and Dam Project
Project Size/Scale	5,000 hectares

PROJECT COMPONENTS

Project Components	Project Description Summary	
1. Agriculture and Irrigation IncludeS Canals, Dams and Appurtenant Structures		
Service Area	New Service Area	1,800 ha
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Dam	Location: 17° 08' 23"N 120° 34' 02"E Type: Zoned type of rock and earthfill dam Height from River Bed: 89 m Normal Storage Capacity: 86.54 MCM Normal Reservoir Area: 245.44 ha	
Spillway	Length: 175m Width: 80m	
Canals	Diversion Canal	1.5 km
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	Lateral	45.61 km

PROJECT COMPONENTS

2. Flood Control	The project will minimize flooding in the areas where Buaya River passes through as it reduces peak flows during the occurrence of typhoons
3. Water Supply	Domestic water supply for the Candon City Water District at 0.046 m3/s
4. Rockfill Quarry	6 possible quarry sites identified
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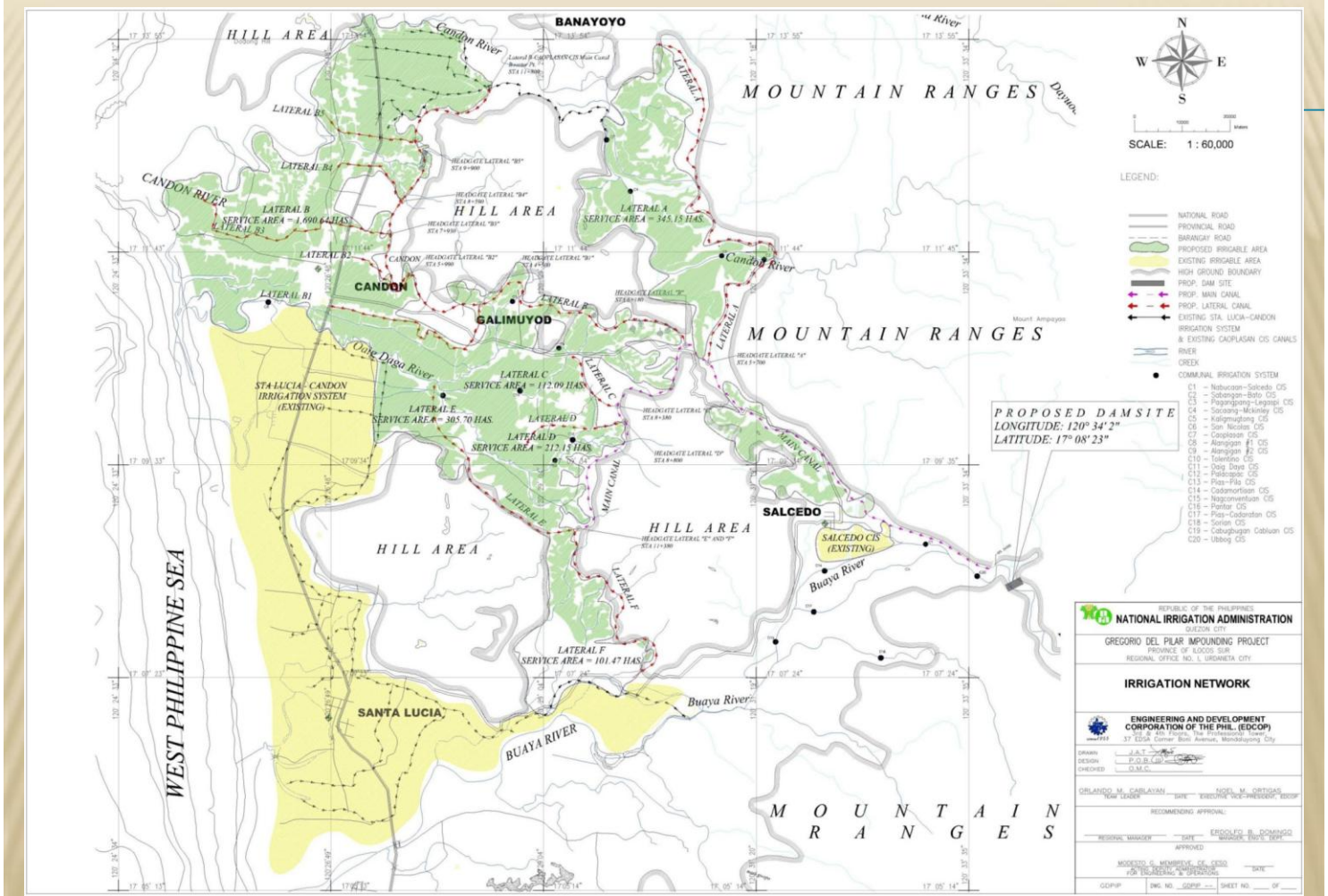


PHILIPPINE EIS SYSTEM
AYON SA
DENR ADMINISTRATIVE ORDER NO. 30, SERIES OF 2003
(DAO 2003-30)

PATAKARAN NG DENR SA PAGPAPATUPAD NG PHILIPPINE ENVIRONMENTAL IMPACT STATEMENT (EIS) SYSTEM

"makamit at mapanatili ang maayos na balanse sa kaunlarang pang-sosyo-ekonomiko at pag-alaga sa kapaligiran"

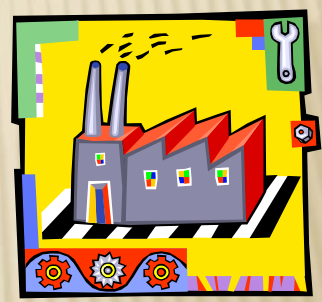
ANG PHILIPPINE EIS SYSTEM AY IPINAGTIBAY NG PD NO. 1586 (1978)

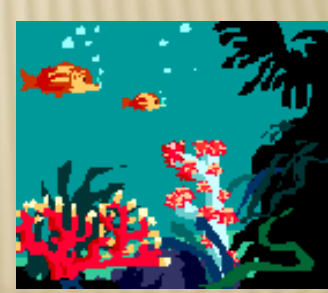
Nasasaad sa Seksyon 4 na "*walang sinumang tao o korporasyon ang maaaring magsagawa o magpatakbo ng anumang proyektong deklaradong ECP o proyekto sa deklaradong ECA nang hindi kumukuha ng Environmental Compliance Certificate (ECC).*"

Ang ECC ay hindi permit, kundi isang patunay na ang isang proyekto ay nagdaan sa masusing pagsusuri at ang mga nasasaad na “mitigating measures” sa isang dokumento ay magiging epektibo kung ipatutupad ang mga ito nang maayos at naaayon sa “Environmental Management Plan” o EMP

NASASAKUPANG PROYEKTO AYON SA PP NO. 2146 (1981)

- Environmentally Critical Projects (ECPs)
- Projects located in Environmentally Critical Areas (ECAs)

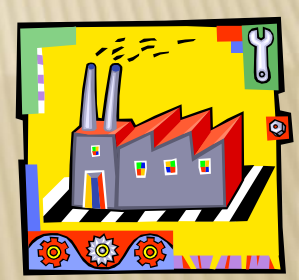




ECPS

Heavy Industries

- *Petroleum and petro-chemical industries, including oil and gas*
- *Smelting plants*



Resource Extractive Industries

- *Major mining and quarrying industries*

ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

Proseso ng pagtaya ng maaaring maging epekto ng isang proyekto sa kapaligiran, at pagdisenyo ng mga akmang pamamaraan o "mitigating measures" upang maiwasan o mabawasan ang masasamang epekto ng proyekto

ANO ANG MGA NILALAMANG NG ISANG EIA STUDY

Ang dokumento o report na resulta ng EIA na...

- Nagtutukoy sa binabalak na proyekto
- Nagtutukoy sa kasalukuyang kalagayan ng kapaligiran
- Nagtutukoy sa mga maaaring epekto ng proyekto sa kapaligiran
- Nagtutukoy sa mga gawaing maaaring makababawas sa mga masasamang epekto o magpapalawig ng mga makabubuting epekto ng proyekto (mitigating and enhancement measures)
- Pag-aaral ng mga kasalukuyang epekto ng operation (EPRMP)

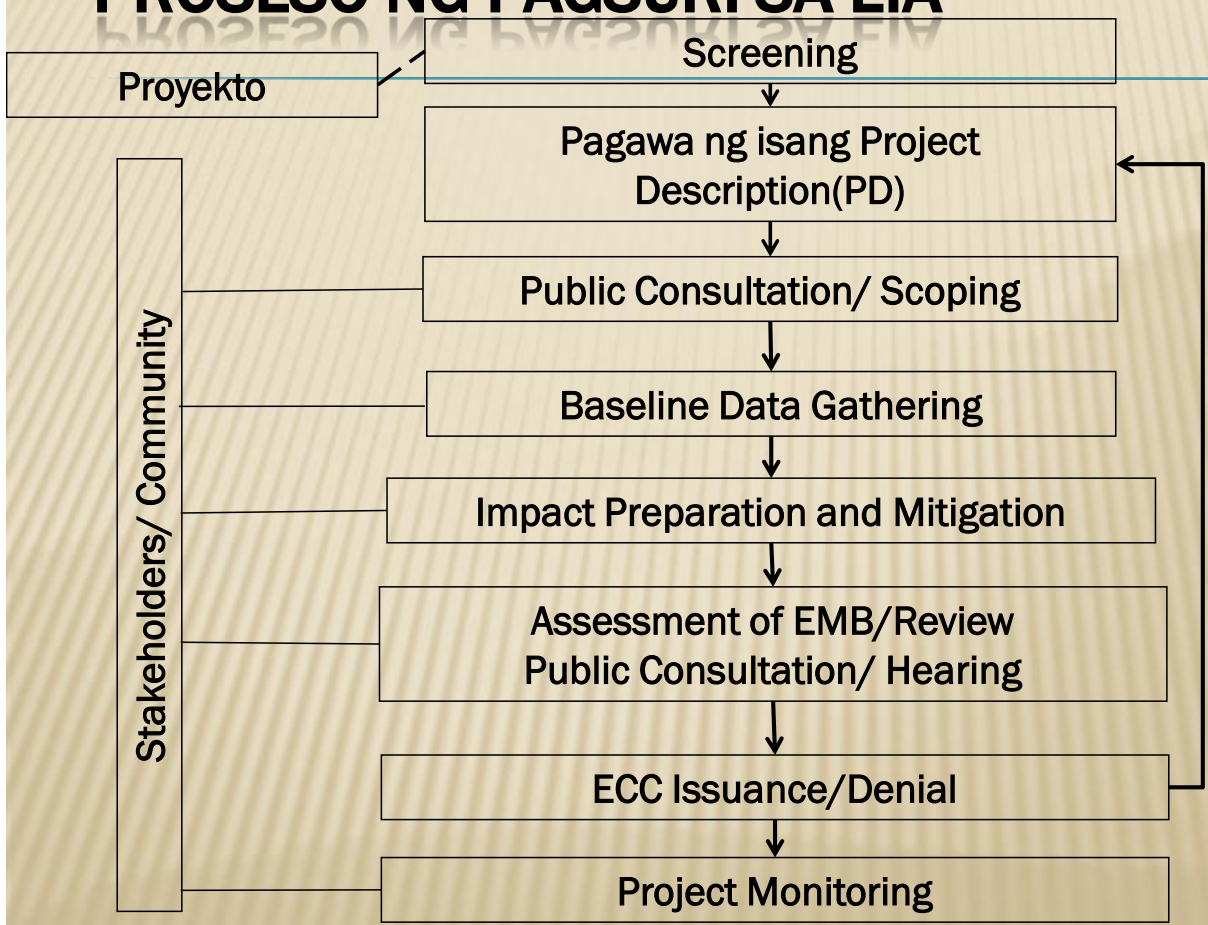
ANU-ANO ANG MGA BAHAGI NG EIA?

- Project Screening
- IEC (Information, Education and Communication)
- Scoping /Public Consultation
- Baseline Characterization
- Impact Assessment and Mitigation
- EIA Preparation
- EIA Review
- Public Hearing/Consultation
- Decision on ECC issuance
- Monitoring

PROSESO NG PAGSURI SA EIA

- Procedural Review
- Substantive Review

PROSESO NG PAGSURI SA EIA

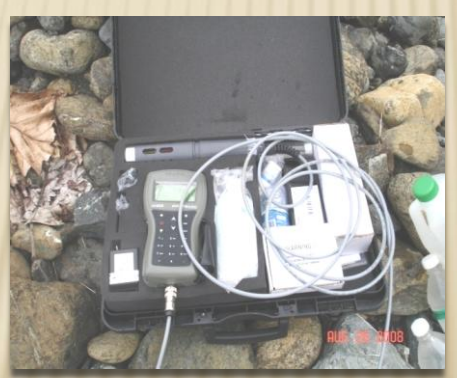


BASELINE CHARACTERIZATION

- Geology and Topography
- Soil and Land Use

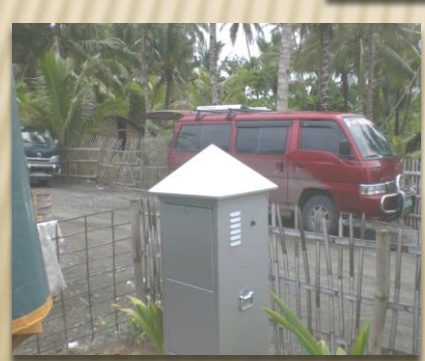
BASELINE CHARACTERIZATION

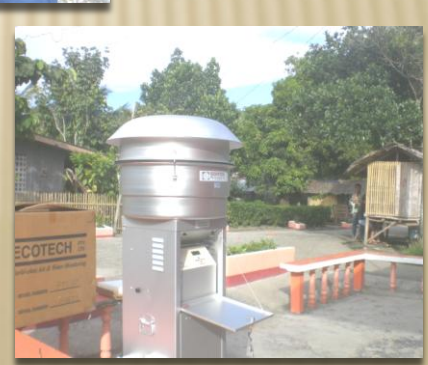
- Water Quality (Freshwater and Marine)



BASELINE CHARACTERIZATION

- Air Quality and Noise



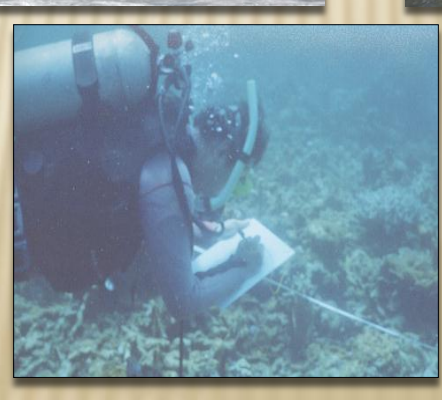


BASELINE CHARACTERIZATION

- Terrestrial Biology

BASELINE CHARACTERIZATION

- Freshwater and Marine Biology



BASELINE CHARACTERIZATION

- Socio-Economic and Culture

KAHALAGAHAN AT BENEPISYO NG PUBLIC PARTICIPATION

Ang "public participation" ang pinaka-epektibong proseso ng pagtukoy sa mga sumusunod

- Makatutulong sa pagtukoy at pagtugon sa mga isyu at agam-agam ng maaapektuhang sektor
- Pagtutok sa mga pangunahing isyu
- Matukoy ang mga alternatibo
- Makapagmungkahi ng mga experto
- Mapalawig ang tiwala
- Mapag-ibayo ang paraan ng pagpapasya
- Maisulong ang responsibilidad ng lipunan sa pangangalaga ng kapaligiran

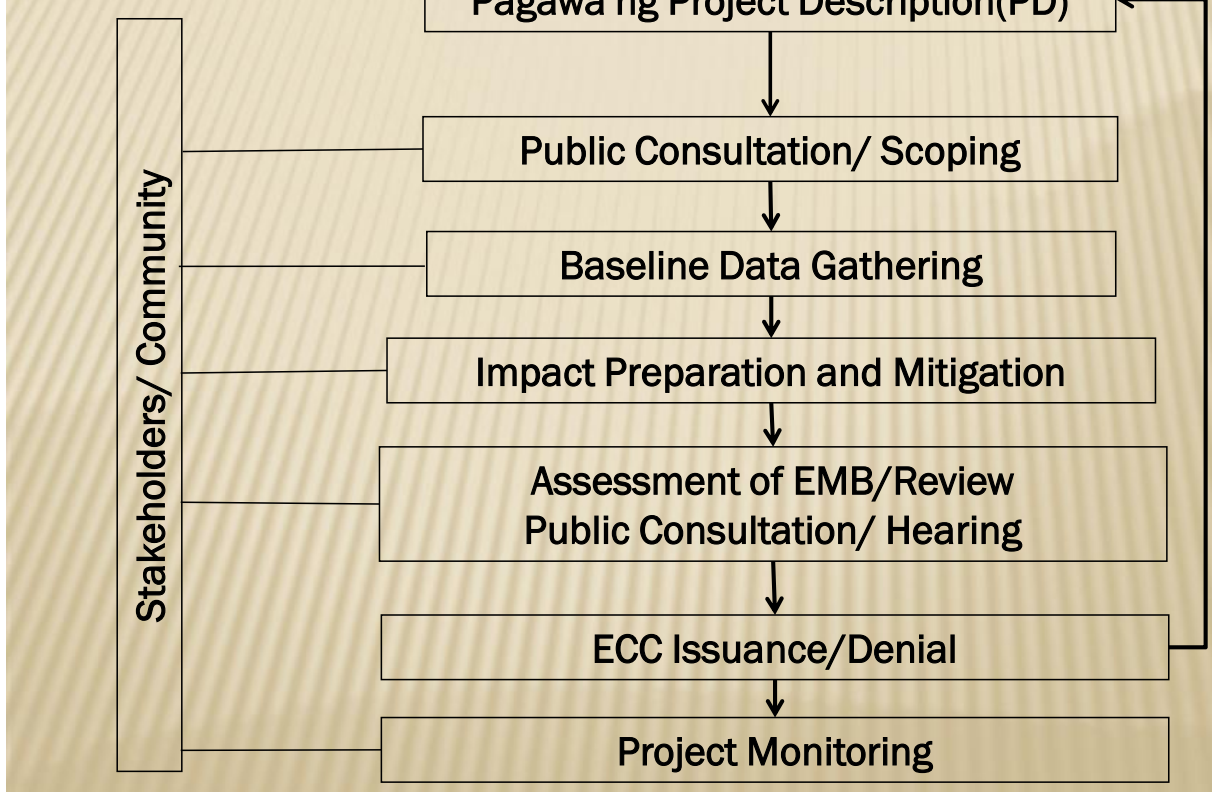
SAAN NAIPAPATUPAD ANG PUBLIC PARTICIPATION?

Ang partisipasyon ng mga apektadong sektor ay makikita sa...

- IEC
- Scoping at Public Consultation
- Baseline Characterization
- Public Hearing o Public Consultation
- Monitoring
- Pagbuo ng SDMP

Ang Public Hearing o Public Consultation ay isinasagawa para malaman ng EMB ang saloobin at agam-agam ng mga taong maaring maapektuhan ng Proyekto (Positibo man o Negatibo) Bago sila mag desisyon kung Bibigyan ng ECC o Palalawigin pa ang Sakop ng Kasalukuyang ECC ang Isang Proyekto

PROSESO NG PAGSURI SA EIA



Maraming Salamat Po!

ANNEX 3: IEC ATTENDANCE

Lichel Technologies, Inc.

National Irrigation Administrati
NIA - Region I
Bayaoas, Urdaneta City, Pangasi

INFORMATION EDUCATION AND COMMUNICATION ACTIVITY
SOCIAL AND ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED GREGORIO DEL PILAR IMPOUNDING PROJECT
ATTENDANCE
ALOHA NUI HOTEL, CANDON CITY ILOCOS SUR | FEBRUARY 19, 2018

	NAME	Gender		IA	CONTACT NO.	SIGNATURE
		M	F			
1	ANTONIO A. TOLENTINO	/		QUENTIBAB INTEGRATED	09465247543	[illegible]
2	DAN K. BATOO-EY	/		QUENTIBAB INTEGRATED		[illegible]
3	MELCHOR B. JAXINAR			MAMPOG MANTANAS IRRIGATORS	09483568595	M Jaxinar
4	Pepito G. Sanchez	/		ALVIAR	09178200211	[illegible]
5	Benjamin Valdez			APASAN	09973824467	[illegible]
6	Ridel V. Gapate			SALCEDO	09752510668	[illegible]
7	SATURNINO H. HABER			KASAMUGAN SABANGAN	09[illegible]9900723	[illegible]
8	Reynaldo V. Camus			Cayeluan I.A.	09065597748	[illegible]
9	TERRY D. MADRID			SIRMATA	09973063553	[illegible]
10	Hipolito H. Alcodia			SIRMATA	09266082125	[illegible]

Lichel Technologies, Inc.

National Irrigation Administrati
NIA - Region I
Bayaoas, Urdaneta City, Pangasi

INFORMATION EDUCATION AND COMMUNICATION ACTIVITY
SOCIAL AND ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED GREGORIO DEL PILAR IMPOUNDING PROJECT
ATTENDANCE
ALOHA NUI HOTEL, CANDON CITY ILOCOS SUR | FEBRUARY 19, 2018

	NAME	Gender		IA	CONTACT NO.	SIGNATURE
		M	F			
1	LAUKEANO "RAUL" ROLDAN	✓		BRY. CAPTAIN	09278885667	
2	FRANCISCA F. FRANCIA		✓	P.B.	09472748398	
3	Valiant Colong Jr			Nabucaan-Laleodo IA PB		
4	ERNESTO Laoodan			PB		
5	Arthur Lacaden			Farmer's leader		
6	MOISES CUPCING			Farmer Leader		
7	RICARTE CUPLANG			Tribal Chieftain		
8	MANUEL D BAIBIKO			SF SAPANG	09177730248 GAUMUYOD I.S.	
9	Edmund V. Gabaan			Allengigan II	09179022426	
10	SKY RAPAS			NIA DRWOO		

Lichel Technologies, Inc.

National Irrigation Administrati
NIA - Region I
Bayaoas, Urdaneta City, Pangasi

INFORMATION EDUCATION AND COMMUNICATION ACTIVITY
SOCIAL AND ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED GREGORIO DEL PILAR IMPOUNDING PROJECT
ATTENDANCE
ALOHA NUI HOTEL, CANDON CITY ILOCOS SUR | FEBRUARY 19, 2018

	NAME	Gender		IA	CONTACT NO.	SIGNATURE
		M	F			
1	EMILIO V ACOSTA	M		ROSANA FIA	09098[illegible]	
2	HENRY R. PIMENTEL	M		ROSANA FIA	09292647O3	
3	FLORENTINO C. HABAB	M		SALUVIC FIA	09198925183	
4	DANICO H. ESMAO	M		SALUVIC FIA	09508171296	
5	Victorino HALLASCON	M		BUKAUEBAN F.I.A		
6	Calixto Ragnel	M		11		
7	ROGELIO HABABAO			N/A		
8	Mia T. Quindipan		✓	NIA - STAFF	09265869643	
9	JOSE V. VALDEZ	✓		Kasalugan FIA		
10	MEPARD BADIACEN	-		MADAPANG FA	09061826447	

Lichel Technologies, Inc.

National Irrigation Administrati
NIA - Region I
Bayaoas, Urdaneta City, Pangasi

INFORMATION EDUCATION AND COMMUNICATION ACTIVITY
SOCIAL AND ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED GREGORIO DEL PILAR IMPOUNDING PROJECT
ATTENDANCE
ALOHA NUI HOTEL, CANDON CITY ILOCOS SUR | FEBRUARY 19, 2018

	NAME	Gender		IA	CONTACT NO.	SIGNATURE
		M	F			
1	DENNIS ALBERT A. SERRANO	✓		NIA - STAFF	0915 8768 770	
2	BERLITO A. [illegible]	✓		SINAMAR FIA	09275132253	
3	C. GIRONELLA JR.	✓		SALCEM	09275783147	
4	F2. BITENG JF2			SALCEDO	09062962353	
5						
6						
7						
8						
9						
10						

Lichel Technologies, Inc.

National Irrigation Administrati
NIA - Region I
Bayaoas, Urdaneta City, Pangasi

INFORMATION EDUCATION AND COMMUNICATION ACTIVITY
SOCIAL AND ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED GREGORIO DEL PILAR IMPOUNDING PROJECT
ATTENDANCE
ALOHA NUI HOTEL, CANDON CITY ILOCOS SUR | FEBRUARY 19, 2018

	NAME	Gender		IA	CONTACT NO.	SIGNATURE
		M	F			
1	Lourdes M. Pagadduan		✓	NIA-Staff (Gr. 100)	09167444335	
2	Cristeta O. Villanueva		✓	NIA Staff	09159745104	
3						
4						
5						
6						
7						
8						
9						
10						

ANNEX 4: LETTER TO LGUS

Lichel Technologies, Inc.

12 February 2018

OFFICE OF THE MUN. MAYOR
RECEIVED
DATE February 20, 2018
BY
SALCEDO, ILOCOS SUR

HON. LEOPOLDO GIRONELLA JR.
Municipal Mayor
Salcedo, Ilocos Sur

Dear **Hon. Gironella,**

The **National Irrigation Administration Region I (NIA I)** commissioned **Lichel Technologies, Inc.**, to conduct the **Social and Environmental Impact Assessment (SEIA)** for their Gen. Gregorio Del Pilar Impounding Project which involves the construction and operation of irrigation structures that will serve the City of Candon and the Municipalities Galimuyod, Sta. Lucia, Sta. Cruz and Salcedo all in the Province of Ilocos Sur. The major components of this proposed project are the following: main dam, spillway, diversion during construction, outlet works, and construction of new irrigation facilities. Other components include: institutional development, watershed management, fishery, flood control, and domestic water supply.

In line with this, we would like to inform you that we will be conducting various studies to establish baseline environmental conditions, public consultations, and socio-economic and perception surveys among the covered areas of the project. Also, we would like to request for the following documents which will greatly aid in the conduct of our study:

- Comprehensive Land Use Plan
- Municipal/City Profile
- Health Data (Morbidity, Mortality, endemic diseases, etc.)
- Municipal/City Development Plan
- Maps

These activities will allow the project proponent to identify the project's potential impacts, as well as develop appropriate environmental management plan. This is in compliance with Presidential Decree 1586, otherwise known as the Philippine Environmental Impact Statement System.

Yours truly,

LICHEL TECHNOLOGIES, INC.

RACHEL A. VASQUEZ
Managing Director

Unit 1403 Presitge Tower Condominium, F. Ortigas Jr. Road, Ortigas Center, Pasig City
Tel.: (02) 637-8209 Tel/Fax.: (02) 633-0094
E-mail: ravasquez@licheltechnologies.com

Lichel Technologies, Inc.

OFFICE OF THE MAYOR
GALIMUYOD, ILOCOS SUR
RECEIVED
DATE: February 20, 2018
TIME: 11:10 AM
BY:

12 February 2018

HON. JUANITO BALINGSAT
Municipal Mayor
Galimuyod, Ilocos Sur

Dear **Hon. Balingsat,**

The **National Irrigation Administration Region I (NIA I)** commissioned **Lichel Technologies, Inc.**, to conduct the **Social and Environmental Impact Assessment (SEIA)** for their Gen. Gregorio Del Pilar Impounding Project which involves the construction and operation of irrigation structures that will serve the City of Candon and the Municipalities Galimuyod, Sta. Lucia, Sta. Cruz and Salcedo all in the Province of Ilocos Sur. The major components of this proposed project are the following: main dam, spillway, diversion during construction, outlet works, and construction of new irrigation facilities. Other components include: institutional development, watershed management, fishery, flood control, and domestic water supply.

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Yours truly,

LICHEL TECHNOLOGIES, INC.

Rachel A. Vasquez

RACHEL A. VASQUEZ
Managing Director

Unit 1403 Presitge Tower Condominium, F. Ortigas Jr. Road, Ortigas Center, Pasig City
Tel.: (02) 637-8209 Tel/Fax.: (02) 633-0094
E-mail: ravasquez@licheltechnologies.com

Lichel Technologies, Inc.

12 February 2018

HON. FERDINAND HERNAEZ
Municipal Mayor
Santa Lucia, Ilocos Sur

Dear **Hon. Hernaez,**

The **National Irrigation Administration Region I (NIA I)** commissioned **Lichel Technologies, Inc.**, to conduct the **Social and Environmental Impact Assessment (SEIA)** for their Gen. Gregorio Del Pilar Impounding Project which involves the construction and operation of irrigation structures that will serve the City of Candon and the Municipalities Galimuyod, Sta. Lucia, Sta. Cruz and Salcedo all in the Province of Ilocos Sur. The major components of this proposed project are the following: main dam, spillway, diversion during construction, outlet works, and construction of new irrigation facilities. Other components include: institutional development, watershed management, fishery, flood control, and domestic water supply.

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Yours truly,

LICHEL TECHNOLOGIES, INC.

Rachel A. Vasquez

RACHEL A. VASQUEZ
Managing Director

OFFICE OF THE MAYOR
RECEIVED
DATE Feb. 20, 2018
BY Monet A. Iniga
STA. LUCIA, ILOCOS SUR

Unit 1403 Presitge Tower Condominium, F. Ortigas Jr. Road, Ortigas Center, Pasig City
Tel.: (02) 637-8209 Tel/Fax.: (02) 633-0094
E-mail: ravasquez@licheltechnologies.com

- 674-7973
- 09189907898
(Condrada Hotline)

Lichel Technologies, Inc.

12 February 2018

HON. ERICSON GACULA SINGSON
Municipal Mayor
Candon City, Ilocos Sur

Dear **Hon. Singson,**

The **National Irrigation Administration Region I (NIA I)** commissioned **Lichel Technologies, Inc.**, to conduct the **Social and Environmental Impact Assessment (SEIA)** for their Gen. Gregorio Del Pilar Impounding Project which involves the construction and operation of irrigation structures that will serve the City of Candon and the Municipalities Galimuyod, Sta. Lucia, Sta. Cruz and Salcedo all in the Province of Ilocos Sur. The major components of this proposed project are the following: main dam, spillway, diversion during construction, outlet works, and construction of new irrigation facilities. Other components include: institutional development, watershed management, fishery, flood control, and domestic water supply.

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Yours truly,

LICHEL TECHNOLOGIES, INC.

RACHEL A. VASQUEZ
Managing Director

OFFICE OF THE CITY MAYOR
RECEIVED
BY: Sheryl Acance
DATE: February 20 2018
TIME: 1:50 PM
CANDON CITY, I. SUR

09171149583

Unit 1403 Presitge Tower Condominium, F. Ortigas Jr. Road, Ortigas Center, Pasig City
Tel.: (02) 637-8209 Tel/Fax.: (02) 633-0094
E-mail: ravasquez@licheltechnologies.com

Lichel Technologies, Inc.

12 February 2018

HON. HENRY S. GALLARDO
Municipal Mayor
Gregorio Del Pilar, Ilocos Sur

Dear **Hon. Gallardo,**

The **National Irrigation Administration Region I (NIA I)** commissioned **Lichel Technologies, Inc.**, to conduct the **Social and Environmental Impact Assessment (SEIA)** for their Gen. Gregorio Del Pilar Impounding Project which involves the construction and operation of irrigation structures that will serve the City of Candon and the Municipalities Galimuyod, Sta. Lucia, Sta. Cruz and Salcedo all in the Province of Ilocos Sur. The major components of this proposed project are the following: main dam, spillway, diversion during construction, outlet works, and construction of new irrigation facilities. Other components include: institutional development, watershed management, fishery, flood control, and domestic water supply.

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Yours truly,

LICHEL TECHNOLOGIES, INC.

Rachel A. Vasquez
RACHEL A. VASQUEZ
Managing Director

RECEIVED
20 FEB 2018
Jesel Gironella
JESEL GIRONELLA
09069331356

Unit 1403 Presitge Tower Condominium, F. Ortigas Jr. Road, Ortigas Center, Pasig City
Tel.: (02) 637-8209 Tel/Fax.: (02) 633-0094
E-mail: ravasquez@licheltechnologies.com

Lichel Technologies, Inc.

12 February 2018

ATTY. VIRGILIO VALLE
Municipal Mayor
Santa Cruz, Ilocos Sur

Dear **Atty. Valle,**

The **National Irrigation Administration Region I (NIA I)** commissioned **Lichel Technologies, Inc**., to conduct the **Social and Environmental Impact Assessment (SEIA)** for their Gen. Gregorio Del Pilar Impounding Project which involves the construction and operation of irrigation structures that will serve the City of Candon and the Municipalities Galimuyod, Sta. Lucia, Sta. Cruz and Salcedo all in the Province of Ilocos Sur. The major components of this proposed project are the following: main dam, spillway, diversion during construction, outlet works, and construction of new irrigation facilities. Other components include: institutional development, watershed management, fishery, flood control, and domestic water supply.

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Yours truly,

LICHEL TECHNOLOGIES, INC.

Rachel A. Vasquez

RACHEL A. VASQUEZ
Managing Director

MAYOR'S OFFICE
RECEIVED
DATE 02-20-18
BY
STA. CRUZ, ILOCS SUR

Unit 1403 Presitge Tower Condominium, F. Ortigas Jr. Road, Ortigas Center, Pasig City
Tel.: (02) 637-8209 Tel/Fax.: (02) 633-0094
E-mail: ravasquez@licheltechnologies.com

077-674-7051
0946-524-0099
Russel
LGU - Sta. Cruz

ANNEX 5: SCREENING AND SCOPING FORM

ECC APPLICATION SCREENING FORM FOR HYDROPOWER/DAM PROJECTS
(Requiring EIS or EIS-based EPRMP)

Control No:_____
☐ 1st ☐2nd ☐3rd ___ th Screening

Date Submitted for Screening: _____
Form of Submission: ___ Hard ___ Digital
Project Title: **GEN. GREGORIO DEL PILAR IMPOUNDING PROJECT**
Project Location: Municipalities of Salcedo, Santa Lucia, Santa Cruz, Banayoyo, Galimuyod, Gregorio del Pilar and the City of Candon in the Province of Ilocos Sur
Project Proponent: National Irrigation Administration Regional Office 1
Address: Brgy Bayaoas, Urdaneta City, Pangasinan
Contact No: (075) 632 2776 Fax No: _____ Contact Person: _____
EIS Consultant: Lichel Technologies Inc
Address: 1403 Prestige Tower Condominium, F. Ortigas Jr. Rd. Ortigas Center Pasig City
Contact No: (02) 6378209 Fax No: (02) 6330094 Contact Person: Ms. Rachel A. Vasquez
Project Classification & Type (Based on Annex A of MC 014-005 Guidelines): Category A. 3.1.1. Dam Project Size >25 ah and > 20 million MCM: 5 ,000 ha service area
Project Status: ☑ New Project __ Existing Year of Establishment: N/A
With previous ECC? __ Yes ☑ No

Date of Technical Scoping: _____
Venue of Technical Scoping: _____

Checklist of Documentary Requirements

	Acceptable?		Screening Officers' Remarks
	Yes	No	
• Environmental Impact Statement (EIS)[1] (Include photograph or plates of project site, impact affected areas and communities and land-use plan showing compatibility of the proposed project)			
• Proof of Authority over the Project Site ☐ Water Rights/COC ☐ Lease Agreement ☐ Others:_____			
• Accountability Statements of Preparers & Proponent (see Annexes 2-21 & 2-22 of Revised Procedural Manual for DAO 2003-30)			
• Duly Accomplished Project Environmental Monitoring & Audit Prioritization Scheme (PEMAPS) Questionnaire (see Annex 2-7d of Revised Procedural Manual for DAO 2003-30)			

ACTION TAKEN: (Please check to indicate corresponding action taken)

☐ Document accepted; please submit ___ copies
EIARC Needed? ( ) Yes ( ) No Expertise Needed: _____
Processing Fee: PhP_____ (*Pay at EMB Cashier)* Review Fund: Based on WFP *(Pay to the duly authorized 3rd Party Review Fund Manager)*

☐ Document not accepted

O.R. # _____
Date _____

NOTED BY:

_____ _____
Screening Officer Section/Division Chief
Division

EMB Central Office
Screening Office Date: _____

[1] *Please refer to attached checklist of EIS Contents*

ECC APPLICATION SCREENING FORM FOR HYDROPOWER/DAM PROJECTS
(Requiring EIS or EIS-based EPRMP)

Control No:_____
☐ 1st ☐2nd ☐3rd ___ th Screening

Checklist of EIS Contents

Executive Summary (maximum of 5 pages)

Contents	Page #	Acceptable?	REMARKS
Project Fact Sheet PD Summary (1 page)			
Process Documentation of the conduct of EIA (1 page) *(EIA Team, EIA Study Schedule & Area, EIA Methodology, Public Participation)*			
Summary of Baseline Characterization Key Environmental Impacts and Management & Monitoring Plan and EMF & EGF Commitments.			

I. Project Description

Items to be Described	Specific Data Requirement	Page #	Acceptable?	REMARKS
1) Project Location and Area	a) Map showing sitio, barangay, municipality, province, region boundaries, vicinity, proposed buffers surrounding the area and Primary & secondary impact areas			
	b) Geographic coordinates (shape file data) of project area (use WGS 84 datum - GPS setting)			
	c) Rationale for selection primary & secondary impact areas			
	d) Discuss the accessibility of the project site/area			
2) Project Rationale	• Cite and focus on the need for the project based on national and regional/local economic development in terms of contribution to sustainable development agenda or current development thrusts. • Describe the justification for the Project with particular reference made to the economic and social benefits, including employment and associate economic development, which the project may provide. The status of the project should be discussed in a regional and national context.			
3) Project Alternatives	a) Cite criteria used in determining preliminary options for facility siting, development design, process/technology selection, resource utilization including discussion of the consequences of not proceeding with the project: • Contextualize site selection in terms of vulnerability/susceptibility to Liquefaction, Ground Shaking, Ground Rupture, Earthquake induced Landslides Volcanic eruptions, rain-induced landslide storm surge, tsunami, and flooding as well as extreme climatologic conditions (data can be obtained from NDRRMC and NAMRIA as well as mandated agencies) • Discuss the alternatives (type and location) considered and nominated during the course of selecting the best option for which the EIS is prepared; • Description of the bases upon which the alternatives were rejected in favor of the preferred option; • Description of the significant differences in environmental impacts among the alternatives considered. Siting: Alternative project locations including factors significant to the selection such as perception of affected communities with regards to project, ancestral domain issues, land classification, etc. Discuss other options on the siting of major components of the project within the project area. Discuss alternative location of access roads in case the preferred locations of the various components are found environmentally not feasible. Technology Selection/Operation Processes: Discuss project's advantage over alternative technologies, operation processes and engineering design Discuss alternative measures for the prevention of the occurrence of major impacts Resources: Discuss the alternatives considered for power generation and how the decisions were made. Discussion should also be in the context of climate change (e.g. use of renewable energy).			
	b) Reasons for selecting the preferred options delineated in terms of technical, commercial, social and natural			

ECC APPLICATION SCREENING FORM FOR HYDROPOWER/DAM PROJECTS
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	environmental aspects			
	c)After the determination, please indicate a summary of the comparative environmental impacts of each alternative			
4) Project Components	• Identification of Major components including technical details such as specifications, capacity, number, etc. (e.g. penstock, spillway, freeboard, etc.) • Specify the operations and processes			
	• Identification of other Support Facilities (i.e. emergency power, process control, early warning/alarm system, etc.) • Identification of infrastructure requirements (transport—road/rail/ship, energy, storm water drainage, Sewerage, Telecommunications, accommodation and other infrastructure),			
	• Identification of Pollution control devices and corresponding facility being served or connected Identification of waste management facilities and devices to address solid waste materials (domestic and hazardous and chemicals) air emissions, solid waste disposal, and wastewater			
	• General layout of facilities; • Footprint of proposed layout of project facilities (if any) • Maps should be provided showing the precise location of the project area, and in particular, the location and boundaries of project area, location and footprint of project components, and location of all proposed buffers. • When applicable contextualize using the PAG-ASA 2020 and 2050 projected rainfall/temperature data.			
5) Process/ Technology	Technology Description and Performance Specifications Indicative process flow-sheets including efficiency of power generation Discuss the impacts of the PAG-ASA 2020 and 2050 projected rainfall pattern on the project and performance/efficiency of the facility.			
6) Project Size	Total volume of water to be impounded & power rated capacity to be generated (if hydropower) Capacity and type of Dam structure			
	Total Project Area in square meters or hectares including area to be inundated and/or service area			
7) Manpower	Tabulate the following per project phase: • manpower requirements; • expertise/skills needed; • nature & estimated number of jobs available for men, women, and indigenous peoples (if sited in IP ancestral land); preferred scheme for sourcing locally from host and neighboring LGUs			
8) Indicative Project Investment Cost (Philippine Peso)				

General Contents	Specific Content Requirement	Page #	Acceptable?	REMARKS
II. Key Environmental Impacts and Management/Monitoring Plan	See attached checklist of contents When applicable include appropriate climate change adaptation measures/options (embedded in each sector).			
III. Impact Management Plan	Limit to most significant impacts per project phase and per environmental component arising from key environmental aspects (See Annex 2-17 of RPM for DAO 2003-30)			
IV. Social Development Framework (SDP) and IEC Framework	SDP • Community development or livelihood programs/activities, projected beneficiaries, partner institutions, timeframe of implementation as well as source and amount allotted per activity/component (See Annex 2-18 of RPM for DAO 2003-30)			

ECC APPLICATION SCREENING FORM FOR HYDROPOWER/DAM PROJECTS
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General Contents	Specific Content Requirement	Page #	Acceptable?	REMARKS
V. Environmental Compliance Monitoring	IEC • Target sector, key messages, scheme/strategy/methods, Information medium, timelines and frequency, cost (See Annex 2-19 of RPM for DAO 2003-30)			
	Self Monitoring Plan Use Annex 2-20 of RPM for DAO 2003-30 as template			
	Multi-Sectoral Monitoring Framework / • Tabulate the list of stakeholder-members of the MMT, basis of selection, proposed role, and scope of MMT responsibilities and activities, etc. (See Annex 3-4 of the RPM for DAO 2003-30).			
	Environmental Guarantee and Monitoring Fund Commitments • Present a propose amount of EMF (based on a draft AWFP in Annex 3-4 and consistent with guidelines in Annex 3-5 of RPM for DAO 2003-30); and • Present a proposed amount of EGF and the basis for the estimate following the guidelines in annex 3-6 of RPM for DAO 2003-30			
VI. Emergency Response Policy and Generic Guidelines	The safety policy and generic guidelines should be consistent with the regulatory requirements. Emergency Preparedness should also consider natural hazards to the infrastructures and facilities.			
VII. Abandonment /Decommissioning /Rehabilitation Policy and	Statement on Proponent's policies and generic procedures for Rehabilitation/ Decommissioning/Abandonment to be submitted post-ECC, within a timeframe specified in the ECC.			
VIII. Institutional Plan for EMP Implementation	Discuss the organizational scheme of the proponent including line of command and reporting procedures as well as manpower complement and relationships with other operating departments.			

Checklist of EIS Contents

Key Environmental Impacts and Management/Monitoring Plan

List of Key Impacts	Baseline Data Parameter Requirements	Required Assessment Methodology/Approach	✓ for *completeness during procedural screening; page numbers should be provided upon submission of the EIS*								Remarks
			Baseline Conditions		Impact Analysis		Mgmt. Plan		Monitoring Plan		
During scoping: Unless otherwise specified as agreed during scoping, all items listed are required. Write specific instructions (if any) on the blanks/spaces provided			Page	✓	Page	✓	Page	✓	Page	✓	
I. Land											
1.1 Land Use and Classification		Assessment of the compatibility of the proposed project in relation to land use and / or the coastal resource management plan of the LGU if any.									
1.1.1 Change/Inconsistency in land use	Description & Map showing the project area in relation to existing land use.										
1.1.2 Encroachment in Environmentally Critical Areas (ECAs)	Identify ECA where the project is located or near the project area. Identify areas vulnerable/susceptible to natural hazards where the project is located or near the project area (include map/s).										
1.1.3 Possible tenurial / land issue	Identify areas under CARP or with CADC / CADT where the project is located or near the project area. Specify other conflicting tenurial / land issues (e.g. IFMA/CBFMA within COC and within MPSA, etc.)										
1.2 Geology/Geomorphology											
1.2.1 Change in surface landform/ topography/ terrain/slope	Slope and Elevation/Topographic Map;										
1.2.2Change in sub-surface/ underground geomorphology	Regional/General Geological Map										
1.2.3 Inducement of subsidence, liquefaction, landslides, mud / debris flow, etc.	Geological Cross-Sections; Sequence Stratigraphic Column of Rock Units; Geomorphological Map: G Factor Contour Maps; Seismicity Map; Differential Settling Map; Results of Geochemical Analyses of Rock Samples (applicable areas); hazard maps (NAMRIA, NDRRMC, MGB, PHIVOLCS, PAG-ASA)	Include discussions on impacts/effects of natural hazard on the project.									
1.3 Pedology											
1.3.1 Soil erosion / Loss of topsoil/overburden	Summary of Soil Investigation Report on soil type and quality; Erodibility potential; Bank stability;	USLE / similar modeling when applicable									
1.3.2 Change in soil quality/fertility	Laboratory results on soil sample analysis for N, P, K, pH, organic matter, micronutrients	Physical analysis (water holding capacity, texture aggregate stability of dam); Secondary data: chemical analysis									

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1.4 Terrestrial Ecology											
1.4.1 Vegetation removal and loss of habitat	• Flora and fauna species inventory or survey report; • Historical occurrences of pest infestation, forest/grass fire and/or similar incidences	Quadrat sampling for flora; Use of mist nets, traps, transect walk for fauna Impact of inundation on terrestrial ecology.									
1.4.2 Threat to existence and/or loss of important local species	Summary of endemicity / conservation status										
1.4.3Threat to abundance, frequency and distribution of important species	• Summary of abundance, frequency and distribution • Economic importance and uses of significant flora and fauna										
1.4.4 Hindrance to wildlife access	Sampling / survey map in relation to the project site										
2. THE WATER											
2.1. Hydrology/Hydrogeology											
2.1.1 Change in drainage morphology / Inducement of flooding/ Reduction in stream volumetric flow	Drainage map; historical flooding/drought occurrences, stream flow measurements/estimates; Delineation of watershed /sub-watersheds/ floodplain; and identification of aquifers if any	flood simulation/modeling should consider extreme weather conditions and the PAG-ASA 2020 and 2050 climate projections									
2.1.2 Change in stream, lake water depth	Regional hydrogeological map										
2.1.3 Depletion of water resources / competition in water use	Identification of current / projected water use in the area and adjacent areas Spring and well inventory and location map; depth of water table ; Analysis/estimation of water availability taking into consideration the PAG-ASA 2020 and 2050 climate projections	conduct water balance / budget analysis									
2.2 Oceanography											
2.2.1 Change/disruption in circulation pattern	Predicted tides; 24-hour tidal cycles; Surface current system										
2.2.2 Change in bathymetry	Bathymetric map;	USLE / similar modeling when applicable									

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2.3 Water Quality											
2.3.1 degradation of groundwater quality	Physico-Chemical characterization of water : ✓ pH ✓ BOD5 ✓ Oil and grease ✓ TSS sampling site map	Use DENR standard methods and procedures for sampling and analysis.									
2.3.2 degradation of surface water quality											
2.3.3 degradation of coastal/marine water quality											
2.4 Freshwater Ecology											
2.4.1 Threat to existence and/or loss species of important local and habitat	• Summary of endemicity / conservation status • Abundance of ecologically and economically important species (fishes, benthos, planktons); • Presence of pollution indicator species; sampling site map	Impact of inundation on freshwater ecology.									
2.4.2 Threat to abundance, frequency and distribution of species											
2.5 Marine Ecology											
2.5.1 Threat to existence and/or loss of important local species and habitat	• Abundance/densities/distribution of ecologically and economically important species (mangroves, fishes, benthos, planktons, coral reefs, algae, seaweeds, sea grasses); • Presence of pollution indicator species; • Historical occurrences of red-tide, fish kill or any related event • marine resource map sampling site map	Quadrat, transect, line intercept, spot dive, manta tow, marine resource characterization (e.g. municipal and commercial fisheries data) Impact of inundation on marine ecology.									
2.5.2 Threat to abundance, frequency and distribution											
3.0 THE AIR											
3.1 Meteorology/Climatology											
3.1.1 Change in the local climate e.g. local temperature	Monthly average rainfall and temperature of the area; Climatological normals/extremes; Wind rose diagrams; Frequency of Tropical cyclones	• In the assessment, consider the PAG-ASA climate change projections for 2020 and 2050.									
3.1.2 Contribution in terms of greenhouse gas emissions	Data on Greenhouse gasses (i.e. carbon dioxide, methane); Calculation of projected GHG emission	Discuss the project's contribution in terms of greenhouse gas emissions									

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List of Key Impacts	Baseline Data Parameter Requirements	Required Assessment Methodology/Approach	✓ for *completeness during procedural screening; page numbers should be provided upon submission of the EIS*								Remarks
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3.2 Air Quality (& Noise)											
3.2.1 Degradation of air quality	characterization of ambient air quality: ✓ TSP (for sampling methods refer to Clean Air Act) sampling site map	Use DENR standard methods and procedures for sampling and analysis. For construction phase only.									
3.2.2 Increase in ambient noise level	Characterization of ambient noise level sampling site map	Use DENR standard methods and procedures for sampling and measurement.									
4.0 THE PEOPLE											
4.1 Displacement of settler/s Displacement / disturbance of properties Change/conflict in land ownership Change/conflict Right of way	Demographic data of impact area: - Number of households and household size - Land area, - Population, - Population density /growth - gender and age profile, - literacy rate, profile of educational attainment,	Discuss how the project would affect existing properties in the area in terms of relocation and devaluation									
4.2 In-migration proliferation of informal settlers	settlements map Census of population / property that will be displaced / disturbed Housing ownership profile / availability of housing/ number of informal settlers	Discuss the in-migration patterns as a result of project implementation									
4.3 Cultural/Lifestyle change (especially on Indigenous People, if there's any)	Demographic data on Indigenous People (if any) and existing Culture/Lifestyle that may be significantly affected	Discuss the impacts on IPs and Culture/Lifestyle									
4.4 Threat to delivery of basic services /resource competition	Availability of public services in terms of: • Water supply • Power supply • Communications /transportation • health resources (Government and Private) • peace and order / crime • education facilities	Discuss how the project would affect the delivery of basic services and may result to resource competition in the area									
4.5 Threat to public health and safety		Discuss the project implementation's threat to public health vis-à-vis the									

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List of Key Impacts	Baseline Data Parameter Requirements	Required Assessment Methodology/Approach	✓ for *completeness during procedural screening; page numbers should be provided upon submission of the EIS*								Remarks
			Baseline Conditions		Impact Analysis		Mgmt. Plan		Monitoring Plan		
During scoping: Unless otherwise specified as agreed during scoping, all items listed are required. Write specific instructions (if any) on the blanks/spaces provided			Page	✓	Page	✓	Page	✓	Page	✓	
	• recreational facilities / sports facilities statistical data / information related to public services: • literacy rate, profile of educational attainment • Morbidity and mortality rates (infants and adults - 5-year trend) • Common diseases in the area including endemic diseases; • Environmental Health and Sanitation Profile; • Crime rate • Food security	baseline health conditions in the area Analysis of diseases that may be affected by climate change.									
4.6 Generation of Local Benefits from the project Enhancement of employment and livelihood opportunities Increased business opportunities and associated economic activities Increased revenue of LGUs	Socioeconomic data: • Main sources of Income • Employment rate/ profile • sources of livelihood • commercial establishments and activities • banking and financial institutions										
4.7 Traffic congestion	Road network/ systems Existing Transportation/traffic situation	Traffic impact assessment if applicable (including capacity of road system in terms of load/count)									

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III. Environmental Risk Assessment									
Type of Risks	**Scope of Assessment**	**Report/Output Required**	✓ **for** *completeness during procedural screening; page numbers should be provided upon submission of the EIS*						
			ERA		**ERP**		**Monitoring Plan**		REMARKS
During scoping: Check (✓) required/applicable items; items with ✓ are automatically required; write specific instruction (if any) on the blanks provided			Page	✓	Page	✓	Page	✓	
☐ Physical Risks (Failure of Structure w/c could endanger life, property and/or the environment)	- Identify conditions, events and "trigger" which could be significant in bringing about identified physical risks - Description & assessment of the possible accident scenarios - Assessment of whether the project location is projected to have extreme climate events for 2020 &or 2050 that could contribute to the triggering identified scenarios - Description of the hazards both immediate (acute effects) and delayed (chronic effects) for man and the environment posed by the failure of structure, as applicable	ERA REQUIREMENT ☐Quantitative Risk Assessment(QRA) Specific Instructions : _____ ☑Descriptive/Qualitative Risk Assessment Specific Instructions : _____ ☑ EMERGENCY PLAN : Specific Instructions : _____ ***Refer to annex 2-7e for the decision criteria the outline***							

Noted By:	**Signature**		**Signature**
Review Committee Members		EMB Representatives	
1.		1.	
2.		2.	
3.		3.	
4.		Project Proponent:	
5.			
6.		Project Preparer/Consultant:	
Resource Person			
1.			

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