REPUBLIC OF THE PHILIPPINES

DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS

REGIONAL OFFICE VIII

SOUTHERN LEYTE 2nd DISTRICT ENGINEERING OFFICE

SOGOD, SOUTHERN LEYTE

C.Y. 2025 PROJECT

DETAILED ENGINEERING DESIGN PLAN FOR

REPAIR/MAINTENANCE OF MAG-ATAS RIVER DIKE 4
BRGY. MAG-ATAS, SOGOD, SOUTHERN LEYTE

STATION: 0+012.50 - 0+062.00

LENGTH: 49.50 L.M.

SUBMITTED :

KING PAUL P. DEL ROSARIO
CHIEF, MAINTENANCE SECTION

DATE :

RECOMMENDED :

EVELYN D. YAP
ASSISTANT DISTRICT ENGINEER

DATE :

APPROVED :

EDUARDO V. SANTOS
DISTRICT ENGINEER

DATE :

INDEX OF SHEETS

SHEET NO. 1 ---------- TITLE PAGE

SHEET NO. 2 ---------- INDEX OF SHEETS, LOCATION MAP, SUMMARY OF QUANTITIES

SHEET NO. 3 ---------- VICINITY MAP

SHEET NO. 4 ---------- PLAN, LOCATION

SHEET NO. 5 --------- TYPICAL CROSS SECTION, SECTION ELEVATION

SHEET NO. 6 --------- STRUCTURE DIMENSION DETAILS

SHEET NO. 7 ---------- GENERAL NOTES

SHEET NO. 8 ---------- CROSS SECTION

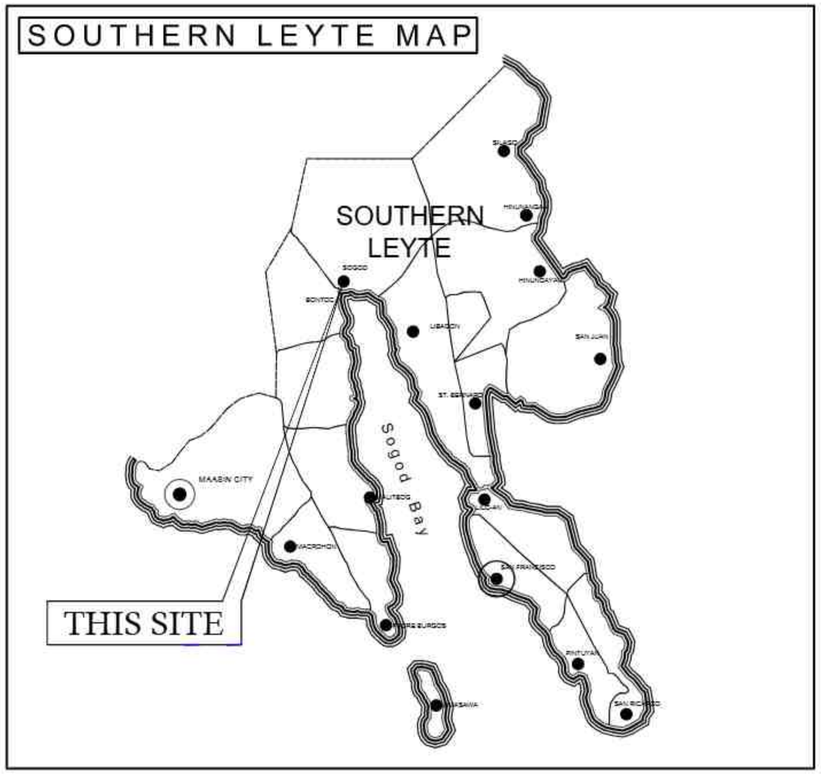
SHEET NO. 9 ---------- DESIGN CRITERIA

SHEET NO. 10-11 ---- DESIGN PARAMETERS

SHEET NO. 12 -------- PROJECT BILLBOARD

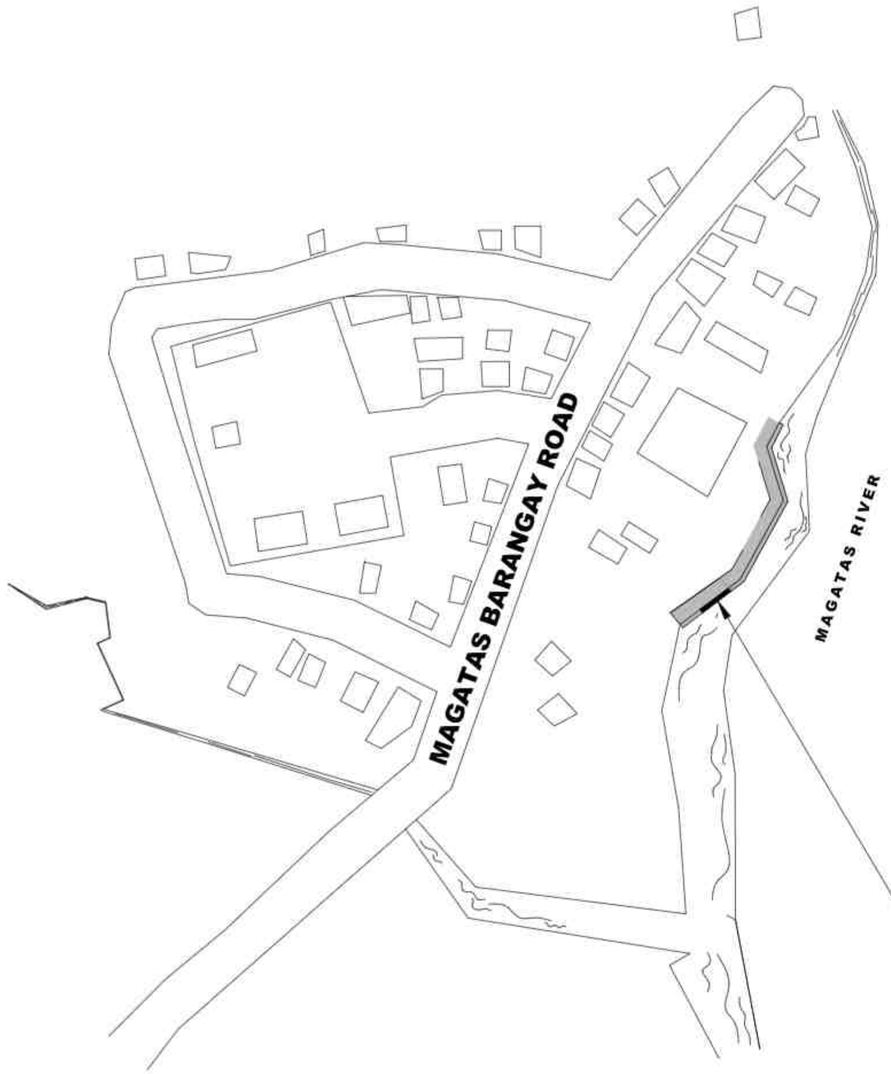
SUMMARY OF QUANTITIES

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	REMARKS
B.4(10)	MISCELLANEOUS SURVEY AND STAKING	LUMP SUM	1.00	
B.5	PROJECT BILLBOARD / SIGNBOARD	EACH	1.00	
B.7(2)	OCCUPATIONAL SAFETY & HEALTH PROGRAM	LUMP SUM	1.00	
B.9(1)	MOBILIZATION / DEMOBILIZATION	LUMP SUM	1.00	
801(1)	REMOVAL OF STRUCTURES AND OBSTRUCTION	LUMP SUM	1.00	
802(2)a	SURPLUS COMMON EXCAVATION	CU. M.	61.18	
900(1)a2	STRUCTURAL CONCRETE - 3000 PSI, (CLASS A, 14 DAYS)	CU. M.	61.18	
902(1)a1	REINFORCING STEEL (DEFORMED) - GRADE 40	KG.	654.22	
902(1)a2	REINFORCING STEEL (DEFORMED) - GRADE 60	KG.	1083.51	
903(2)	FORMWORKS AND FLASEWORKS	SQ.M.	112.86	



REPUBLIC OF THE PHILIPPINES DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS REGIONAL OFFICE VIII SOUTHERN LEYTE 2nd DISTRICT ENGINEERING OFFICE SOGOD,SOUTHERN LEYTE	PROJECT NAME AND LOCATION: REPAIR/MAINTENANCE OF MAG-ATAS RIVER DIKE 4 BRGY. MAG-ATAS, SOGOD, SOUTHERN LEYTE SOGOD, SOUTHERN LEYTE	SHEET CONTENTS: INDEX OF SHEETS LOCATION MAP SUMMARY OF QUANTITIES	DRAFTED: JANET M. MAKILANG ENGINEER II PREPARED: JUNROMEO V. VILLEJO ENGINEER II	REVIEWED: RAINIER LOU C. RUIZ CHIEF, PLANNING & DESIGN SECTION	SUBMITTED: KING PAUL P. DEL ROSARIO CHIEF, MAINTENANCE SECTION	RECOMMENDED: EVELYN D. YAP ASSISTANT DISTRICT ENGINEER	APPROVED: EDUARDO V. SANTOS DISTRICT ENGINEER	SET NO. 1	SHEET NO. 2 12

N

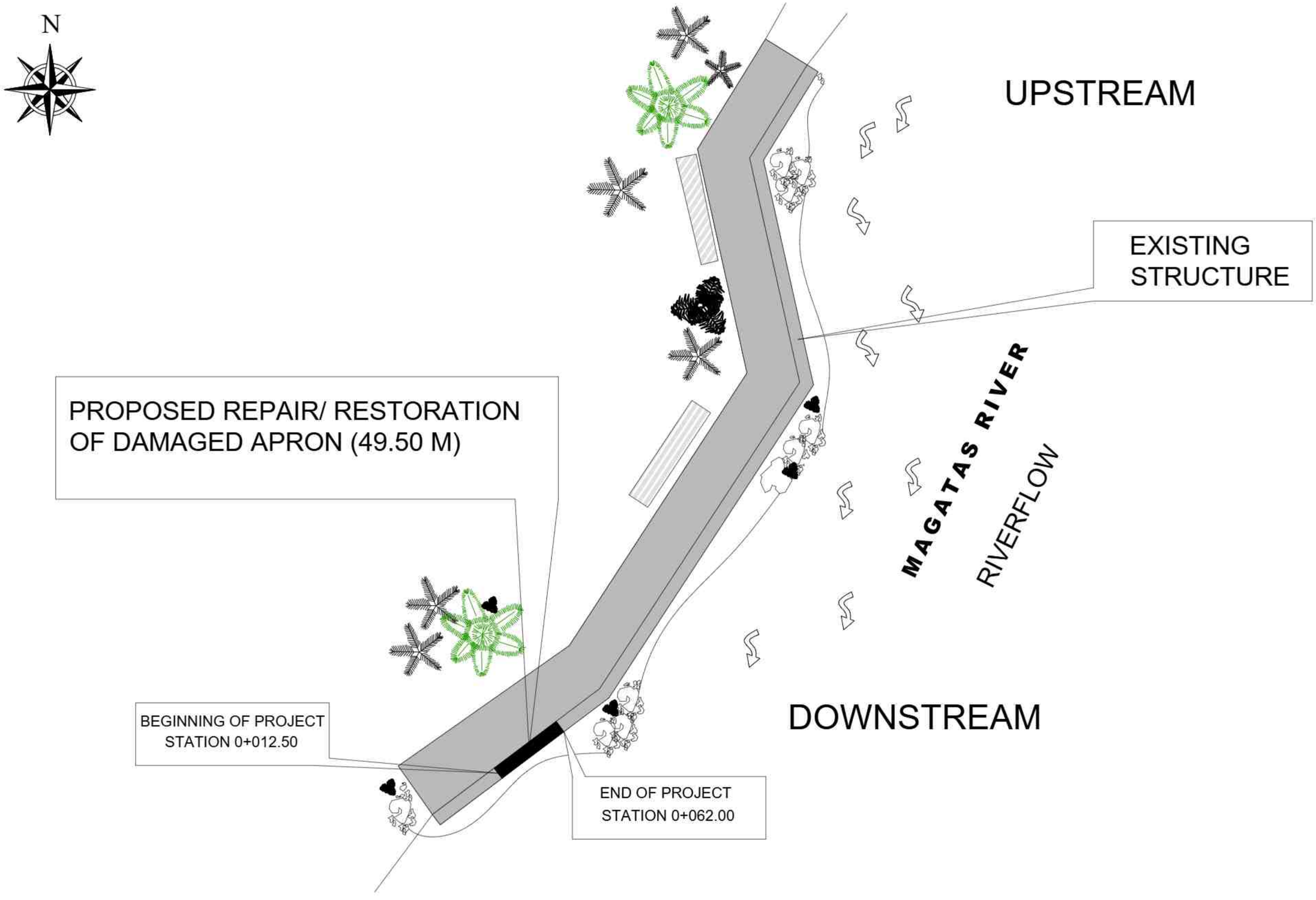


PROPOSED
REPAIR/RESTORATION OF
APRON (49.50 m)

VICINITY MAP

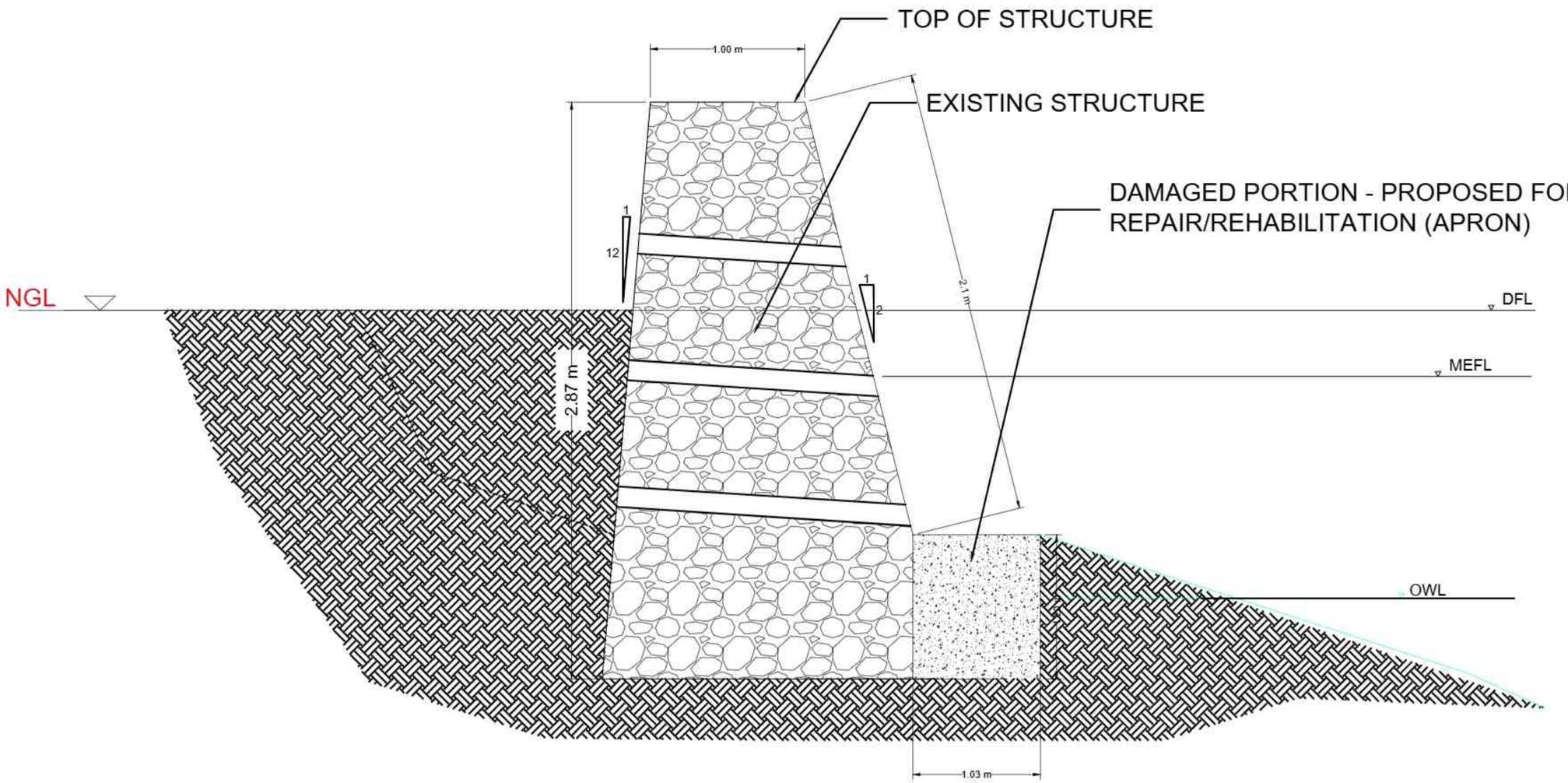
NOT TO SCALE

REPUBLIC OF THE PHILIPPINES **DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS** REGIONAL OFFICE VIII SOUTHERN LEYTE 2nd DISTRICT ENGINEERING OFFICE SOGOD, SOUTHERN LEYTE	PROJECT NAME AND LOCATION: **REPAIR/MAINTENANCE OF MAG-ATAS RIVER DIKE 4 BRGY. MAG-ATAS, SOGOD, SOUTHERN LEYTE** SOGOD, SOUTHERN LEYTE	SHEET CONTENTS: VICINITY MAP	DRAFTED: JANET M. MAKILANG ENGINEER II PREPARED: JUNROME C. VILLEJO ENGINEER II	REVIEWED: RAINIER LOU C. RUIZ CHIEF, PLANNING & DESIGN SECTION	SUBMITTED: KING PAUL P. DEL ROSARIO CHIEF, MAINTENANCE SECTION	RECOMMENDED: EVELYN D. YAP ASSISTANT DISTRICT ENGINEER	APPROVED: EDUARDO V. SANTOS DISTRICT ENGINEER	SET NO. 1	SHEET NO. 3 12



REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
REGIONAL OFFICE VIII
SOUTHERN LEYTE 2nd DISTRICT ENGINEERING OFFICE
SOGOD,SOUTHERN LEYTE

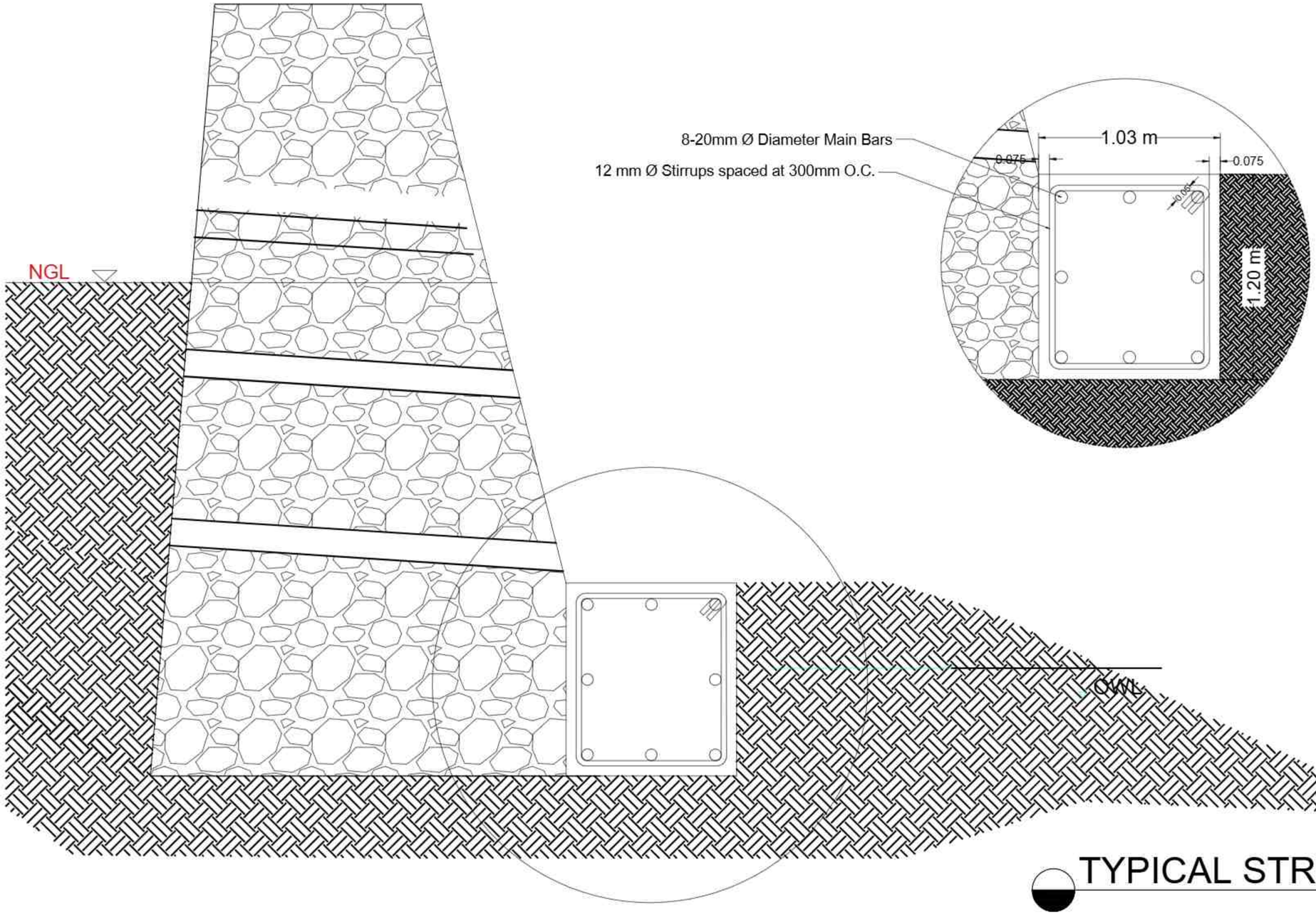
PROJECT NAME AND LOCATION:	SHEET CONTENTS:	DRAFTED:	REVIEWED:	SUBMITTED:	RECOMMENDED:	APPROVED:	SET NO.	SHEET NO.
REPAIR/MAINTENANCE OF MAG-ATAS RIVER DIKE 4 BRGY, MAG-ATAS, SOGOD, SOUTHERN LEYTE SOGOD, SOUTHERN LEYTE	PLAN, LOCATION	JANET M. MAKILANG, ENGINEER II PREPARED: JUNROME C. VILLEJO, ENGINEER II	RAINIER LOU C. RUIZ, CHIEF, PLANNING & DESIGN SECTION	KING PAUL P. DEL ROSARIO, CHIEF, MAINTENANCE SECTION	EVELYN D. YAP, ASSISTANT DISTRICT ENGINEER	EDUARDO V. SANTOS, DISTRICT ENGINEER	1	4/12



TYPICAL CROSS SECTION

SCALE 1 : 50m

REPUBLIC OF THE PHILIPPINES **DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS** REGIONAL OFFICE VIII SOUTHERN LEYTE 2nd DISTRICT ENGINEERING OFFICE SOGOD,SOUTHERN LEYTE	PROJECT NAME AND LOCATION: **REPAIR/MAINTENANCE OF MAG-ATAS RIVER DIKE 4 BRGY. MAG-ATAS, SOGOD, SOUTHERN LEYTE** SOGOD, SOUTHERN LEYTE	SHEET CONTENTS: TYPICAL CROSS SECTION SECTION ELEVATION	DRAFTED: JANET M. MAKILANG ENGINEER II PREPARED: JUNROME C. VILLEJO ENGINEER II	REVIEWED: RAINIER LOU C. RUIZ CHIEF, PLANNING & DESIGN SECTION	SUBMITTED: KING PAUL P. DEL ROSARIO CHIEF, MAINTENANCE SECTION	RECOMMENDED: EVELYN D. YAP ASSISTANT DISTRICT ENGINEER	APPROVED: EDUARDO V. SANTOS DISTRICT ENGINEER	SET NO. 1	SHEET NO. 5 12



TYPICAL STRUCTURE

SCALE 1 : 50m

REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
REGIONAL OFFICE VIII
SOUTHERN LEYTE 2nd DISTRICT ENGINEERING OFFICE
SOGOD,SOUTHERN LEYTE

PROJECT NAME AND LOCATION:	SHEET CONTENTS:	DRAFTED:	REVIEWED:	SUBMITTED:	RECOMMENDED:	APPROVED:	SET NO.	SHEET NO.
REPAIR/MAINTENANCE OF MAG-ATAS RIVER DIKE 4 BRGY. MAG-ATAS, SOGOD, SOUTHERN LEYTE SOGOD, SOUTHERN LEYTE	STRUCTURE DIMENSION DETAILS	JANET M. MAKILANG ENGINEER II PREPARED: JUNROME C. VILLEJO ENGINEER II	RAINIER LOU C. RUIZ CHIEF, PLANNING & DESIGN SECTION	KING PAUL P. DEL ROSARIO CHIEF, MAINTENANCE SECTION	EVELYN D. YAP ASSISTANT DISTRICT ENGINEER	EDUARDO V. SANTOS DISTRICT ENGINEER	1	6/12

GENERAL NOTES:

1. STANDARD SPECIFICATIONS
   a) ALL WORKS SHALL COMPLY WITH DPWH STANDARD SPECIFICATIONS FOR HIGHWAYS, BRIDGES, AND AIRPORTS, REVISED 2013. SPECIAL PROVISIONS AND SUPPLEMENTAL SPECIFICATIONS PERTAINING TO THE PROJECT. CONDITIONS OF THE CONTRACT (INTERNATIONAL) FOR WORKS OF CIVIL ENGINEERING CONSTRUCTION, 2nd EDITION, PREPARED BY F.I.D.I.C. SHALL ALSO GOVERN.

2. DIMENSIONS
   a) UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS WHICH INCLUDE STATIONING, DISTANCES BETWEEN CONTROL POINTS AND ELEVATIONS ARE MEASURED IN MILLIMETERS.

3. SLOPE / EMBANKMENT PROTECTION WORKS (RUBBLE CONCRETE)
   a) FOUNDATION OF EMBANKMENT PROTECTION WORKS SHALL SIT ON A FIRM AND STABLE FOUNDATION. ALLOWABLE SOIL BEARING CAPACITY SHALL NOT LESS THAN 196 KPa. SOIL BORING TEST SHALL BE CONDUCTED DURING CONSTRUCTION TO VERIFY THE ACTUAL SOIL BEARING CAPACITY OF SOIL SPOTS UNDER THE FOUNDATION SHALL BE REMOVED AND REPLACED WITH SUITABLE BEDDING MATERIALS OR CONCRETE CLASS "B"
   b) SOFT SPOTS BETWEEN THE CUT FACE AND SLOPE/ EMBANKMENT PROTECTION WALLS MUST BE FILLED WITH ROCKS OR SUITABLE MATERIALS SUCH BACKFILL MATERIALS PLACED BEHIND THE WALL SHALL BE FREE DRAINAGE NON EXPANSIVE AND WATER SHALL BE DRAINED BY WEEP HOLES PLACES AT SUITABLE INTERVALS AND ELEVATIONS.
   c) THE DEPTH OF PENETRATION SHALL BE MEASURED FROM THE LEVEL OF THE ORIGINAL GROUND SURFACE AND SHALL NOT INCLUDE EXCAVATED MATERIALS
   d) THE THICKNESS OR DIAMETER OF STONES FOR STONE MASONRY SHALL NOT BE LESS THAN 250mm.

4. CONSTRUCTION STAKES
   a) THE CONTRACTOR WILL BE RESPONSIBLE FOR TRUE AND PROPER SETTING-OUT OF THE WORK OR IMPROVEMENT AND FOR CORRECTNESS OF POSITION, LEVEL, SLOPE AND CONTINUOUS PROFILE GRADE IN ROAD WORK. HE WILL SET CONSTRUCTION STAKES, ESTABLISHING LINES, SLOPE AND CONTINUOUS PROFILE WORK AND OTHER LINE AND BENCH MARK FOR BRIDGE WORK, GRADE IN ROAD PROTECTIVE AND NECESSARY STRUCTURES AND APPURTENANCES CULVERT WORK, AS ARE DEEMED NECESSARY FROM THE REFERENCE DATE TO BE FURNISHED BY THE ENGINEER IN WRITING.
   b) THE CHECKING OF CONSTRUCTION STAKES BY THE ENGINEER SHALL NOT IN ANY WAY RELIEVE THE CONTRACTOR OF HIS RESPONSIBILITY FOR THE CORRECTNESS THEREOF AND THE CONTRACTOR SHALL CAREFULLY PROTECT AND PRESERVE ALL BENCH MARK, PEGS AND OTHER THINGS USED IN SETTING-OUT THE WORK.
   c) IN THE CASE OF "CHANGES" OR CHANGE IN CONDITION "WHICH INVOLVES ANY CHANGES IN STAKE OUT, THE CONTRACTOR SHALL COOPERATE WITH THE ENGINEER AND FACILITATE THE PROMPT RE-ESTABLISHMENT OF THE FIELD CONTRACT FOR THE ALTERNATIVE OF ADJUSTED WORK.

5. STANDARD DRAWING
   a) THE NECESSARY DRAWING CONTAINED IN THE DPWH STANDARD FOR FLOOD CONTROL SHALL BE UTILIZED FOR THE PROJECT UNLESS OTHERWISE MORE DETAILED.

6. QUANTITY
   a) QUANTITY OF VARIOUS WORK ITEM INVOLVED ARE 2ndJECT TO DECREASE OR INCREASE DEPENDING ON THE ACTUAL FIELD CONDITION.

Gabion Mattress

1. Mesh Properties

Wire Diameter	=	2.70 mm
Selvage Wire Diameter	=	3.40mm
Tensile Strength (Minimun)	=	4,700 Kg./cm^2 (460 MPa)
Compression Resistance	=	300 - 400 tons/sqm
Filled Gabion Density	=	17 kn/cum (min)
Minimum Zinc Coating	=	244.00 gm/m (ASTM A 641-82)
Mesh Size	=	6x8
Tying / Connecting Wire	=	2.70mm

Wire Should Be Triple Twisted

2. Product tests shall be conducted on the product sample prior to its acceptance.
   Stones should be of durable pieces and resistant to weathering having a minimum density of 1.7 g/cc, at saturated surface dry (SSD) condition with sizes ranging from 100-200 mm in diameter, properly hand-laid for minimum voids.

3. Geotextile Filter - 100 % Polypropylene, non-woven geotextile, resistant to biological & chemical environments.

Permeability	=	100 - 180 l/m^2 /sec
Pore Size	=	80 - 100 microns
Tensile Strength CBR Puncture	=	10 KN/m (min)
Strength Grab Tensile	=	2.1 KN (min)
Strength	=	600 N (min)
Thickness	=	1.2 mm (min)
Min. Overlap	=	0.30 m (min.)
Bonding Medium	=	Mechanical (sewn)

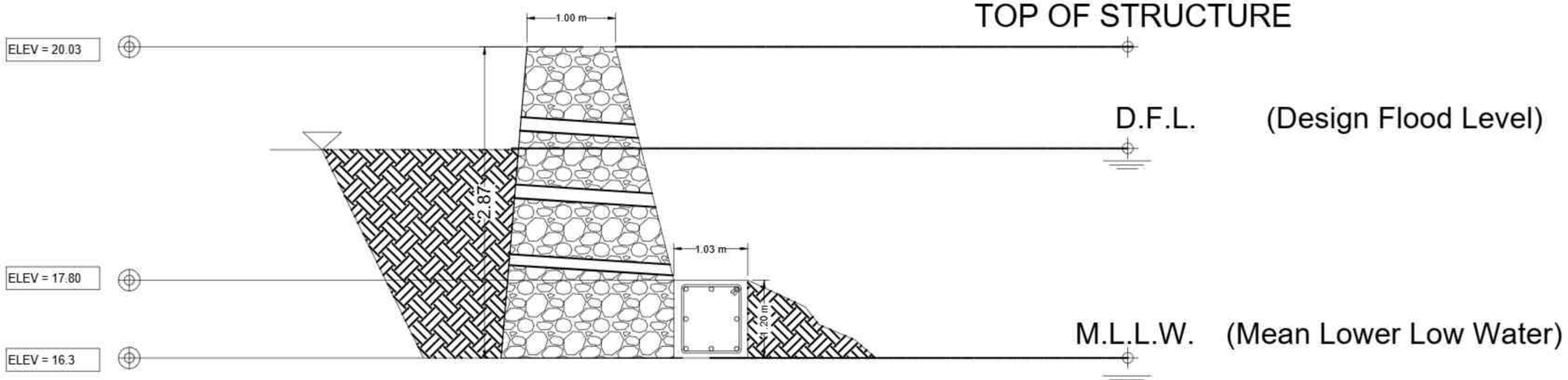
End weights shall be 12mm Ø RSB wrapped around at both edges of the geotextile, parallel to the bank, and held together by sewing.

OTHERS

PRE-CONSTRUCTION SURVEY SHALL BE CONDUCTED JOINTLY BY THE REPRESENTATIVES OF THE IMPLEMENTING AGENCY AND THE CONTRACTOR. THE CORRESPONDING " AS-STAKED" PLAN SHALL BE PREPARED BASED ON THE RESULT OF THE PRE - CONSTRUCTION SURVEY INCORPORATING THE CHANGES FROM THE APPROVED PLAN, 2ndJECT FOR APPROVAL BY THE UNDER SECRETARY FOR TECHNICAL SERVICES.

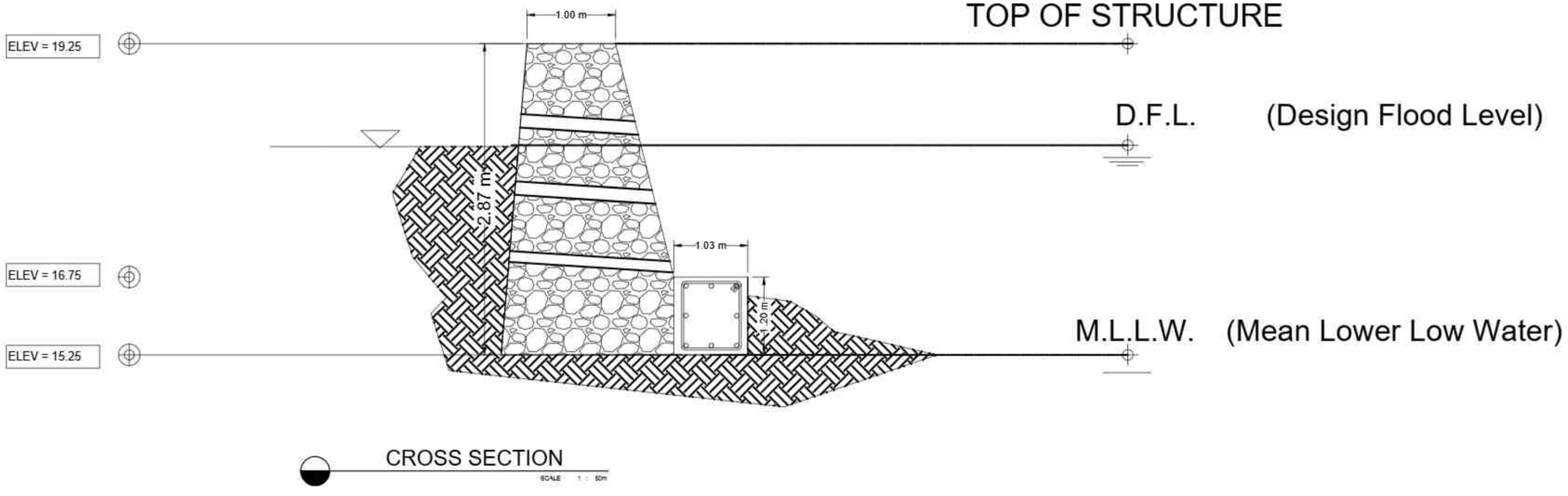
REPUBLIC OF THE PHILIPPINES **DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS** REGIONAL OFFICE VIII SOUTHERN LEYTE 2nd DISTRICT ENGINEERING OFFICE SOGOD,SOUTHERN LEYTE	PROJECT NAME AND LOCATION: **REPAIR/MAINTENANCE OF MAG-ATAS RIVER DIKE 4 BRGY. MAG-ATAS, SOGOD, SOUTHERN LEYTE** SOGOD, SOUTHERN LEYTE	SHEET CONTENTS: GENERAL NOTES	DRAFTED: JANET M. MAKILANG ENGINEER II PREPARED: JUNROME C. VILLEJO ENGINEER II	REVIEWED: RAINIER LOU C. RUIZ CHIEF, PLANNING & DESIGN SECTION	SUBMITTED: KING PAUL P. DEL ROSARIO CHIEF, MAINTENANCE SECTION	RECOMMENDED: EVELYN D. YAP ASSISTANT DISTRICT ENGINEER	APPROVED: EDUARDO V. SANTOS DISTRICT ENGINEER	SET NO. 1	SHEET NO. 7 12

0+012.50



STA. 0+012.50 - STA. 0+062.00	Area	Volume
Surplus Common Excavation	1.236	61.18

0+062.00



CROSS SECTION

SCALE 1 : 50m

REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
REGIONAL OFFICE VIII
SOUTHERN LEYTE 2nd DISTRICT ENGINEERING OFFICE
SOGOD,SOUTHERN LEYTE

PROJECT NAME AND LOCATION:
REPAIR/MAINTENANCE OF MAG-ATAS RIVER DIKE 4 BRGY, MAG-ATAS, SOGOD, SOUTHERN LEYTE
SOGOD, SOUTHERN LEYTE

SHEET CONTENTS:
CROSS SECTION

DRAFTED:
JANET M. MAKILANG
ENGINEER II

PREPARED:
JUNROMEO C. VILLEJO
ENGINEER II

REVIEWED:
RAINIER LOU C. RUIZ
CHIEF, PLANNING & DESIGN SECTION

SUBMITTED:
KING PAUL P. DEL ROSARIO
CHIEF, MAINTENANCE SECTION

RECOMMENDED:
EMIL VAL D. YAP
ASSISTANT DISTRICT ENGINEER

APPROVED:
EDUARDO V. SANTOS
DISTRICT ENGINEER

SET NO. 1

SHEET NO. 8/12

DESIGN CRITERIA:

DESIGN FLOOD

THE DESIGN FLOOD FOR THE BANK PROTECTION WORKS AND DIKES IS TYPICALLY DETERMINED AT THE MASTER PLAN STAGE. HOWEVER, WHERE A MASTER PLAN HAS NOT BEEN UNDERTAKEN, THEN DESIGN FLOOD WILL NEED TO BE DETERMINED IN CONSIDERATION OF A NUMBER OF FACTORS, INCLUDING ECONOMIC, ENVIRONMENTAL AND SOCIAL.

IN DETERMINATION OF A DESIGN FLOOD FOR A PROJECT, A RISK BASED IS OFTEN ADOPTED, WHERE RISK CAN BE REPRESENTED AS:

RISK = LIKEHOOD X CONSEQUENCE

LIKEHOOD REFERS TO THE FREQUENCY OF THE FLOOD EVENT, SUCH AS A 100 YEAR FLOOD OR A 5 YEAR FLOOD. CONSEQUENCES REFERS TO THE IMPLICATIONS OF THE INUNDATION OCCURRING, AND MAY INCLUDE THE ECONOMIC DAMAGES OF INUNDATION AND POTENTIAL RISK TO LIFE. THESE FACTORS SHOULD BE WEIGHED UP IN THE DETERMINATION OF SUITABLE DESIGN FLOOD.

SOME CONSIDERATIONS FOR THE DESIGN FLOOD ARE AS FOLLOWS:

- WHERE PROTECTION OF NEW ASSETS OR NEW DEVELOPMENTS IS TO BE CONSTRUCTED, THEN THE DESIGN FLOOD MAY BE BASED ON THE DESIGN FLOOD FOR DEVELOPMENT OF THAT ASSET, SO AS TO PROVIDE SUITABLE PROTECTION. FOR EXAMPLE, IT MAY BE APPROPRIATE TO ADOPT A LARGER FLOOD FOR URBAN AREAS WHERE INUNDATION WILL CAUSE POTENTIAL RISK TO LIFE AND PROPERTY, AND A SMALLER FLOOD FOR RURAL LAND WHERE INUNDATION MAY NOT BE A KEY ISSUE
- FOR PROTECTION OF EXISTING ASSETS, THEN THE DESIGN FLOOD MAY BE A LEVEL THAT IS ACHIEVABLE CONSIDERING AVAILABLE SPACE AND CONSTRAINTS IN INSTALLING A PROTECTION MEASURES
- WHERE A REVETMENT OR SPUR DIKE ASSESSMENT OR MASTER PLAN. TABLE 5-1 PROVIDES DESIGN FLOODS THAT CAN BE ADOPTED FOR DIFFERENT RIVER SIZES.

Table 5-1
Design Flood-Suggested Protection Levels

RIVER TYPE	DESIGN FLOOD
Principal and Major Rivers (40 km² drainage area and above)	100 year
For Small Rivers (below 40 km² drainage area)	50 year

HEIGHT AND FREEBOARD

THE HEIGHT OF THE DIKE IS DETERMINED FROM THE DESIGN FLOOD LEVEL ELEVATION PLUS AN ADDITIONAL FREEBOARD ALLOWANCE DEPENDING ON THE DESIGN DISCHARGE AS SHOWN IN TABLE 5-3.

FREEBOARD IS THE MARGIN OF HEIGHT MAINTAINED BETWEEN THE TOP OF THE EMBANKMENT AND DESIGN FLOOD LEVEL TO GUARD AGAINST OVER-TOPPING AND WAVE WASH. TABLE 5-3 SHOWS THE FREEBOARD ALLOWANCE CORRESPONDING TO THE DESIGN FLOOD DISCHARGE.

Table 5-3
Freeboard Allowance for Dikes

Design flood discharge Q (m³/s)	Freeboard (m)
Less than 200	0.6
200 and less than 500	0.8
500 and less than 2,000	1.0
2,000 and less than 5,000	1.2
5,000 and less than 10,000	1.5
10,000 and over	2.0

HYDROLOGY:

THIS SECTION PROVIDES A BROAD OUTLINE OF HYDROLOGICAL TECHNIQUES. IT OUTLINES THE FOLLOWING STEPS IN THE HYDROLOGICAL ANALYSIS PROCESS:

- CATCHMENT DELINEATION
- DESIGN RAINFALL ANALYSIS
- CHOICE AND USE OF HYDROLOGICAL ANALYSIS TECHNIQUES

CATCHMENT DELINEATION:

ONE OF THE BASIC DATA REQUIRED IN UNDERTAKING HYDROLOGICAL ANALYSIS IS THE CATCHMENT AREA.

THE CATCHMENTS AREA IS DERIVED BY DELINEATING THE BASIN BOUNDARY IN A TOPOGRAPHIC MAP. TOPOGRAPHIC MAPS MAY INCLUDE:

- 1:50,000 OR BETTER MAPPING FROM NATIONAL MAPPING AND RESOURCE INFORMATION ADMINISTRATION (NAMRIA)
- TOPOGRAPHICAL SURVEY, WHICH MAY ASSIST PARTICULARLY FOR SMALLER PORTIONS OF THE CATCHMENTS AND FOR DRAINAGE PROJECTS
- AERIAL SURVEY, SUCH AS LIDAR OR PHOTOGRAMMETRY
- URBAN DRAINAGE LAYOUT, WHICH PROVIDES AN INDICATION OF THE RUNOFF CHARACTERISTICS

A CATCHMENTS AREA IS THEN COMPUTED USING THE FOLLOWING:

- PLANIMETER- 2ndJECT TO REGULAR CALIBRATION/MAINTENANCE TO ATTAIN ACCURATE RESULT
- TRIANGULATION
- CROSS-SECTION MILLIMETER PAPER; AND
- CAD/GIS SOFTWARE

CAD AND GIS SOFTWARE ARE LIKELY TO BE MOST COMMON METHOD FOR DELINEATING CATCHMENTS IN THE COMING YEARS.

IN ADDITION TO OVERALL CATCHMENTS DELINEATION, FURTHER 2nd-CATCHMENTS DELINEATION IS TYPICALLY UNDERTAKEN TO:

- PROVIDE FLOW ESTIMATES AT DIFFERENT POINTS IN THE STUDY AREA
- ALIGN WITH KEY INFLOW POINTS TO A HYDRAULIC MODEL
- IN DRAINAGE STUDIES, TO ESTIMATE THE FLOWS ARRIVING AT DRAINAGE INLETS OR CULVERTS. NOTE THAT THIS MIGHT CHANGE WITH DIFFERENT DRAINAGE LAYOUT ALTERNATIVES THAT MIGHT BE CONSIDERED
- PROVIDE SUFFICIENT RESOLUTION FOR MODELS OTHER THAN THE RATIONAL METHOD

THE LEVEL OF DETAILS THAT THE CATCHMENTS IS DELINEATED INTO 2nd-CATCHMENTS IS HIGHLY DEPENDENT ON THE PARTICULAR PROJECT AND STUDY AREA. FOR LARGE RIVER BASINS, 2nd-CATCHMENTS MAY BE IN THE ORDER OF 100 KM² TO 200 KM², WHILE FOR DRAINAGE STUDIES CATCHMENTS COULD BE LESS THAN 1 HECTARES

RAINFALL ANALYSIS:

RAINFALL ANALYSIS INCLUDES THE FORMATION OF DESIGN HYETOGRAPHS FOR HYDROLOGICAL ANALYSIS, AS WELL AS THE ANALYSIS OF RECORDED RAINFALL DATA.

RUNOFF ANALYSIS:

THE SPECIFIC DISCHARGE METHOD IS AN APPROXIMATE METHOD FOR THE ESTIMATE OF FLOW, AND IS TYPICALLY USED TO VALIDATE FLOWS FROM THE HYDROLOGICAL ANALYSIS TECHNIQUE, RATHER THAN FOR THE ESTIMATION OF FLOWS IN ITS OWN RIGHT. GIVEN THE APPROXIMATE NATURE, IT SHOULD BE USED WITH CAUTION FOR INFRASTRUCTURE DESIGN. IT IS TYPICALLY APPLICABLE FOR RIVER BASINS RATHER THAN URBAN DRAINAGE APPLICANTS. THIS METHOD IS BASED ON THE APPROACH PRESENTED IN FCSEC.

THE SPECIFIC DISCHARGE IS THE FLOOD PEAK DISCHARGE PER UNIT CATCHMENTS AREA (REFER TO EQUATION 3-7). GENERALLY, THE SPECIFIC DISCHARGE FOR SMALL RIVERS IS COMPARATIVELY LARGER THAN OF THE BIGGER RIVERS. THE SPECIFIC DISCHARGE CURVE EXPLAINS THIS (REFER TO FIGURE 3-4 SPECIFIC DISCHARGE CURVE, WHERE THE SPECIFIC DISCHARGE IS THE ORDINATE AND THE SIZE OF THE CATCHMENTS AREA AS THE ABSCISSA). FROM THIS CURVE, DESIGN DISCHARGE IS ROUGHLY CALCULATED EVEN WITHOUT ANY RUNOFF ANALYSIS. THE RELIABILITY OF THE DESIGN DISCHARGE ESTIMATED BY RUNOFF METHODS CAN BE EASILY ASSESSED BY COMPARING IT WITH SPECIFIC DISCHARGE METHOD.

THE METHOD IS BEST SUITED TO RURAL CATCHMENTS, OR CATCHMENTS WITH A LOWER PROPORTION OF URBANIZATION.

EQUATION 3-7

$q = AQ$

WHERE:
q = SPECIFIC DISCHARGE (M³/S/KM²)
Q = DESIGN DISCHARGE (M³/S)
A = CATCHMENTS AREA (KM²)

TABLE 3-5 INDICATES CONSTANTS OF THE CREAGER TYPE SPECIFIC TYPE CURVE FOR THE FOLLOWING EQUATION.

$Q = CA^{(A-0.048-1)}$

WHERE:
C = CONSTANT (TABLE 3-5)
A = CATCHMENTS AREA (KM²)

Table 3-5
Constant (c) for Regional Specific Discharge Curve

Region	Return Period					
	2 - year	5- year	10- year	25 - year	50- year	100-year
Luzon	15.66	17.48	18.91	21.51	23.83	25.37
Visayas	6.12	7.77	9.36	11.81	14.52	17.47
Mindanao	8.12	9.15	10.06	11.60	12.80	14.00

REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
REGIONAL OFFICE VIII
SOUTHERN LEYTE 2nd DISTRICT ENGINEERING OFFICE
SOGOD,SOUTHERN LEYTE

PROJECT NAME AND LOCATION: **REPAIR/MAINTENANCE OF MAG-ATAS RIVER DIKE 4 BRGY. MAG-ATAS, SOGOD, SOUTHERN LEYTE** SOGOD, SOUTHERN LEYTE

SHEET CONTENTS: DESIGN CRITERIA

DRAFTED: JANET M. MAKILANG, ENGINEER II
PREPARED: JUNROME C. VILLEJO, ENGINEER II

REVIEWED: RAINIER LOU C. RUIZ, CHIEF, PLANNING & DESIGN SECTION

SUBMITTED: KING PAUL P. DEL ROSARIO, CHIEF, MAINTENANCE SECTION

RECOMMENDED: EVELYN D. YAP, ASSISTANT DISTRICT ENGINEER

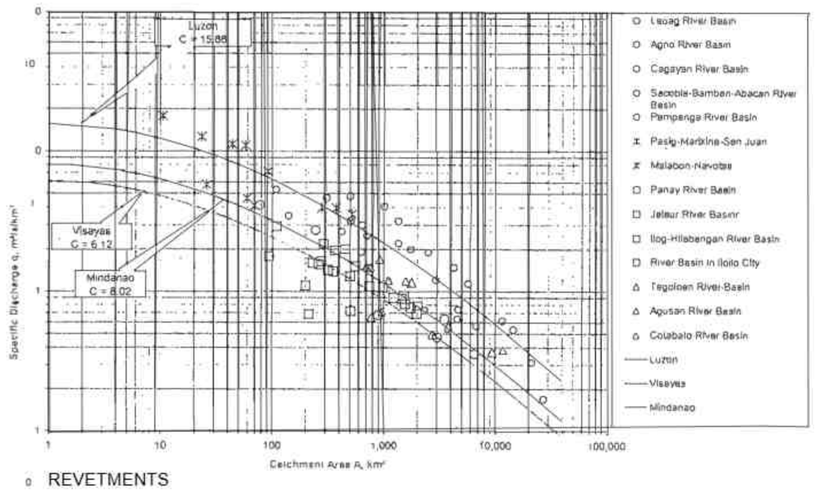
APPROVED: EDUARDO V. SANTOS, DISTRICT ENGINEER

SET NO. 1

SHEET NO. 9/12

USING THE SPECIFIC DISCHARGE CURVE OR EQUATION, DESIGN DISCHARGE OR PROBABLE DISCHARGE IS OBTAINED AS FOLLOWS:

- DETERMINE THE CATCHMENTS AREA (A)
- DETERMINE THE RETURN PERIOD OR SAFETY LEVEL
- FROM THE SPECIFIC DISCHARGE CURVE, FIND THE REGION WHERE THE PROJECT IS LOCATED, THE RETURN PERIOD AND THE CATCHMENTS AREA IN FIGURE 3-4.
- ANOTHER WAY IS TO COMPUTE SPECIFIC DISCHARGE (Q) FROM THE EQUATION, USING CATCHMENTS (A) AND CONSTANT (C) FROM TABLE 3-5 WITH CORRESPONDING REGIONS AND RETURN PERIODS



REVETMENTS

REVETMENTS ARE FLOOD CONTROL STRUCTURES CONSTRUCTED ALONG RIVER BANKS 2ndJECTED TO DIRECT ATTACK OF THE RIVER FLOW AND ALONG LEVEE FOR PROTECTION AGAINST EROSION, SCOURING, RIVERBED DEGRADATION AND WAVE WASH. THEY ARE USED IN MANY SITUATIONS WHERE THE RIVERBANK IS TO BE PROTECTED IN ITS EXISTING LOCATION.

A REVETMENT SHOULD BE DESIGN BASED ON THE EXISTING SITE CONDITIONS, SUCH AS RIVER FLOW VELOCITY AND DIRECTION, EMBANKMENT MATERIAL, TOPOGRAPHICAL, MORPHOLOGICAL, AND GEOLOGICAL CONDITIONS OF THE RIVERBANK, ETC. FURTHER, THE REVETMENT SHOULD BE DESIGNED TO WITHSTAND THE LATERAL FORCES DUE TO HIGH VELOCITY FLOW, WHEN LOCATED IN FLOW ATTACK ZONE, ON A WEAK GEOLOGICAL CONDITION OF RIVERBANK, AND WITH POOR EMBANKMENT MATERIALS.

IT IS IMPORTANT TO NOTE THAT MOST FLEXIBLE REVETMENTS (RIPRAP, GABION MATTRESS (SPREAD TYPE), CONCRETE BLOCKS) DO NOT PROVIDE RESISTANCE AGAINST GEOTECHNICAL INSTABILITY, SUCH AS SLUMPING FAILURE IN SATURATED STREAMBANKS AND EMBANKMENTS

SHEET PILE WALLS

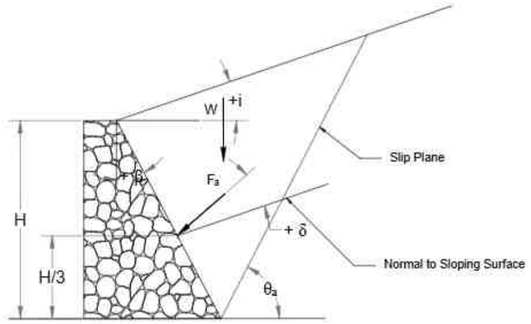
REVETMENTS ARE FLOOD CONTROL STRUCTURES CONSTRUCTED ALONG RIVER BANKS 2ndJECTED TO DIRECT ATTACK OF THE RIVER FLOW AND ALONG LEVEE FOR PROTECTION AGAINST EROSION, SCOURING, RIVERBED DEGRADATION AND WAVE WASH. THEY ARE USED IN MANY SITUATIONS WHERE THE RIVERBANK IS TO BE PROTECTED IN ITS EXISTING LOCATION.

A REVETMENT SHOULD BE DESIGN BASED ON THE EXISTING SITE CONDITIONS, SUCH AS RIVER FLOW VELOCITY AND DIRECTION, EMBANKMENT MATERIAL, TOPOGRAPHICAL, MORPHOLOGICAL, AND GEOLOGICAL CONDITIONS OF THE RIVERBANK, ETC. FURTHER, THE REVETMENT SHOULD BE DESIGNED TO WITHSTAND THE LATERAL FORCES DUE TO HIGH VELOCITY FLOW, WHEN LOCATED IN FLOW ATTACK ZONE, ON A WEAK GEOLOGICAL CONDITION OF RIVERBANK, AND WITH POOR EMBANKMENT MATERIALS.

IT IS IMPORTANT TO NOTE THAT MOST FLEXIBLE REVETMENTS (RIPRAP, GABION MATTRESS (SPREAD TYPE), CONCRETE BLOCKS) DO NOT PROVIDE RESISTANCE AGAINST GEOTECHNICAL INSTABILITY, SUCH AS SLUMPING FAILURE IN SATURATED STREAMBANKS AND EMBANKMENTS

LATERAL EARTH PRESSURE

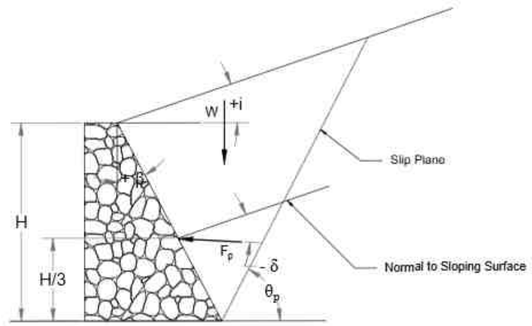
COULOMB'S ACTIVE EARTH PRESSURE FOR INCLINED BACKFILL



ACTIVE CASE

(ACTIVE PRESSURE COEFFICIENT)

$$K_a = \frac{\cos^2(\phi - \beta)}{\cos^2\beta \cos(\beta - \delta)\left[1 - \sqrt{\frac{\sin(\phi + \delta)\sin(\phi - i)}{\cos(\beta + \delta)\cos(\beta - i)}}\right]^2}$$



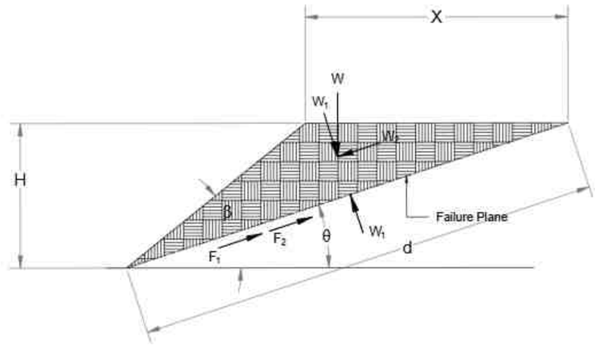
PASSIVE CASE

(PASSIVE PRESSURE COEFFICIENT)

$$K_p = \frac{\cos^2(\phi + \beta)}{\cos^2\beta \cos(\beta - \delta)\left[1 - \sqrt{\frac{\sin(\phi + \delta)\sin(\phi - i)}{\cos(\beta - \delta)\cos(\beta - i)}}\right]^2}$$

SLOPE STABILITY

FINITE SLOPE WITH PLANE FAILURE SURFACE
(CULMAN'S METHOD)



$$\frac{c_d}{} = \frac{c}{F.S.}$$

$$FS_\theta = \frac{\tan\phi}{\tan\phi_d}$$

$$\tan\theta_d = \frac{\tan}{\phi}$$

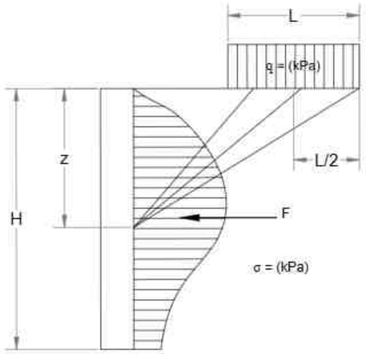
FS

$$c_d = \frac{\gamma_s H\ [1-\cos(\beta - \phi_d)]}{4\sin\beta\cos\phi_d}$$

$$m = \frac{1-\cos(\beta - \phi_d)}{4\sin\beta\cos\phi_d}$$

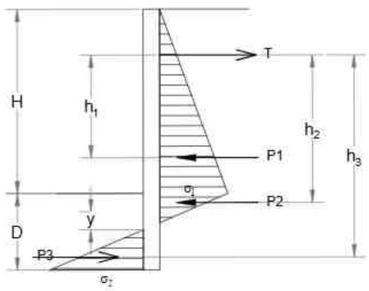
REPUBLIC OF THE PHILIPPINES DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS REGIONAL OFFICE VIII SOUTHERN LEYTE 2nd DISTRICT ENGINEERING OFFICE SOGOD,SOUTHERN LEYTE	PROJECT NAME AND LOCATION: REPAIR/MAINTENANCE OF MAG-ATAS RIVER DIKE 4 BRGY. MAG-ATAS, SOGOD, SOUTHERN LEYTE SOGOD, SOUTHERN LEYTE	SHEET CONTENTS: DESIGN PARAMETERS	DRAFTED: JANET M. MAKILANG ENGINEER II PREPARED: JUNROMEO C. VILLEJO ENGINEER II	REVIEWED: RAINIER LOU C. RUIZ CHIEF, PLANNING & DESIGN SECTION	SUBMITTED: KING PAUL P. DEL ROSARIO CHIEF, MAINTENANCE SECTION	RECOMMENDED: EVELYN D. YAP ASSISTANT DISTRICT ENGINEER	APPROVED: EDUARDO V. SANTOS DISTRICT ENGINEER	SET NO. 1	SHEET NO. 10 12

LATERAL PRESSURE ON RETAINING WALL DUE TO STRIP-LOAD SURCHARGE



$$\sigma_t = \frac{2q\ (\beta - \sin\beta \cos 2\alpha)}{H}$$

ANCHORED SHEET PILES



$\sigma_1 = \gamma_s H K_a$

$\gamma_s (K_p - K_a) y = \gamma_s H K_a$

$\sigma_2 = \gamma_s (K_p - K_a) h$

PILED FOUNDATION

PILES (DRIVEN OR BORED) IS RECOMMENDED FOR IMPORTANT STRUCTURES SUCH AS THE PROJECT CONCERNED. THE PILES CAN BE SET ON OVER COMPACTED STRATUM WHERE THEY CAN DEVELOP THEIR AXIAL RESISTANCE FROM END BEARING AND SKIN RESISTANCE.

4.5.1 ULTIMATE LOAD-CARRYING CAPACITY, Q_u
THE ULTIMATE LOAD-CARRYING CAPACITY Q_u OF A PILE IS GIVEN BY THE EQUATION:

$Q_u = Q_p + Q_s$

EQUATION 1

Where:

Q_p = LOAD - CARRYING CAPACITY OF THE PILE POINT
Q_s = FRICTIONAL RESISTANCE (SKIN FRICTION) DERIVED FROM THE SOIL PILE INTERFACE

4.5.2 POINT BEARING CAPACITY (MEYERHOF, 1976), Q_p
FOR PILES IN SAND, C' = 0, THE NET ULTIMATE LOAD CAN BE GIVEN AS

$Q_p = A_p q' N_q^* \leq A_p q_l$

EQUATION 2

Where:

A_p = AREA OF THE PILE
q' = EFFECTIVE VERTICAL STRESS AT THE LEVEL OF THE PILE TIP
N_q^* = BEARING CAPACITY FACTOR (BASED ON TABLE 11.5 IN DAS, 2007)
q_l = $0.5 p_a N_q^* \tan \phi$
p_a = ATMOSPHERIC PRESSURE (= 100 kN/m^2)

FOR PILES IN SATURATED CLAYS UNDER UNDRAINED CONDITIONS (ϕ = 0), THE NET ULTIMATE LOAD CAN BE GIVEN AS

$Q_p = 9 c_u A_p$

EQUATION 3

Where:

cu = UNDRAINED COHESION OF THE SOIL BELOW THE TIP OF THE PILE
Ap = AREA OF PILE TIP

4.5.3 FRICTIONAL RESISTANCE, Q_s
THE FRICTIONAL , OR SKIN, RESISTANCE OF A PILE IN SAND MAY BE WRITTEN AS:

$Q_s = \Sigma p \Delta L f$

EQUATION 4

Where:

p = PERIMETER OF THE PILE SECTION
ΔL = INCREMENTAL PILE LENGTH OVER WHICH P AND F ARE TAKEN TO BE CONSTANT
f = UNIT FRICTION RESISTANCE AT NAY DEPTH z,

THE UNIT FRICTION RESISTANCE FOR SAND, F IS DEFINED BY THIS RELATIONSHIP:

$f = K \sigma_o' \tan \delta'$

EQUATION 5

Where:

σ_o = AVERAGE VERTICAL EFFECTIVE STRESS
k = 1.65 M FOR H-PILES , 1.26 FOR STEEL PIPE PILES, 1.5 FOR PRE-CAST PILES (MANSUR AND HUNTER, 1970)
φ' = SOIL-PILE FRICTIOLN ANGLE $0.5\varphi'$ to $0.8\varphi'$

THE ULTIMATE SKIN RESISTANCE FOR SAND CAN THUS BE GIVEN AS:

$Q_s = \Sigma (K \sigma_o' \tan \delta') p \Delta L$

EQUATION 6

THE UNIT FRICTION RESISTANCE FOR CLAY, F ACCORDING TO THE A METHOD IS RELATED TO THE UNDRAINED COHESION BY THIS RELATIONSHIP:

$f = \alpha c_u$

EQUATION 7

Where α = EMPERICAL ADHESION FACTOR (SLADEN, 1992),

$\alpha = C (\sigma_o / \sigma_a)$

EQUATION 8

Where:

$\bar{\sigma'_o}$ = AVERAGE VERTICAL EFFECTIVENESS STRESS
C ≈ 0.4 TO 0.5 FOR BORED PILES AND $\geq$ 0.5 FOR DRIVEN PILES

THE ULTIMATE SKIN RESISTANCE CAN THUS BE GIVEN AS:

$Q_s = \Sigma \alpha c_u p \Delta L$

EQUATION 9

4.5.4 ALLOWABLE LOAD, Q_{all}

AFTER THE TOTAL ULTIMATE LOAD - CARRYING CAPACITY OF A PILE HAS BEEN DETERMINED, A REASONABLE FACTOR OF SAFETY SHOULD BE USED TO OBTAIN THE TOTAL ALLOWABLE LOAD FOR EACH PILE, OR

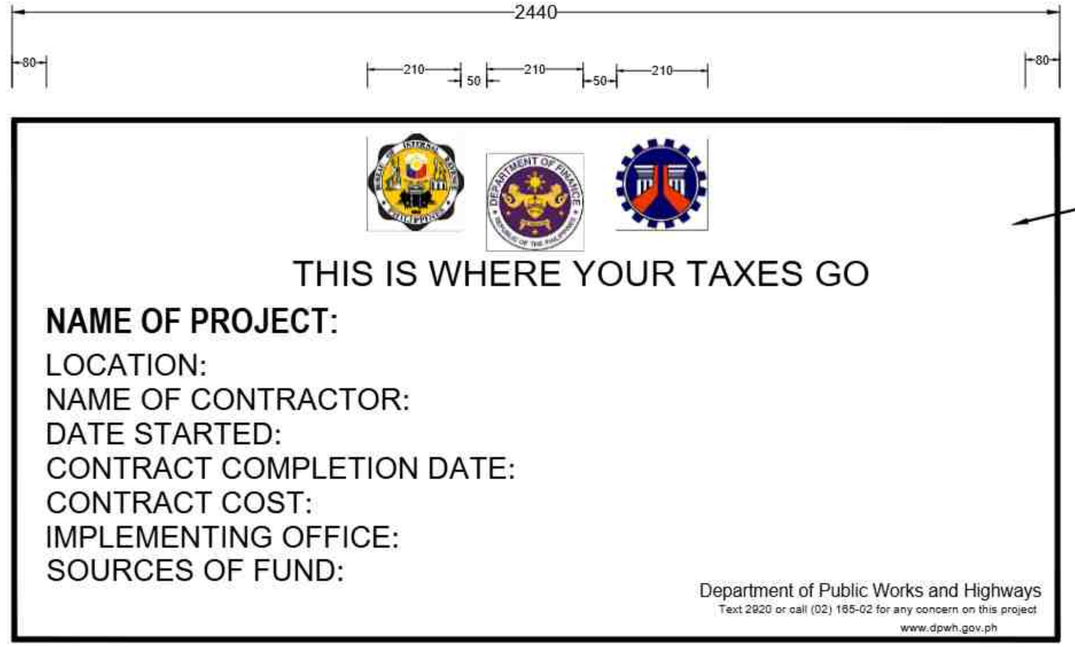
$Q_{all} = Q_u / FS$

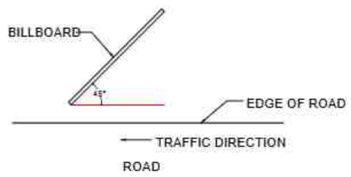
EQUATION 10

Where:

Q_{all} = ALLOWABLE LOAD CARRYING CAPACITY FOR EACH PILE
FS = FACTOR OF SAFETY

REPUBLIC OF THE PHILIPPINES **DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS** REGIONAL OFFICE VIII SOUTHERN LEYTE 2nd DISTRICT ENGINEERING OFFICE SOGOD,SOUTHERN LEYTE	PROJECT NAME AND LOCATION: **REPAIR/MAINTENANCE OF MAG-ATAS RIVER DIKE 4 BRGY. MAG-ATAS, SOGOD, SOUTHERN LEYTE** SOGOD, SOUTHERN LEYTE	SHEET CONTENTS: DESIGN PARAMETERS	DRAFTED: JANET M. MAKILANG ENGINEER II PREPARED: JUNROME C. VILLEJO ENGINEER II	REVIEWED: RAINIER LOU C. RUIZ CHIEF, PLANNING & DESIGN SECTION	SUBMITTED: KING PAUL P. DEL ROSARIO CHIEF, MAINTENANCE SECTION	RECOMMENDED: EVELYN D. YAP ASSISTANT DISTRICT ENGINEER	APPROVED: EDUARDO V. SANTOS DISTRICT ENGINEER	SET NO.: 1	SHEET NO.: 11/12



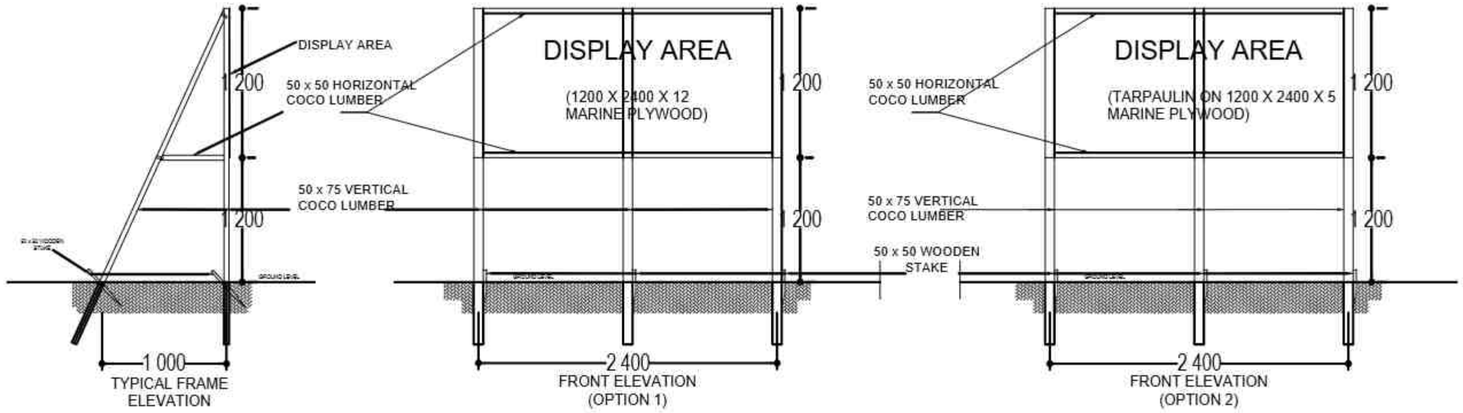


DPWH STANDARD PROJECT BILLBOARD

NOTE:

INSTALLATION OF BILLBOARD SHALL REFER TO DEPARTMENT ORDER NO 11, SERIES OF 2022, INSTALLATION OF REVISED PROJECT BILLBOARDS.

ORIENTATION



BILLBOARD FRAME

(NOT TO SCALE, ALL DIMENSIONS ARE IN MILLIMETERS)

REPUBLIC OF THE PHILIPPINES **DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS** REGIONAL OFFICE VIII SOUTHERN LEYTE 2nd DISTRICT ENGINEERING OFFICE SOGOD,SOUTHERN LEYTE	PROJECT NAME AND LOCATION: **REPAIR/MAINTENANCE OF MAG-ATAS RIVER DIKE 4 BRGY, MAG-ATAS, SOGOD, SOUTHERN LEYTE** SOGOD, SOUTHERN LEYTE	SHEET CONTENTS: PROJECT BILLBOARD	DRAFTED: JANET M. MAKILANG ENGINEER II PREPARED: JUNROME C. VILLEJO ENGINEER II	REVIEWED: RAINIER LOUIS C. RUIZ CHIEF, PLANNING & DESIGN SECTION	SUBMITTED: KING PAUL P. DEL ROSARIO CHIEF, MAINTENANCE SECTION	RECOMMENDED: EVELYN D. YAP ASSISTANT DISTRICT ENGINEER	APPROVED: EDUARDO V. SANTOS DISTRICT ENGINEER	SET NO. 1	SHEET NO. 12 12