097.13 DPWH
11.24.2021

Republic of the Philippines
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
CENTRAL OFFICE
Manila

NOV 23 2021

DEPARTMENT ORDER NO. 103 Series of 2021 11/24/2021

SUBJECT: New and Updated Standard Plans for Various Water Engineering Projects (CY 2020)

In line with the issuance of Department Order No. 179 series of 2015, re: DPWH Design Guidelines, Criteria and Standards (DGCS), 2015 Edition, new and updated standard plans for the design of various water engineering projects are now available for reference.

The issuance of these standard plans aims to ensure the safety, cost effectiveness and development of high quality detailed design for water engineering projects incorporating the industry's best practice in design adaptable to local requirements. The said plans shall serve as guide for District Engineering Offices, Regional Offices, Project Management Office Clusters and Engineering Consultants in the preparation of water engineering plans based on the revised design guidelines.

The new and updated standard plans for water engineering projects are as follows:

I. NEW
   1. Rubble Mound Groynes (4 sheets)

II. UPDATED
   1. Boulder Spur Dike (3 sheets)

The aforementioned plans can be downloaded from the DPWH Intranet (http:dpwhnet) under Bureau of Design - Standard Design.

ROGER G. MERCADO
Acting Secretary

Department of Public Works and Highways
Office of the Secretary
WIN1R01508

5.1.2 RFIL/LLL/ECM

REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
BUREAU OF DESIGN, WATER PROJECTS DIVISION
BONIFACIO DRIVE, PORT AREA, MANILA

STANDARD RUBBLE MOUND GROYNES

SUBMITTED BY:

LEONARDO L. LINGAN
CHIEF, WATER PROJECTS DIVISION
BUREAU OF DESIGN

DATE:

RECOMMENDING APPROVAL:

ARISTARCO M. DOROY
OFFICER-IN-CHARGE
BUREAU OF DESIGN

DATE: NOV 25 2020

APPROVED BY:

MAXIMO L. CARVAJAL
UNDERSECRETARY FOR
TECHNICAL SERVICES

DATE:

GENERAL NOTES

I. DESIGN CRITERIA AND SPECIFICATIONS

1. DPWH DESIGN GUIDELINES, CRITERIA AND STANDARDS 2015 - VOLUMES II AND III
2. DPWH STANDARD SPECIFICATIONS FOR PUBLIC WORKS AND HIGHWAYS, 2013 EDITION
3. UNITED STATES ARMY CORPS OF ENGINEERS (USACE) COASTAL ENGINEERING MANUAL, 2011
4. PHILIPPINE PORTS AUTHORITY MANUAL, 2009

II. DESIGN CONDITION

1. DESIGN WAVE HEIGHT SHALL BE DETERMINED BASED ON THE ANALYSIS.
2. GROYNE LENGTH DEPENDS ON THE DESIRED BEACH ALIGNMENT. TOO LONG GROYNES TEND TO ACCELERATE DOWNDRIFT EROSION WHILE TOO SHORT GROYNES MIGHT BE INEFFECTIVE.
3. GROYNE SPACING OR THE DISTANCE BETWEEN GROYNE DEPENDS ON WAVE DIRECTION. ADJUSTED SHORELINE FORMS PERPENDICULAR TO THE NEARSHORE DIRECTION OF THE PREDOMINANT WAVES.
4. CREST HEIGHT IS DEPENDENT ON THE EQUIVALENT TOTAL HEIGHT OF HIGHER HIGH WATER, SIGNIFICANT WAVE, AND FREEBOARD.
5. CREST WIDTH IS DEPENDENT ON THE STABILITY COMPUTATION, CONSTRUCTION METHODOLOGY, AND OTHER PURPOSES TO BE CONSIDERED.

III. MATERIAL AND CONSTRUCTION REQUIREMENTS

1. ARMOUR COVER

   THE WEIGHT OF ARMOUR UNIT, W_{50} AND THE LAYER THICKNESS FOR THE ARMOUR COVER SHALL BE AS SPECIFIED IN THE PLAN & SCHEDULE. ARMOUR STONE DIAMETER, D_{50} SHALL BE EQUAL TO THE CUBE ROOT OF THE QUOTIENT OF ARMOUR WEIGHT OVER STONE UNIT WEIGHT. EXPOSED ARMOUR ROCKS SHALL BE CLASS II ROCKS WITH A MINIMUM OF 500KG PER PIECE OR AS SPECIFIED IN THE SCHEDULE. TOE PROTECTION OR SUBMERGED ROCKS SHALL BE CLASS I ROCKS WITH A MINIMUM OF 2000 KG PER PIECE OR AS SPECIFIED IN THE SCHEDULE. NO STONE SHALL HAVE A LONGEST DIMENSION LESS THAN TWO NOR MORE THAN THREE TIMES ITS SHORTEST DIMENSION AS DETERMINED ALONG PERPENDICULAR AXES PASSING THROUGH THE APPROXIMATE CENTER OF GRAVITY.

2. CORE MATERIAL

   THE WEIGHT OF CORE MATERIAL (CLASS II AND/OR CLASS III ROCKS) SHALL NOT BE LESS THAN ARMOUR ROCK WEIGHT OVER 4000 NOR GREATER THAN ARMOUR ROCK WEIGHT OVER 200 PER PIECE AS SPECIFIED IN THE SCHEDULE. QUARRY STONES SHALL BE ROUGH AND ANGULAR.

3. STONE PLACEMENT

   EACH STONE WILL BE INDIVIDUALLY PLACED BY EQUIPMENT SUITABLE FOR LIFTING, MANIPULATING AND PLACING STONES OF THE SIZE AND SHAPE SPECIFIED. EACH STONE SHALL BE PLACED WITH ITS LONGEST AXIS PERPENDICULAR TO THE ARMOR SLOPE . PLACING EFFORTS SHALL ENSURE THAT EACH STONE IS FIRMLY SET AND SUPPORTED BY UNDERLYING MATERIALS AND ADJACENT STONES. LOOSE STONES SHALL BE RESET OR REPLACED.

4. FILTER/BEDDING LAYER

   STONES SHOULD BE WELL BLENDED. THE STONES WITH THE LARGEST DIMENSION, GREATER THAN THREE TIMES THE LEAST DIMENSION SHOULD NOT CONSTITUTE MORE THAN 10 PERCENT OF THE TOTAL.

   MATERIALS SHOULD BE INERT TO CHEMICAL AND BIOLOGICAL DEGRADATION IN SEA WATER.

   THE WEIGHT OF BEDDING MATERIAL SHALL NOT BE LESS THAN ARMOUR ROCK WEIGHT OVER 6000 NOR GREATER THAN ARMOUR ROCK WEIGHT OVER 2000 PER PIECE AS SPECIFIED IN THE SCHEDULE.

   GRADATION REQUIREMENTS OF THE BEDDING LAYER OF FILTER BLANKET SHALL BE D85 (FILTER) $\leq$ 5 D15 (FOUNDATION); i.e, THE DIAMETER EXCEEDED BY THE COARSEST 85 PERCENT OF THE FILTER MATERIAL MUST BE LESS THAN OR EQUAL TO FIVE TIMES THE DIAMETER EXCEEDED BY THE COARSEST 15 PERCENT OF THE FOUNDATION MATERIAL. QUARRY SPALLS RANGING IN SIZE FROM 0.45 KG TO 23 KG WILL GENERALLY SUFFICE IF THE BEDDING LAYER IS PLACED ON A FILTER CLOTH OR A COARSE GRAVEL (OR CRUSHED STONE) FILTER LAYER WHICH MEETS THE STATED FILTER DESIGN CRITERIA.

   THE FOLLOWING STANDARD TESTS SHALL BE CONDUCTED TO ESTABLISH MATERIAL DURABILITY:

ABRASION TEST	:	ASTM C-535 OR EQUIVALENT
TOUGHNESS TEST	:	ASTM C-170 OR EQUIVALENT
HARDNESS TEST	:	ASTM C-235 OR EQUIVALENT
APPARENT SPECIFIC GRAVITY AND ABSORPTION TEST	:	ASTM C-127 OR EQUIVALENT

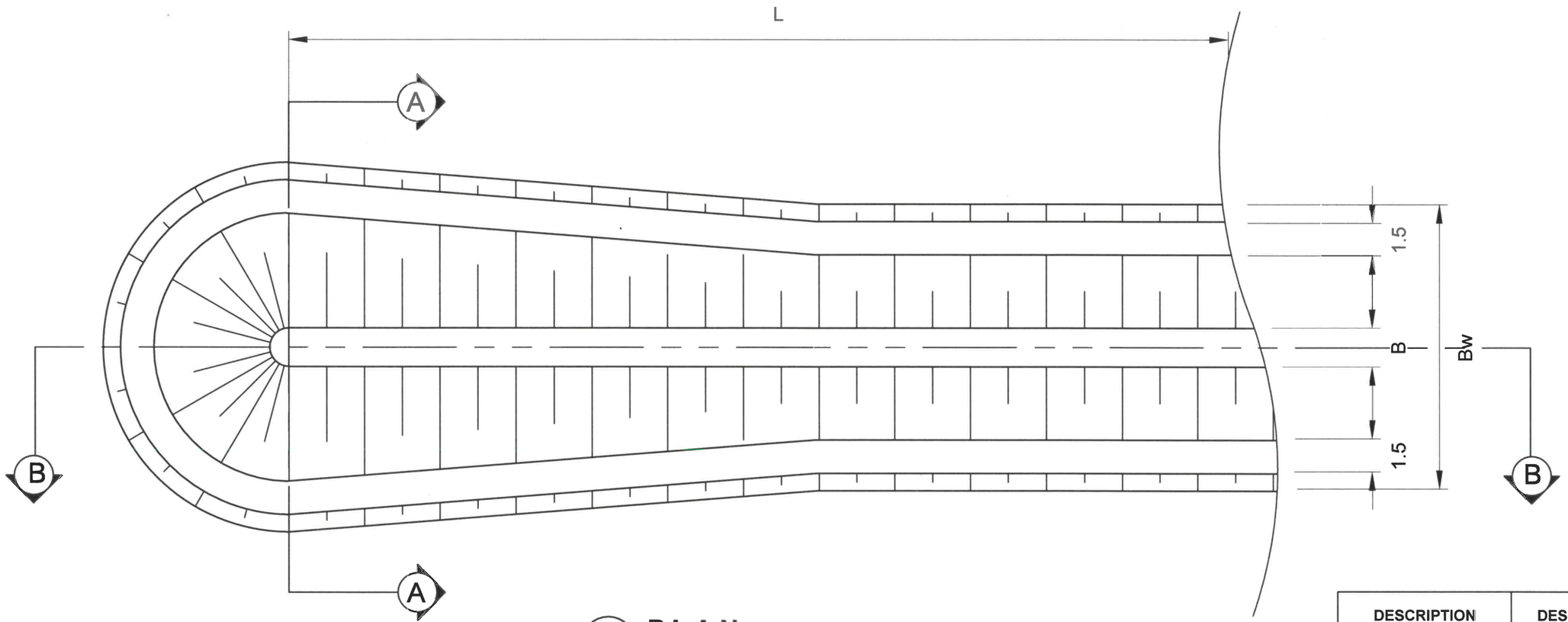
5. SAND INFILL

   THE SAND INFILL MATERIAL SHALL CONSIST OF NATURALLY OCCURRING OR PROCESSED MATERIAL WHICH AT THE TIME OF FILLING IS CAPABLE OF FULFILLING THE SPECIFIED REQUIREMENTS TO PROVIDE MASS AND INTEGRITY. THE FILL MATERIAL SHALL NOT CONTAIN MATERIALS SUSCEPTIBLE TO VOLUME CHANGE (i.e. MARINE MUD, SWELLING CLAYS AND COLLAPSIBLE SOILS), PEAT, VEGETATION, TIMBER, ORGANIC, SOLUBLE OR PERISHABLE MATERIAL, TOXIC, COMBUSTIBLE OR DANGEROUS MATERIAL, METAL, RUBBER OR OTHER UNSUITABLE MATERIAL.

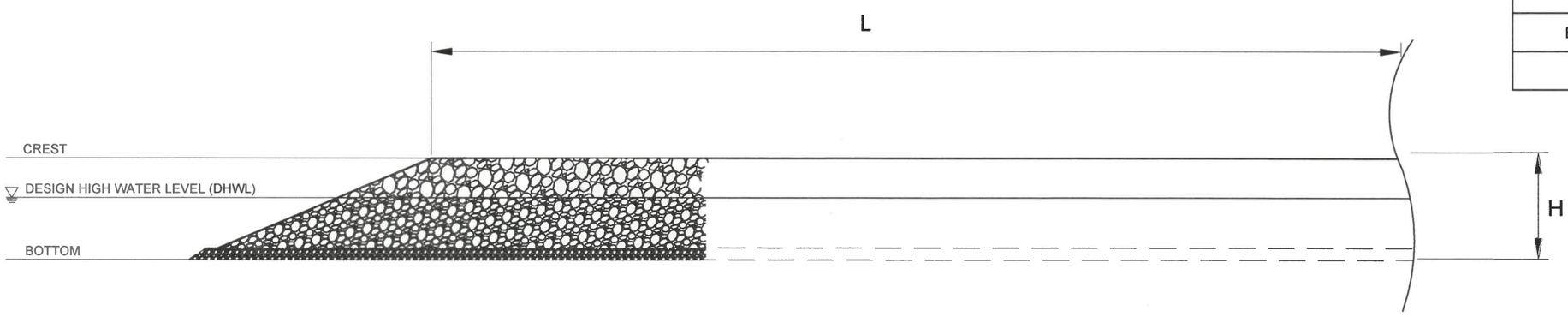
6. ALL QUANTITIES SHALL BE VERIFIED DURING CONSTRUCTION. ALL DIMENSIONS, ELEVATIONS AND STATIONING SHALL BE VERIFIED BEFORE THE START OF CONSTRUCTION.

REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
BUREAU OF DESIGN
WATER PROJECTS DIVISION
BONIFACIO DRIVE, PORT AREA, MANILA

SHEET TITLE:	SHEET CONTENTS:	PREPARED:	SUBMITTED:	RECOMMENDING APPROVAL:	APPROVED:	SET NO.	SHEET NO.
STANDARD RUBBLE MOUND GROYNES	GENERAL NOTES	DARYL PAUL B. DE LA ROSA, ENGINEER II; CATHERINE KAY G. DUQUE, ENGINEER III DRAFTED: RAFAELL. REGIL, ENGINEERING ASSISTANT REVIEWED: TESSIE E. DAGURO, ENGINEER IV	LEONARDO L. LINGAN, CHIEF, WATER PROJECTS DIVISION DATE	SEE COVER SHEET ARISTARCO M. DOROY, OFFICER-IN-CHARGE BUREAU OF DESIGN DATE NOV 25	SEE COVER SHEET MAXIMO L. CARVAJAL, UNDERSECRETARY FOR TECHNICAL SERVICES DATE	STD 01 04	1 OF 4



PLAN
SCALE: NTS



PROFILE
SCALE: NTS

DESCRIPTION	DESIGNATION
HEIGHT	H
CREST WIDTH	B
BASE WIDTH	Bw
LENGTH	L

REPUBLIC OF THE PHILIPPINES
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BUREAU OF DESIGN
WATER PROJECTS DIVISION
BONIFACIO DRIVE, PORT AREA, MANILA

SHEET TITLE: STANDARD RUBBLE MOUND GROYNES

SHEET CONTENTS: PLAN & PROFILE

PREPARED: DARYL PAUL B. DE LA ROSA, ENGINEER II; CATHERINE JOY G. DUQUE, ENGINEER III
DRAFTED: RAFAEL T. REGIL, ENGINEERING ASSISTANT
REVIEWED: TESSIE E. DAGURO, ENGINEER IV

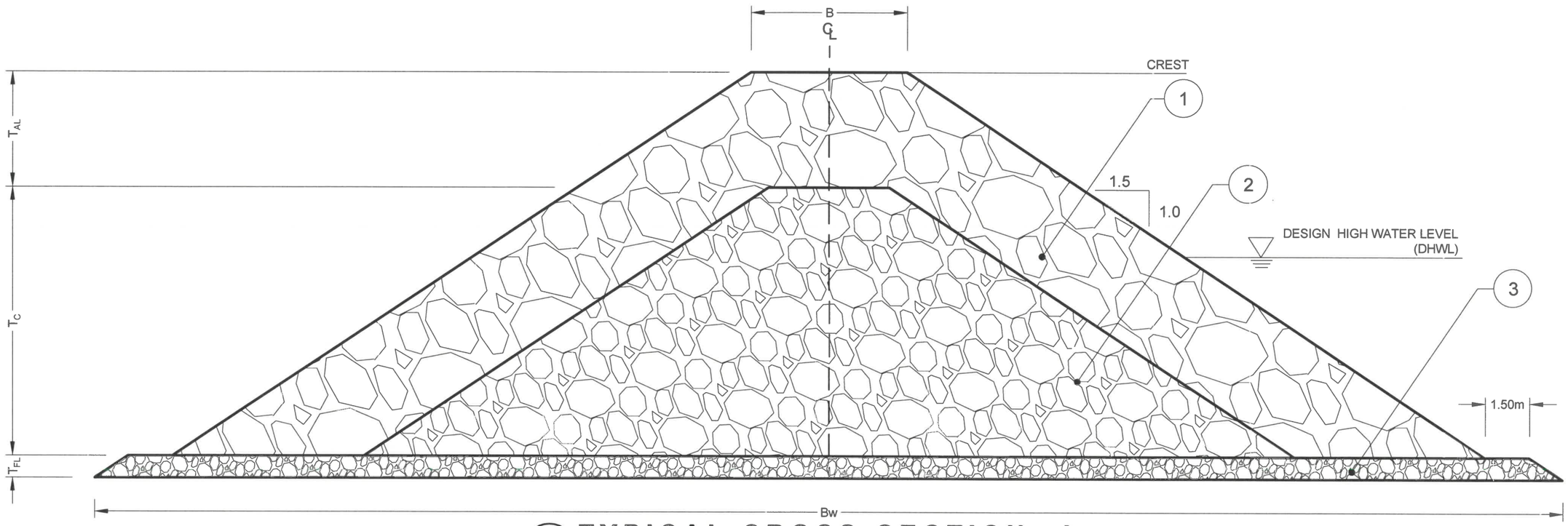
SUBMITTED: LEONARDO L. LINGAN, CHIEF, WATER PROJECTS DIVISION, DATE

RECOMMENDING APPROVAL: SEE COVER SHEET, ARISTARCO M. DOROY, OFFICER-IN-CHARGE, BUREAU OF DESIGN, DATE NOV 25 2020

APPROVED: SEE COVER SHEET, MAXIMO L. CARVAJAL, UNDERSECRETARY FOR TECHNICAL SERVICES, DATE

SET NO. STD 02 04

SHEET NO. 2 OF 4



TYPICAL CROSS-SECTION :A

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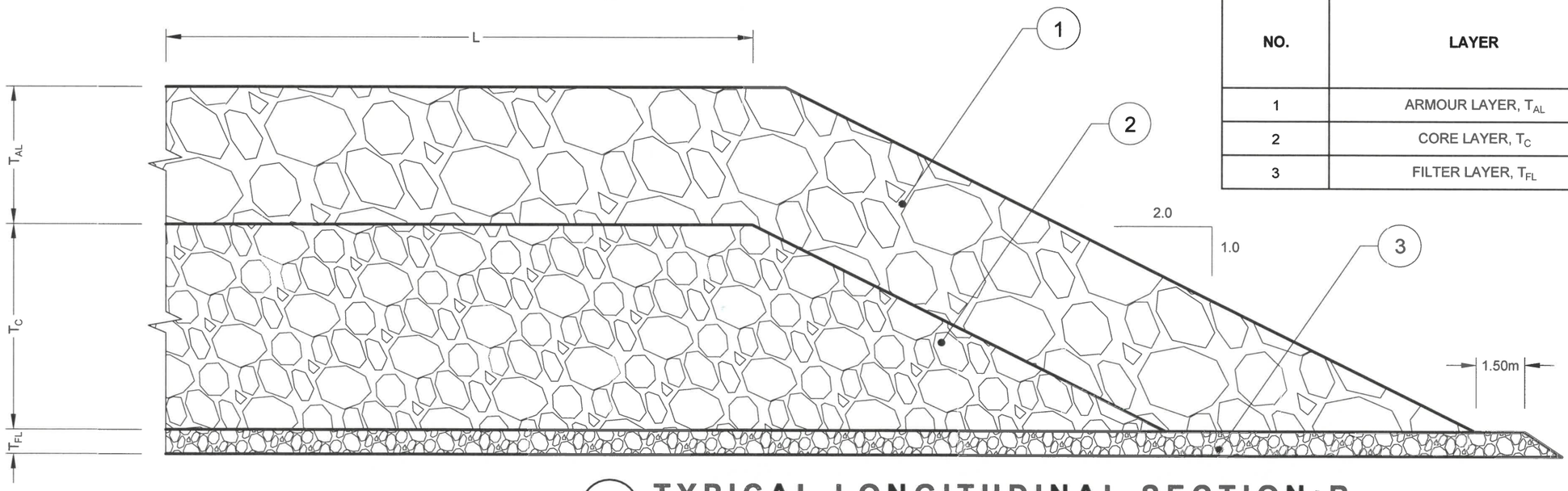

NO.	LAYER	MINIMUM ROCK WEIGHT
1	ARMOUR LAYER, T_{AL}	W_{50}
2	CORE LAYER, T_C	$W_{50}/200$ to $W_{50}/4000$
3	FILTER LAYER, T_{FL}	$W_{50}/2000$ to $W_{50}/6000$

TYPICAL LONGITUDINAL SECTION:B

SCALE: NTS

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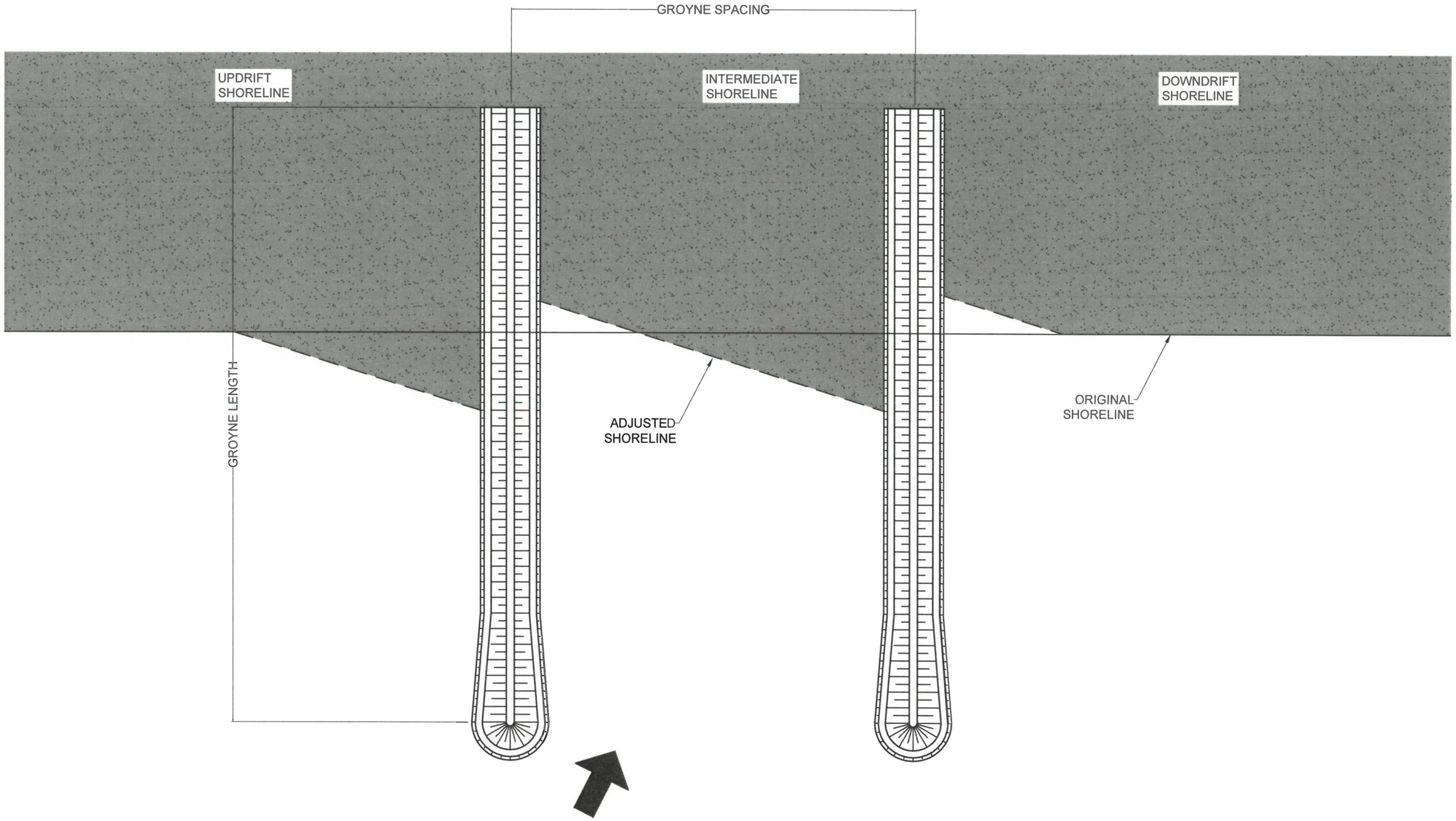
WATER PROJECTS DIVISION
BONIFACIO DRIVE, PORT AREA, MANILA

SHEET TITLE:	SHEET CONTENTS:	PREPARED:	SUBMITTED:	RECOMMENDING APPROVAL:	APPROVED:	SET NO.	SHEET NO.
STANDARD RUBBLE MOUND GROYNES	TYPICAL SECTION	DARYL PAUL B. DE LA ROSA, ENGINEER II; CATHERINE KAY G. DUQUE, ENGINEER III DRAFTED: RAFAELA REGIL, ENGINEERING ASSISTANT REVIEWED: TESSIE E. DAGURO, ENGINEER IV	LEONARDO L. LINGAN, CHIEF, WATER PROJECTS DIVISION DATE	SEE COVER SHEET ARISTARCO M. DOROY, OFFICER-IN-CHARGE, BUREAU OF DESIGN DATE NOV	SEE COVER SHEET MAXIMO L. CARVAJAL, UNDERSECRETARY FOR TECHNICAL SERVICES DATE	STD 03 04	3 OF 4



GENERAL LAYOUT PLAN

SCALE: NTS

REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
BUREAU OF DESIGN
WATER PROJECTS DIVISION
BONIFACIO DRIVE, PORT AREA, MANILA

SHEET TITLE:	SHEET CONTENTS:					SET NO.	SHEET NO.
STANDARD RUBBLE MOUND GROYNES	GENERAL LAYOUT PLAN	PREPARED: DARYL PAUL B. DE LA ROSA, ENGINEER II; CATHERINE KAYE S. DUQUE, ENGINEER III	SUBMITTED: LEONARDO L. LINGAN, CHIEF, WATER PROJECTS DIVISION, DATE	RECOMMENDING APPROVAL: SEE COVER SHEET ARISTARCO M. DOROY, OFFICER-IN-CHARGE BUREAU OF DESIGN, DATE NOV 2 2020	APPROVED: SEE COVER SHEET MAXIMO L. CARVAJAL, UNDERSECRETARY FOR TECHNICAL SERVICES, DATE	STD 04 04	4 OF 4
		DRAFTED: RAFAEL L. REGIL, ENGINEERING ASSISTANT					
		REVIEWED: TESSIE E. DAGURO, ENGINEER IV					

REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
BUREAU OF DESIGN, WATER PROJECTS DIVISION
BONIFACIO DRIVE, PORT AREA, MANILA

STANDARD PLAN OF BOULDER SPUR DIKE

SUBMITTED BY:

LEONARDO L. LINGAN
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BUREAU OF DESIGN

DATE:

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BUREAU OF DESIGN

DATE: NOV 25 2020

APPROVED BY:

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GENERAL NOTES

I. DESIGN CRITERIA AND SPECIFICATIONS

1. DPWH DESIGN GUIDELINES, CRITERIA AND STANDARDS 2015 - VOLUME III
2. DPWH STANDARD SPECIFICATIONS FOR PUBLIC WORKS AND HIGHWAYS, 2013 EDITION

II. DESIGN CONDITIONS

1. HYDRAULIC DATA
   A. DRAINAGE AREA, DA = ___km^2
   B. DESIGN DISCHARGE, Q = ___m^3/sec.
   C. VELOCITY, V = ___m/sec.

2. DESIGN WATER LEVEL
   THE DESIGN FLOOD LEVEL (DFL) AND ORDINARY WATER LEVEL (OWL) DURING RAINY SEASON SHALL BE INDICATED ON THE DESIGN PLAN.

3. DESIGN VELOCITY
   THE DESIGN VELOCITY SHALL BE TWO (2) TIMES THE CROSS SECTIONAL AVERAGE VELOCITY

4. ORIENTATION
   IT IS RECOMMENDED THAT THE SPUR DIKE FURTHEST UPSTREAM BE ANGLED DOWNSTREAM. THE FIRST SPUR DIKE SHOULD BE LOCATED UPSTREAM OF THE MOST SEVERE SCOURING AREA, SUBSEQUENT SPURS DOWNSTREAM SHOULD BE GENERALLY ALL BE SET NORMAL TO THE BANK LINE.

5. HEIGHT
   A. THE HEIGHT OF IMPERMEABLE SPUR DIKES SHOULD NOT EXCEED THE TOP OF THE BANKS.
   B. THE HEIGHT OF NON-OVERFLOW TYPE SHOULD BE AT THE LEVEL OF THE DESIGN FLOOD.
   C. THE HEIGHT OF OVERFLOW TYPE SHALL BE THE MAXIMUM OF:
      - 10% TO 40% OF THE DISTANCE RECKONED FROM THE AVERAGE RIVERBED TO THE DFL.
      - 0.5M TO 1.0M ABOVE THE ORDINARY WATER LEVEL DURING RAINY SEASON.

6. TOP/CREST WIDTH
   THE TOP/CREST WIDTH OF IMPERMEABLE SPUR DIKES RANGES FROM 1M TO 3M.

7. SLOPES
   A. LONGITUDINAL SLOPE = 1V : 20H TO 1V : 100H TOWARDS THE CENTER OF THE RIVER
   B. SIDE SLOPES = 1V : 1H TO 1V : 2H BOTH ON UPSTREAM AND DOWNSTREAM SIDE

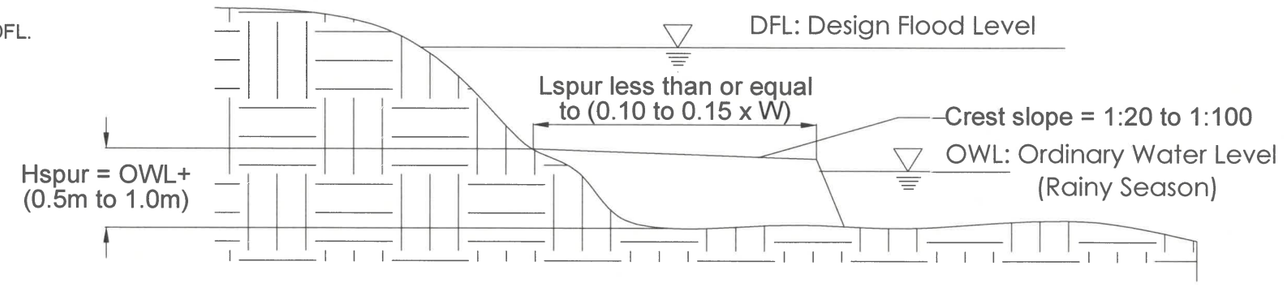
8. LENGTH
   A. 10% TO 15% OF THE RIVER WIDTH ≤ 100M
   B. THE RIVER FLOW CAPACITY SHOULD BE EXAMINED WHEN:
      - LENGTH OF SPUR DIKE IS MORE THAN 10% OF THE RIVER WIDTH
      - SPUR DIKE IS TO BE CONSTRUCTED IN NARROW RIVER

9. SPACING
   A. THE SPACING FOR SEMI-IMPERMEABLE/IMPERMEABLE SPUR DIKES, S, SHOULD BE:
   - S < 2 TIMES ITS EFFECTIVE LENGTH AT FLOW ATTACK ZONES
   - S < 2 TO 4 TIMES ITS EFFECTIVE LENGTH AT STRAIGHT SECTIONS OF CHANNEL
   *NOTE:EFFECTIVE LENGTH, L = LENGTH FROM DESIRED BANKLINE TO THE TIP OF THE SPUR DIKE

10. EMBEDMENT DEPTH
    PROVISION OF 0.20M LAYER OF GRAVEL BEFORE PLACEMENT OF THE MAIN BODY

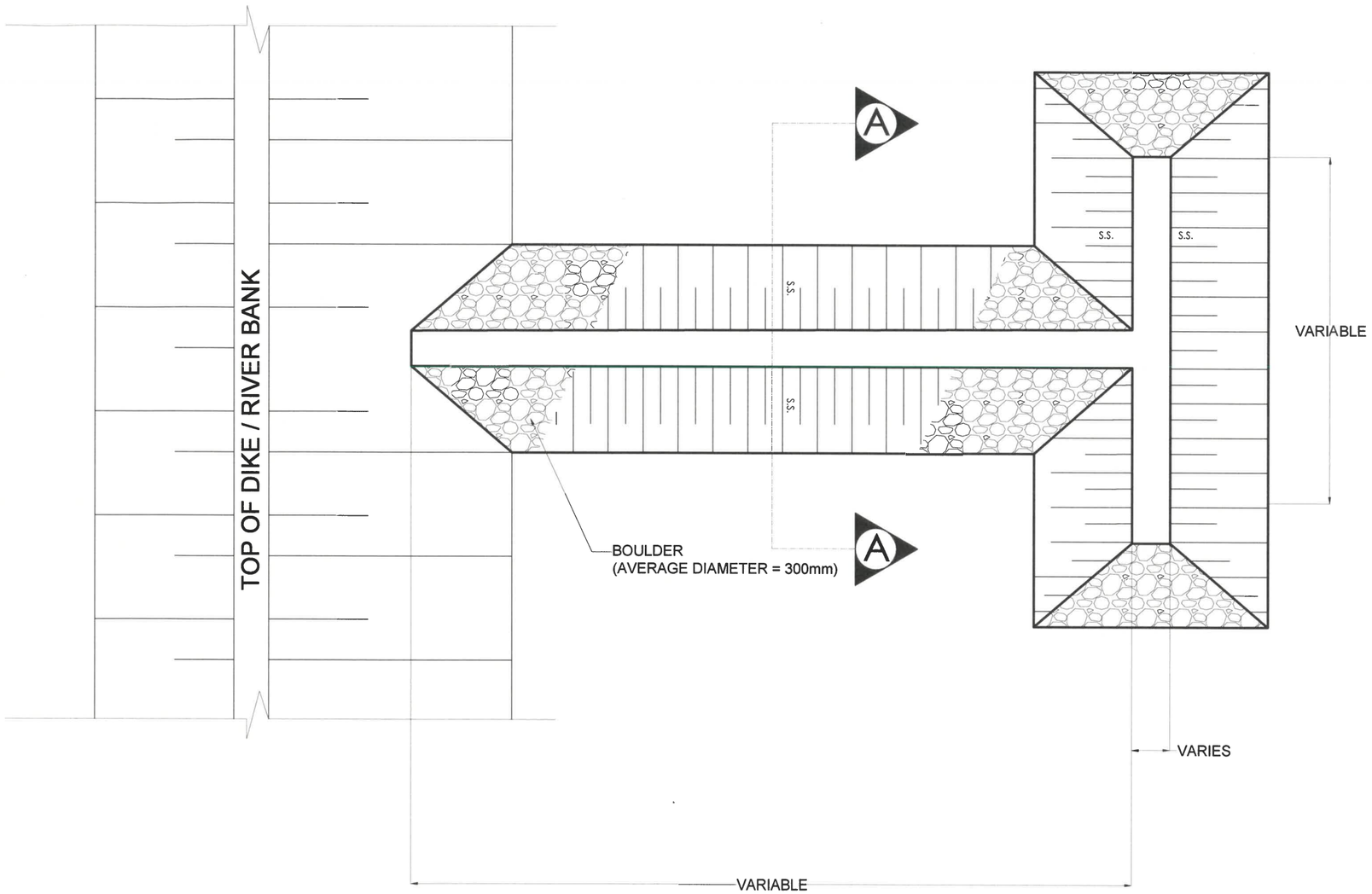
11. THE AVERAGE DIAMETER OF THE BOULDER SHALL BE 300MM. IF THE DIAMETER OF THE BOULDER PRESENT IN THE RIVER IS LARGER THAN 300MM, USE LARGER BOULDER SIZE AS CONSTRUCTION MATERIAL

12. REQUIRED DESIGN ANALYSES (HYDROLOGY, HYDRAULICS, SCOUR, SETTLEMENT & STABILITY) SHALL BE CONDUCTED



GENERAL NOTES
SCALE NTS

REPUBLIC OF THE PHILIPPINES **DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS** BUREAU OF DESIGN WATER PROJECTS DIVISION BONIFACIO DRIVE, PORT AREA, MANILA	SHEET TITLE: STANDARD PLAN OF BOULDER SPUR DIKE	SHEET CONTENTS: GENERAL NOTES	PREPARED: RICHARD V. LOMBOY, ENGINEER III DRAFTED: JAN CHRISTOPHER A. TUASON, ENGINEERING ASSISTANT REVIEWED: TESSIE E. DAGURO, ENGINEER IV	SUBMITTED: LEONARDO L. LINGAN CHIEF, WATER PROJECTS DIVISION DATE	RECOMMENDING APPROVAL: SEE COVER SHEET ARISTARCO M. DOROY OFFICER-IN-CHARGE BUREAU OF DESIGN DATE MAY 25 2020	APPROVED: SEE COVER SHEET MAXIMO L. CARVAJAL UNDERSECRETARY FOR TECHNICAL SERVICES DATE	SET NO. STD 01 03	SHEET NO. 01 03

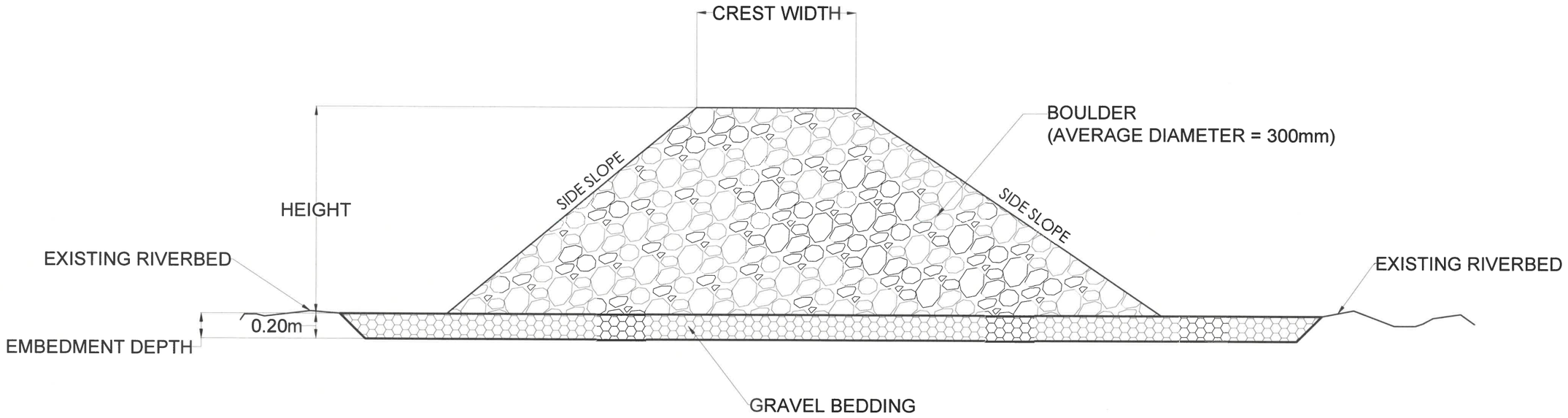


PLAN

SCALE NTS

REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
BUREAU OF DESIGN
WATER PROJECTS DIVISION
BONIFACIO DRIVE, PORT AREA, MANILA

SHEET TITLE:	SHEET CONTENTS:	PREPARED:	SUBMITTED:	RECOMMENDING APPROVAL:	APPROVED:	SET NO.	SHEET NO.
STANDARD PLAN OF BOULDER SPUR DIKE	PLAN	RICHARD V. LOMBOY, ENGINEER III DRAFTED: JAN CHRISTOPHER A. TUASON, ENGINEERING ASSISTANT REVIEWED: TESSIE E. DAGURO, ENGINEER IV	LEONARDO L. LINGAN CHIEF, WATER PROJECTS DIVISION DATE	SEE COVER SHEET ARISTARCO M. DOROY OFFICER-IN-CHARGE BUREAU OF DESIGN DATE NOV 25 2020	SEE COVER SHEET MAXIMO L. CARVAJAL UNDERSECRETARY FOR TECHNICAL SERVICES DATE	STD 02 03	02 03



SECTION A-A

SCALE NTS

REPUBLIC OF THE PHILIPPINES **DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS** BUREAU OF DESIGN WATER PROJECTS DIVISION BONIFACIO DRIVE, PORT AREA, MANILA	SHEET TITLE: STANDARD PLAN OF BOULDER SPUR DIKE	SHEET CONTENTS: SECTION A-A	PREPARED: **RICHARD V. LOMBOY** ENGINEER III DRAFTED: **JAN CHRISTOPHER A. TUASON** ENGINEERING ASSISTANT REVIEWED: **TESSIE E. DAGURO** ENGINEER V	SUBMITTED: **LEONARDO L. LINGAN** CHIEF, WATER PROJECTS DIVISION DATE	RECOMMENDING APPROVAL: SEE COVER SHEET **ARISTARCO M. DOROY** OFFICER-IN-CHARGE BUREAU OF DESIGN DATE 25 2020	APPROVED: SEE COVER SHEET **MAXIMO L. CARVAJAL** UNDERSECRETARY FOR TECHNICAL SERVICES DATE	SET NO. STD 03 03	SHEET NO. 03 03