

Republic of the Philippines DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS OFFICE OF THE SECRETARY

Manila



MAY 1 7 2024

DEPARTMENT ORDER	)
75	)
NO. /'D	)
Series of 2024	j
dy 5/20/2024	

#### SUBJECT: Guidelines for the Conduct of Geotechnical Investigation for all DPWH Infrastructure

In order to ensure a rational, safe and economical design and construction of infrastructure projects, the hereto attached Guidelines is hereby issued as reference and guidance in the conduct of geotechnical investigation prior to the preparation of design documents and plans for proposed projects.

The said Guidelines comprises of the general policies and guidelines, discussion on detailed unit price analysis, qualification requirements of geotechnical engineer, standard format for final borehole log and summary of test pit/auger hole, process flow and schematic diagram for the conduct of geotechnical investigation.

This Order shall take effect immediately and shall supersede the following policies:

Department Order No. 4, Series of 2000 - Department Order No. 229, Series of 1993 -

Submission of Subsurface Exploration DataGuidelines on Soil Survey and Sampling for

Highway Design and Subsurface Exploration for Design and Construction of Foundation of Bridges

MANUEL M. BONOAN Secretary

5.1.1 RVR/BSR/DLB



⊕/ebsite: https://www.dpwh.gov.ph T&. No(s).: 5304-3000 / (02) 165-02



# GUIDELINES FOR THE CONDUCT OF GEOTECHNICAL INVESTIGATION FOR ALL DPWH INFRASTRUCTURE

(as per Department Order No. <u>75</u>, series of <u>2024</u>)

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#### GUIDELINES FOR THE CONDUCT OF GEOTECHNICAL INVESTIGATION FOR ALL DPWH INFRASTRUCTURE

#### I. OBJECTIVES

- 1. To quantify the subsurface exploration and tests requirements relative to the conduct of preliminary and/or detailed engineering design of proposed infrastructures;
- 2. To provide guidance that shall govern in the conduct of geotechnical investigation; and
- 3. To establish a systematic and standardized approach in the conduct of geotechnical investigation to ensure a rational, safe and economical design and construction of the Department's Infrastructure.

#### **II. DEFINITION OF TERMS**

**Borehole Location and Test Pit / Auger Hole Location** – Shows the location of the boreholes in coordinates (Northing and Easting) and the station location of Test Pit / Auger Hole, respectively, and shall include the elevation datum

**Geotechnical Consulting Firm** – A consulting company / firm that owns and operates a drilling rig used for subsurface investigation

**Drilling Method** – it is a method used to advance various types of boring equipment to obtain suitable quality of soil and/or rock and groundwater condition

Drill Rig – A type of equipment that is set up to drill holes on the earth's surface

**Geotechnical Investigation (GI)** – Performed by geotechnical engineers or engineering geologists to obtain information on the physical properties of soil materials for earthworks and foundation for proposed structures and for repair of distress to earthworks and structures caused by subsurface conditions

**Terms of Reference (TOR)** – A document that defines all aspects of how a consultant or a team will conduct the Geotechnical Investigation. It defines the objectives and scope of evaluation, outlines the responsibilities of the Consultant or team, and provides a clear description of the resources available in the conduct of the study

**Geotechnical Investigation Report (GIR)** – A report with comprehensive assessment of both geological and geotechnical conditions of a particular area based from the conducted geotechnical investigation where construction is to be undertaken

**Geotechnical Database System (GDS)** – A web application which serves as database for borehole logs with defined location using its unique coordinates (Northing and Easting or Latitude and Longitude). The main feature of this application is that users can be guided in the geotechnical and geological feature of a project site where it contains the SPT N-Value, Unit Weight, Strength Parameters, Classification of Soil, Moisture Content, etc., which can be utilized as reference in the foundation design of infrastructure

#### **III. GENERAL POLICIES AND GUIDELINES**

As supplement to the DPWH Design Guidelines, Criteria and Standards (DGCS), Volume 2C – Geological and Geotechnical Investigations, 2015 Edition, the following are the prescribed revised guidelines:

- The Planning and Design Division / Section (PDD / PDS) and Quality Assurance & Hydrology Division / Section (QAHD / QAS) of DPWH Regional Offices (ROs) / District Engineering Offices (DEOs), and Bureau of Design and Bureau of Research and Standards (BRS), in coordination with the Unified Project Management Office (UPMO) of the Central Office (if necessary) shall create a Geotechnical Investigation (GI) Team that shall monitor / supervise / formulate / review / approve all relevant works related to geotechnical investigation, either By Admin or By Contract. The details of the GI team composition is discussed in pages 10 – 11 of this Guidelines.
- 2. The aforementioned GI team shall prepare a GI plan and methodology report based on the conducted office and field validation. The following must be included in the GI plan and methodology:
  - a. Preliminary information, which includes data from nearby existing project/s, if applicable and available (Geology, Topography, Vegetation, Right-of-Way, Accessibility, Land Use, Existing Structures and Utilities, etc.)
  - b. Proposed Borehole / Test Pit / Auger Hole Quantity and Location Plan (see Chapter 4 DPWH DGCS Vol. 2C, 2015 Edition or Annex: Design Investigation Program Requirements of this Department Order, and / or its latest edition)
  - c. Type of Geotechnical Investigation Equipment. For Boring Equipment, particularly Standard Penetration Test (SPT), it shall follow the minimum technical specifications established by the BRS (per DO No. 100 s. 2018)
  - d. Proposed In-situ and / or Laboratory Test Program (see Annex F DPWH DGCS Vol. 2C, 2015 Edition or Annex: Design Investigation Program Requirements of this Department Order and / or its latest edition)
  - e. Approved Copy of Engineering Geological and Geohazard Assessment (EGGA) Report, if available.

No soil exploration and laboratory testing shall commence prior to the approval of the GI plan and methodology.

The approval of the GI plan and methodology report shall be based on Department Order No. 250, series of 2022 and/or its latest edition.

In case of By Contract, the aforementioned report shall be incorporated in the preparation of Terms of Reference (TOR) for Geotechnical Investigation. The IOs

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shall ensure that the qualifications of the Consultant stipulated in page 8 of this Guidelines is incorporated in the TOR.

- 3. The GI team shall coordinate with the concerned Office or Consulting Firm prior to the conduct of the geotechnical investigation.
  - 3.1. In case of By Admin, the GI team shall inform and discuss the scope of work identified in the GI plan and methodology report with the QAHD / QAS in preparation for the conduct of geological/ geotechnical investigation on the proposed project location.
  - 3.2. In case of By Contract: A coordination meeting between the GI Team and the Consultant shall be scheduled to discuss the GI plan and methodology report, and shall conduct site inspection together to define the scope of the project.
- 4. The conduct of field and laboratory tests for the project shall be witnessed and certified by the duly designated representative from the GI team. During the conduct of this activities, photos shall be taken and geotagged accordingly.
- Laboratory tests on soil samples recovered during field investigation shall be performed at the DPWH Bureau of Research and Standards (BRS)/ ROs / DEOs, or other Testing Centers accredited by DPWH – BRS.

In the conduct of geotechnical investigation, the QAHD / QAS and the Consultant shall utilize the standard format for Final Borehole Log and Test Pit / Auger Hole Drilling (See annexes of this Guidelines). Legends for soils / rocks shall be in accordance to Annex "D": Borehole Logging of DPWH DGCS Volume 2C 2015 Edition and/or its latest edition.

- 6. The Geotechnical Investigation Report (GIR) shall be prepared by the following:
  - 6.1. In case of By Admin: The GI team shall prepare the GIR based on the results of field and laboratory tests. The contents of the GIR shall be as stipulated in Annex "E" and "F" of DPWH-DGCS Volume 2C, 2015 Edition and/or its latest edition. GIR shall be duly signed by the Head of the GI Team.
  - 6.2. In case of By Contract: The Consultant shall prepare the GIR based on the approved TOR for Geotechnical Investigation. The GIR prepared by the Consultant shall be duly signed by the Geotechnical Engineer on-record of the Geotechnical Consulting Firm, subject for review of the GI team and approval of the Head of the Implementing Office (IO).

The Geotechnical Consulting Firm's designated Geotechnical Engineer on-record must comply with or satisfy the requirements stipulated in page 6 of this Guidelines, and shall affix his/her signature in the GIR and Geotechnical Plan submitted by the Geotechnical Consulting Firm he/she represents.

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Please take note that the geotagged photos taken during the field investigation and laboratory testing shall be attached as annexes or shall be part of appendices of the GIR.

7. The preparation of Geotechnical Plan shall be in accordance with the latest Department issuance/s for the preparation of Detailed Engineering Design (DED) plans.

In case of By Contract, once the GIR has been finalized, the Geotechnical Consulting Firm shall prepare the Geotechnical Plan in accordance to latest DO regarding the preparation of DED plan.

For the purpose of uniformity and consistency, the Implementing Office, in case of By Admin, or the Consultant, in case of By Contract, may refer to Annex: Sample Geotechnical Plans of this DO in the preparation of Geotechnical Plans.

- 8. After the conduct of geotechnical investigation and approval of GIR and Geotechnical Plan, the IOs are required to submit the electronic copy of the said documents, within thirty (30) calendar days, to the Bureau of Design (BOD) for publication in the BOD Geotechnical Database System (BOD GDS). These reports may be utilized as reference in the preparation of design documents and plans for the proposed rehabilitation and reconstruction projects. If in any event, the IO failed to submit the aforementioned documents within the prescribed time, the Bureau of Design shall impose the following sanctions on the IO:
  - a. For the first violation or strike a first warning;
  - b. For the second violation or strike a second warning;
  - c. For the third violation or strike reprimand the Implementing Office and subject to administrative penalty in accordance with the Human Resource and Management Service (HRAS) rules and regulations of the Department.

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#### IV. DISCUSSION ON DETAILED UNIT PRICE ANALYSIS (DUPA) FOR GEOTECHNICAL INVESTIGATION OF DPWH PROJECTS

The preparation of a Detailed Unit Price Analysis (DUPA) for Geotechnical Investigation (GI) shall be based on the DPWH Design Guidelines, Criteria, and Standards Volume 2C 2015 Edition and/or its latest edition, with respect to the conditions of the project area.

The prices in the preparation of DUPA shall be based from Department Order No. 188 series of 2022 and/or its latest edition, while the number of tests required shall be based on the minimum drilling, sampling, and testing requirements as stipulated in the DPWH Design Guidelines, Criteria, and Standards Volume 2C 2015 and/or its latest edition.

Mobilization and demobilization costs for Geotechnical Investigation are assumed to cover the expenses in hauling the drilling machine to and from the site as well as the delivery of samples to the laboratory. Regional variations in labor and equipment rates must be accounted for in the preparation of the Detailed Unit Price Analysis. The Implementing Office (IO) shall take note that the following are assumed to be the minimum costs needed in conducting soil investigation for each type of project, to wit:

Roads Subsurface Investigation Cost Calculation

$$TDC = (4K + 1) * DU + (4K * HH) + MD + ME$$

$$TC = TDC + OCM + CP + VAT$$

Where *K* is the number of kilometers of the road project, *DU* is the direct unit cost, *HH* is the cost for the hole to hole transfer, *MD* is the mobilization and demobilization cost and *ME* is the miscellaneous expenses. The summation of the Total Direct Unit Cost (*TDC*), Overhead, contingencies and miscellaneous (*OCM*), Contractor's Profit (*CP*), and Value Added Tax (*VAT*) is the Total Cost for the Geotechnical Investigation.

• Bridges Subsurface Investigation Cost Calculation:

 $TDC = (N_{sp} + 1) * DU + (N_{sp} * HH) + MD + ME$ TC = TDC + OCM + CP + VAT

Where  $N_{sp}$  is the number of spans for the bridge, DU is the direct unit cost, HH is the cost for the hole to hole transfer, MD is the mobilization and demobilization cost and ME is the miscellaneous expenses. The summation of the Total Direct Unit Cost (TDC), Overhead, contingencies and miscellaneous (OCM), Contractor's Profit (CP), and Value Added Tax (VAT) is the Total Cost for the Geotechnical Investigation.

• Water Project Subsurface Investigation Cost Calculation

$$TDC = (4K + 1) * DU + (8K * HH) + MD + ME$$

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#### TC = TDC + OCM + CP + VAT

Where *K* is the number of kilometers of the project, *DU* is the direct unit cost, *HH* is the cost for the hole to hole transfer, *MD* is the mobilization and demobilization cost and *ME* is the miscellaneous expenses. The summation of the Total Direct Unit Cost (*TDC*), Overhead, contingencies and miscellaneous (*OCM*), Contractor's Profit (*CP*), and Value Added Tax (*VAT*) is the Total Cost for the Geotechnical Investigation.

Building Project Subsurface Investigation Cost Calculation

$$TDC = NB * DU + [(NB - 1) * HH)] + MD + ME$$

TC = TDC + OCM + CP + VAT

Where *NB* is the number of borehole per area of footprint of the project, *DU* is the direct unit cost, *HH* is the cost for the hole to hole transfer, *MD* is the mobilization and demobilization cost and *ME* is the miscellaneous expenses. The summation of the Total Direct Unit Cost (*TDC*), Overhead, contingencies and miscellaneous (*OCM*), Contractor's Profit (*CP*), and Value Added Tax (*VAT*) is the Total Cost for the Geotechnical Investigation.

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#### V. QUALIFICATION REQUIREMENTS OF DPWH REPRESENTATIVES AND GEOTECHNICAL ENGINEER OF THE CONSULTANT IN THE CONDUCT OF GEOTECHNICAL INVESTIGATION

The following criteria must be satisfied by the DPWH Representative for witnessing and certifying Geotechnical Investigation:

- 1. Holds a permanent position in the Department
- 2. Attended trainings on Geotechnical Investigation from the Department or other recognized organizations; and
- 3. Representatives shall have a graduate degree or have taken completed graduate units in Civil Engineering and/or relevant course in place of training certificates.

The following minimum criteria must be satisfied by the Consultant's Geotechnical Engineer on-record:

- 1. Must be a holder of a Master's Degree in Geotechnical Engineering; and
- 2. Must have at least five (5) years of related work or research experience.

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### VI. PROCESS FLOW AND SCHEMATIC DIAGRAM FOR THE CONDUCT OF GEOTECHNICAL INVESTIGATION

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**Process Flow** 

#### Responsible

Details

For Regional Office and District Office:

Team Leader:

 Chief and/or Assistant Chief of PDD / PDS

Assistant Team Leader:

• Chief and/or Assistant Chief of QAHD / QAS

Team Member/s:

- Engineer/s and/or geologist/s holding plantilla position from PDD / PDS
- Engineer/s holding plantilla position from the QAHD / QAS

The GI Team from the Central Office, composed of BOD and BRS, shall oversee the GI Teams of every Regional and District Engineering Offices.

Before going to the field, the GI team shall identify the needed frequency and depth of field investigation as well as the laboratory tests based on DPWH Design Guidelines, Criteria, and Standards (DGCS) Volume 2C, 2015 Edition or Annex: Design Investigation Program Requirements of this Department Order, and/or its latest edition.

The identified information above shall be validated in the field, which may change and vary depending on the actual site condition.

A GI plan and methodology report shall be prepared based on the conducted office and field validation, to wit:

a. In case of By Admin: The GI plan and methodology report shall be prepared by the GI team.

Conduct of Office and Field Validation (Reconnaissance)

GI team

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**Process Flow** Responsible В GI team Conduct of Geotechnical Investigation QAHD / QAS Geotechnical Consulting Firm (in case of by Contract)

Details

b. In case of By Contract: The GI plan and methodology report shall be prepared by the GI team and approved by the Head of the Office.

The aforementioned report shall be incorporated in the preparation of Terms of Reference (TOR) for the Geotechnical Investigation. The IOs shall ensure the incorporation of the qualifications of the Consultant stipulated in page 8 of this Guidelines.

The approval of the GI plan and methodology report shall be based on Department Order No. 250, series of 2022 and/or its latest edition.

The GI team shall coordinate with the concerned office or consulting firm prior to the conduct of the geotechnical investigation.

 a. In case of By Admin: The GI team shall relay and discuss the scope of work identified in the GI plan and methodology report with the QAHD / QAS in preparation for the conduct of geological / geotechnical investigation on the proposed project location.

A representative from Geotechnical Investigation Team shall oversee / supervise the field investigation.

The QAHD / QAS shall perform the laboratory tests on the soil samples recovered during field investigation.

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#### **Process Flow**

C

#### Responsible

Details

b. In case of By Contract: A coordination meeting (GI Team and Consultant) shall be scheduled to discuss the report and together shall conduct site inspection to define the scope of the project.

A representative from the Geotechnical Investigation Team shall oversee / supervise the field investigation.

The QAHD / QAS or any approved DPWH – BRS Testing Centers shall perform the laboratory tests on the soil samples recovered during the field investigation.

In the conduct of geotechnical investigation, the QAHD / QAS and Consultant shall utilize the standard format for Final Borehole Log and Test Pit/Auger Hole Drilling (See Annex of this Guidelines).

During the conduct of geotechnical investigation, photos shall be taken and geotagged accordingly.

The Geotechnical Investigation Report (GIR) shall be prepared by the following:

a. In case of By Admin: The GI team shall prepare the GIR based on the results of field and laboratory tests.

The contents of the GIR shall be as stipulated in Annex "E" and "F" of DPWH-DGCS Volume 2C, 2015 Edition and/or its latest edition. GIR shall be duly signed by the Head of the GI Team.

In addition, discussion on data regarding the geological and geotechnical features of existing nearby project shall be incorporated in the GIR.

Preparation of Geotechnical Investigation Report (GIR) GI team

Geotechnical Consulting Firm (in case of by Contract) Department Order No. <u>JC</u> s. 2024 Guidelines for the Conduct of Geotechnical Investigation for all DPWH Infrastructure

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**Process Flow** 

D

#### Responsible

Details

b. In case of By Contract: The Consultant shall prepare the GIR based on the approved TOR for the conduct of Geotechnical Investigation. The GIR prepared by Consultant shall be duly signed by the geotechnical engineer on-record of the Geotechnical Consulting Firm, subject for review of the GI team and approval of the Head of the Implementing office (IO).

In case of sub-contracting the geotechnical investigation, the geotechnical engineer of the Contracted Consulting Firm shall sign the GIR, in concurrence, together with the geotechnical engineer of the hired Geotechnical Consulting Firm.

Please take note that the geotagged photos taken, during the conduct of geotechnical investigation, shall be attach as annexes or shall be part of appendices of the GIR.

After preparation of the GIR, a geotechnical plan shall be prepared, to wit:

- a. In case of By Admin: The GI team shall prepare the Geotechnical Plan in accordance to latest Department Order/s (DO) regarding the preparation of Detailed Engineering Design (DED) plans.
- b. In case of By Contract: Once the GIR has been finalized, the Geotechnical Consulting Firm shall prepare the Geotechnical Plan in accordance to existing DO regarding the preparation of DED Plan.

Preparation and Approval of Geotechnical Plan GI team

Geotechnical Consulting Firm (in case of by Contract)

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Responsible

Details

For the purpose of uniformity and consistency, the GI team or the Consulting Firm may refer to Annex: Sample Geotechnical Plans of this DO in the preparation of Geotechnical Plans.

After the preparation and approval of GIR and Geotechnical Plan, the GI team is required to submit an electronic copy of the GIR and Geotechnical Plan to BOD for publication in the Geotechnical Database System (GDS).

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# SCHEMATIC DIAGRAM FOR THE CONDUCT OF GEOTECHNICAL INVESTIGATION



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Annex: Standard Format for Final Borehole Log and Summary of Test Pit / Auger Hole Drilling Test Results

### STANDARD FORMAT FOR FINAL BOREHOLE LOG AND SUMMARY OF TEST PIT / AUGER HOLE DRILLING TEST RESULTS

### (BY ADMIN)



#### Department of Public Works and Highways (Name of Implementing Office)

#### STANDARD FORMAT FOR FINAL BOREHOLE LOG

LOGGED B	BY		BEGIN DATE	BORE	EHOLE	LOCAT	ION (No	orthing/	/Easting	and Da	atum)			HOLE ID				
DRILLING	CON	ITRACT	FOR		BORE	EHOLE	LOCAT	ION (Of	fset, St	tation, l	_ine)				SURFACE ELEVATION			
DRILLING	i MET	HOD			DRIL	L RIG		BOREHOLE DIAMETER										
SAMPLE T	SAMPLE TYPE(S) AND SIZES(S) (ID)					HAMME	r type	HAMMER EFFICIENCY										
BOREHOLE BACKFILL AND COMPLETION					GROI DRIL	UNDWA LING	ATER D	URING		GROUI (DATE	NDWAT	ER AFT	ER DRI	LLING	TOTAL DEPTH OF BORING			
ELEVATION (m)	DEPTH (m) DEPTH (m) NAMES ROUP SYMBOLS AND NAMES						SAMPLE NUMBER	BLOWS PER 15CM (N Value)	RECOVERY (%)	RQD (%)	MOISTURE CONTENT (%)	UNIT WEIGHT	SHEAR STRENGTH	DRILLING METHOD SYMBOL	REMARKS			
				DRILLING SUPERVIS	GOR		PROJE	CT TITL	E									
IMPL	EM	ENT	ING OFFICE	DPWH INSPECTOR			SECTION ID/ BRIDGE ID			PREPARED BY DATE					SHEET			

DPWH-QMSP-11-02-Rev00



Department of Public Works and Highways (Name of Implementing Office)

#### STANDARD FORMAT FOR TEST PIT / AUGER HOLE DRILLING TEST RESULTS

				SUMM	<b>1ARY OF TE</b>	ST PI	/ AUG	ER H	IOLE	DRIL	LING	TEST	RESU	JLTS									
Project I	Name:									Prepare	d By:			Certifi	ed By:								
Project I	ocatio	n:								-													
Impleme	enting	Office: _		*						IMPLEMENTING AGENC										CY			
Local/Fo	Local/Foreign Consultant:									DPWH Inspector:													
										I													
TEST				440170	NIMC	SDECIEIC	ATTERBERG LIMITS		CBR		MOIS	STURE SITY			S	IEVE ANA	IALYSIS GRADING % PASSING						
STATION	PIT NO.	NO.	(m)	SOIL DESCRIPTION	CLASSIFICATION	(%)	GRAVITY (Gs)	LL (%)	PI (%)	95% MDD	100% MDD	MDD (g/cc)	OMC (%)	2"	1 1/2"	1"	3/4"	3/8"	#4	#10	#40	#100	#200
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																							- x'
				4																			•
															1								

Note:

• Legends for Soil and Rock (Final Boring Log and Test Pit / Auger Hole) shall be in accordance to Annex "D": Borehole Logging of DPWH DGCS Volume 2C - Geological and Geotechnical Investigation, 2015 Edition.

Department Order No. <u>1</u> s. 2024 Guidelines for the Conduct of Geotechnical Investigation for all DPWH Infrastructure

Annex: Standard Format for Final Borehole Log and Summary of Test Pit / Auger Hole Drilling Test Results

## STANDARD FORMAT FOR FINAL BOREHOLE LOG AND SUMMARY OF TEST PIT / AUGER HOLE DRILLING TEST RESULTS

### (BY CONTRACT)

DPWH-QMSP-11-03-Rev00

	Geotechnical Firm/Consultant's Header													
(Logo)	DRILLING SUPERVISOR	PROJECT TITLE												
	DPWH INSPECTOR	SECTION ID/ BRIDGE ID	PREPARED BY	DATE	SHEET									

	BEGIN DATE	DATE	BOREHOLE LOCATION (Northing/Easting and Datum)														
DRILLING CONTRAC	TOR		BORE	EHOLE	LOCATI		SURFACE ELEVATION										
DRILLING METHOD			DRILL RIG											BOREHOLE DIAMETER			
SAMPLE TYPE(S) ANI	D SIZES(S) (ID)		SPT	SPT HAMMER TYPE										EFFICIENCY			
BOREHOLE BACKFILI	GRO DRIL	UNDWA LING	TER DI	JRING		GROUI (DATE	NDWAT )	ER AFT	ER DRI	LLING	TOTAL DI	EPTH OF BORING					
ELEVATION (m) DEPTH (m) GROUP SYMBOLS AND NAMES	DE		SAMPLER GRAPHIC SYMBOL	SAMPLE NUMBER	BLOWS PER 15CM (N Value)	RECOVERY (%)	RQD (%)	MOISTURE CONTENT (%)	UNIT WEIGHT	SHEAR STRENGTH	DRILLING METHOD SYMBOL		REMARKS				

(Group symbols and Names, Field and Laboratory Testing, Sampler Graphic Symbol, Drilling Method Symbol, Water Level Symbol and etc.)

1		n)
	LUG	0,

Geotechnical Firm / Consultant's Header

				SUMM	ARY OF TE	ST PIT	/ AUG	ER H	OLE	DRILL	ING	TEST	RESU	LTS									
Project N	lame:									Prepared	By:			Certifie	ed By:								
Project L	ocatio	n:																TN				GENC	Y
Impleme	Implementing Office:									DPWH Inspector:											·		
Local/Foreign Consultant:									DEANLI	ispector													
						ATTER LIM	BERG ITS	CBR MOISTURE DENSITY		TURE		eve ana	NALYSIS GRADING % PASSING										
STATION	PIT NO.	SAMPLE NO.	DEPTH (m)	SOIL DESCRIPTION	AASHTO CLASSIFICATION	NMC (%)	MC SPECIFIC %) GRAVITY (Gs)	LL (%)	PI (%)	95% MDD	100% MDD	MDD (g/cc)	OMC (%)	2"	1 1/2"	1"	3/4"	3/8"	#4	#10	#40	#100	#200
																						<u> </u>	
																					<u> </u>	<u> </u> !	
																					<u> </u>		
																						<u> </u>	
																					<u> </u>	<u> </u>	
																						<u> </u>	
																						-	
																					<u> </u>		

#### Note:

 Legends for Soil and Rock (Final Boring Log and Test Pit / Auger Hole) shall be in accordance to Annex "D": Borehole Logging of DPWH DGCS Volume 2C - Geological and Geotechnical Investigation, 2015 Edition. Department Order No. <u>\*</u> s. 2024 Guidelines for the Conduct of Geotechnical Investigation for all DPWH Infrastructure

Annex: Sample Geotechnical Plan

### SAMPLE GEOTECHNICAL PLAN FOR HIGHWAYS PROJECT

Department Order No. <u>+</u>S s. 2024 Guidelines for the Conduct of Geotechnical Investigation for all DPWH Infrastructure



Department Order No. <u>1</u> s. 2024 Guidelines for the Conduct of Geotechnical Investigation for all DPWH Infrastructure



Department Order No. <u>FS</u> s. 2024 Guidelines for the Conduct of Geotechnical Investigation for all DPWH Infrastructure



Department Order No. <u>75</u> s. 2024 Guidelines for the Conduct of Geotechnical Investigation for all DPWH Infrastructure



Department Order No. <u>**75</u>** s. 2024 Guidelines for the Conduct of Geotechnical Investigation for all DPWH Infrastructure</u>



Department Order No. <u>15</u> s. 2024 Guidelines for the Conduct of Geotechnical Investigation for all DPWH Infrastructure

Annex: Sample Geotechnical Plan

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### SAMPLE GEOTECHNICAL PLAN FOR BRIDGE PROJECT

Department Order No. <u>75</u> s. 2024 Guidelines for the Conduct of Geotechnical Investigation for all DPWH Infrastructure



Department Order No. <u>75</u> s. 2024 Guidelines for the Conduct of Geotechnical Investigation for all DPWH Infrastructure



Department Order No. <u>15</u> s. 2024 Guidelines for the Conduct of Geotechnical Investigation for all DPWH Infrastructure


Department Order No. <u>\*</u> s. 2024 Guidelines for the Conduct of Geotechnical Investigation for all DPWH Infrastructure

Annex: Sample Geotechnical Plan

## SAMPLE GEOTECHNICAL PLAN FOR WATER ENGINEERING PROJECT

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Annex: Sample Geotechnical Plan

## SAMPLE GEOTECHNICAL PLAN FOR BUILDING PROJECT

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Annex: Sample Geotechnical Plan

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Annex: Sample Geotechnical Plan

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## **GEOLOGICAL / GEOTECHNICAL WAIVER**

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Republic of the Philippines Department of Public Vicens and Highways Bareau of Design SURVEY AND INVESTIGATION (DIVISION Boobacio Drive, Post Acess, Martia	PHYLOCIT SAME ANY LICENTER	GEOTECHNICAL WAIVER	The second of	SIGNATIVE		arreg         arreg <td< td=""></td<>

Guidelines for the Conduct of Geotechnical Investigation for all DPWH Infrastructure

Annex: Design Investigation Program (DIP) Requirements for Geotechnical Investigation

## DESIGN INVESTIGATION PROGRAM (DIP) REQUIREMENTS FOR GEOTECHNICAL INVESTIGATION

Department Order No.  $\underline{\mathcal{T}}$  s. 2024 Guidelines for the Conduct of Geotechnical Investigation for all DPWH Infrastructure

DPWH DGCS 2015 EDITION: VOLUME	SPACING / FREQUENCY		DEPTH		TYPE OF	REQUIRED			
AND GEOTECHNICAL INVESTIGATION	EXISTING	REVISION	EXISTING	REVISION	SUBSURFACE EXPLORATION	LABORATORY TESTS			
A. HIGHWAYS PRO	JECTS								
New Road (New Road / Widening / Existing Earth Road)	For new roads, test pitting, 250m for heterogeneous layers or loose layers and 500m for homogenous layers. For existing earth roads, test pitting, 250m where traffic is greater than 300 vehicles per day or every 500m where traffic is less.	For new roads, test pitting shall be made along the proposed alignment at an average interval of 500 meters for homogenous strata, and 250 meters for loose or heterogeneous strata or lesser (i.e. based on the recommendation of the geotechnical engineer) for soft marshy portions. For existing earth roads, test pitting shall be made along the centerline of the road at an average interval of 250 meters where traffic is greater than 300 vehicles per day or every 500 meters where traffic is less, in a	For areas of light cut and fill, 1.50m maximum depth below the subgrade material. 2.0m below the base elevation in deep cuts. 20 - 25m below the existing grade line depending on the base of the identified soft clay.	For areas of light cut and fill, not exceeding one (1) meter in height, where there are no special problems, exploration shall extend to a maximum depth of 1.5m below the proposed subgrade. Where deeper cuts (i.e. greater than 1.0 meters) are to be made, the depth shall be two (2) meters below the proposed subgrade. For larger embankment across the marshland or where subsurface information indicates the presence of four	Minimum Requirement: - Test Pitting Conditional Requirement for Complex Ground Conditions: - Auger Boring - Cone Penetration Test (CPT)	Minimum Requirements: - Mechanical Sieve Analysis - Specific Gravity - Atterberg Limits - Natural Moisture Content - Compaction Test - Laboratory California Bearing Ratio (CBR) Test - Swell Index Test Conditional Test Requirements for Complex Ground Conditions, and for Deep Cuts: - Consolidation Test - Permeability Test - Soil/Rock Strength Test - Hydrometer Test Please take note that the required number of			

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DPWH DGCS 2015 EDITION: VOLUME	SPACING /	FREQUENCY	DE	РТН		REQUIRED LABORATORY TESTS
AND GEOTECHNICAL INVESTIGATION	EXISTING	REVISION	EXISTING	REVISION	EXPLORATION	
		staggered pattern offsets. For widening of roads, test pitting shall be located in the area of widening (left / right edge of the existing pavement below the shoulder) in a staggered pattern, with as the same spacing for existing earth roads. In case ground conditions are believed to be complex (which may require boring), and exploratory locations at these spacing are likely to be inadequate to clearly identify the variability of ground conditions, then the spacing of exploratory locations shall be reduced to half		<ul> <li>(4) to five (5) weak layers, the depth shall depend on the topography and nature of the subsoil; soft clays may be extended to a deep of 20–25 meters, and the base of the soft clay must be identified.</li> <li>Note: For stations , with test pitting, located on sections with excavation having a depth of 1.50 meters or deeper as per Detailed Engineering Design (DED), confirmatory test pitting shall be conducted during project implementation on the same station.</li> </ul>		samples for California Bearing Ratio (CBR) test shall be one (1) for every layer of each test pit.

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DPWH DGCS 2015 EDITION: VOLUME 2C – GEOLOGICAL	SPACING / FREQUENCY		DEF	ΫΤΗ	TYPE OF SUBSURFACE	REQUIRED
AND GEOTECHNICAL INVESTIGATION	EXISTING	REVISION	EXISTING	REVISION	EXPLORATION	LABORATORY TESTS
		of these spacing for generally complex sites, and to 50 meters in areas where specific anomalies such as karst are expected. Please take note that if the main investigation results are inadequate to clearly identify the variability of the ground or to sufficient depth to enable adequate design,				
		then a supplementary investigation shall be carried out and exploratory holes sited at the areas where specific information is required.				
Rehabilitation (Reconstruction / Upgrading)	No spacing specified.	Conduct test pitting and deep cone penetration test (DCPT) at an interval of 500 meters along the road	No depth specified.	For test pitting in areas of little or no grade change, extend investigation to a minimum of 1.50	<u>Minimum</u> <u>Requirement:</u> Test Pitting - Test Pitting	Minimum Requirements: - Mechanical Sieve Analysis - Specific Gravity - Atterberg Limits

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DPWH DGCS 2015 EDITION: VOLUME 2C - GEOLOGICAL	SPACING /	FREQUENCY	DE	РТН	TYPE OF	REOUIRED	
AND GEOTECHNICAL INVESTIGATION	EXISTING	REVISION	EXISTING	REVISION	SUBSURFACE EXPLORATION	LABORATORY TESTS	
		alignment in a staggered pattern offsets from the centerline, as applicable in widening.		meters below the cut at the ditch line or top of subgrade, whichever is greater. For stations with test pitting located on sections with excavation having a depth of 1.50 meters or deeper as per Detailed Engineering Design (DED), a confirmatory test pitting shall be conducted during implementation on the same station.	- Deep Cone Penetration Test (DCPT)	<ul> <li>Natural Moisture Content</li> <li>Compaction Test</li> <li>California Bearing Ratio (CBR) Test</li> </ul> <u>Conditional Test</u> <u>Requirements based on</u> <u>Initial Assessment of</u> <u>Actual Site Condition:</u> <ul> <li>Consolidation Test</li> <li>Permeability Test</li> <li>Soil/Rock Strength Test</li> <li>Hydrometer Test</li> <li>Swell Index Test</li> </ul>	
Rehabilitation (Re-blocking / Squaring)	No spacing specified.	During re-blocking / squaring works, one (1) test pitting shall be conducted at every 100 meters road section with rehabilitation works for future reference.	No depth specified.	For test pitting in areas of little or no grade change, extend to a minimum of 1.50 meters below the cut at ditch line or top of subgrade, whichever is greater.	<u>Minimum</u> <u>Requirements:</u> - Test Pitting - Deep Cone Penetration Test (DCPT)	Minimum Requirements: - Mechanical Sieve Analysis - Specific Gravity - Atterberg Limits - Natural Moisture Content - Compaction Test	

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DPWH DGCS 2015 EDITION: VOLUME	SPACING / FREQUENCY		DEPTH		TYPE OF	REQUIRED
AND GEOTECHNICAL INVESTIGATION	EXISTING	REVISION	EXISTING	REVISION	SUBSURFACE EXPLORATION	LABORATORY TESTS
		For rehabilitation works in urban areas with roadside facilities, adopt the previous test pitting results.		For stations with test pitting located on sections with excavation having a depth of 1.50 meters or deeper as per Detailed Engineering Design (DED), confirmatory test pitting shall be conducted during project implementation on the same station.	<u>Conditional</u> <u>Requirement:</u> - Asphalt Coring	<ul> <li>California Bearing Ratio (CBR) Test</li> <li><u>Conditional Test</u> <u>Requirements based on</u> <u>Initial Assessment of</u> <u>Actual Site Condition:</u></li> <li>Consolidation Test</li> <li>Permeability Test</li> <li>Soil/Rock Strength Test</li> <li>Hydrometer Test</li> <li>Swell Index Test</li> </ul>
Reinforced Concrete Pipe Culvert (RCPC)	No spacing specified.	If the RCPC length is less than 50 meters, provide one (1) test pit only, preferably at the midpoint or at the critical location. This applies for cross-drains. For multiple cross- drains along road alignment, select a	1.50 meters below the proposed subgrade.	For test pitting, the depth shall be 1.50 meters below the subgrade. For borings, the depth shall have a minimum value equal to twice the culvert height unless a bearing layer (dense soil or rock	Minimum Requirements: - Test PittingConditional Requirement for RCPC Diameter greater than 0.90 meters: - Borehole Drilling	Minimum Requirements: - Mechanical Sieve Analysis - Specific Gravity - Atterberg Limits - Natural Moisture Content Conditional Test Requirements for RCPC

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DPWH DGCS 2015 EDITION: VOLUME 2C – GEOLOGICAL	SPACING / FREQUENCY		DEPTH		TYPE OF	REQUIRED
AND GEOTECHNICAL INVESTIGATION	EXISTING	REVISION	EXISTING	REVISION	SUBSURFACE EXPLORATION	LABORATORY TESTS
		representative defined by its critical location and engineering judgment to be a reference for the design of the other cross- drains within the 25 meters offsets from the centerline of the representative cross- drain. For RCPC with 50 meters or greater in length will require one (1) test pit at the start and one (1) at the end of the project. Additional intermediate test pitting for every 500 meters. Test pit shall be performed for culverts in general, while culverts (RCPC) with more than 0.90 meters		formation) is encountered above this depth. Where soft soil layers are encountered, which may present stability or settlement concerns, the borings shall extend until three (3) successive SPT N values >30 are obtained. If rock is encountered within the proposed depth of excavation, coring should be performed with a minimum of 0.50 meters core shall be taken. In the event the RCPC crosses an existing ditch, creek, or stream channel, the boring criteria above shall be		Diameter greater than 0.90 meters: - Consolidation Test - Permeability Test - Soil/Rock Strength Test - Hydrometer Test

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DPWH DGCS 2015 EDITION: VOLUME 2C – GEOLOGICAL AND GEOTECHNICAL INVESTIGATION	SPACING / FREQUENCY       EXISTING     REVISION		DEPTH EXISTING REVISION		TYPE OF SUBSURFACE EXPLORATION	REQUIRED LABORATORY TESTS
		in diameter shall require boring. An undisturbed sample boring under the highest part of the fill is required if the fill is 6 meters or more in height. Samples shall be obtained at 1.50 meters interval to twice the embankment height or to the top of bedded material, whichever is shallower. This boring and rock line sounding shall be obtained to allow an evaluation of settlement and slope analysis.		followed, and an additional boring shall be located in the existing channel. If the additional boring is inaccessible to the drilling apparatus, a minimum of one hand auger sounding shall be performed at that location to a depth of 1.50 meters.		
Reinforced Concrete Box Culvert (RCBC)	No spacing specified.	Test pit shall be performed for culverts in general, while culverts (RCBC) with more than 3 meters in	1.50 meters below the proposed subgrade.	Depth of borehole shall be nine (9) meters below the invert of the proposed foundation. Borings shall penetrate to the	<u>Minimum</u> <u>Requirements:</u> - Test Pitting or Borehole Drilling	Minimum Requirements: - Mechanical Sieve Analysis - Specific Gravity - Atterberg Limits

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DPWH DGCS 2015 EDITION: VOLUME 2C – GEOLOGICAL AND GEOTECHNICAL INVESTIGATION	SPACING /	<b>FREQUENCY</b> REVISION	DE	<b>PTH</b> REVISION	TYPE OF SUBSURFACE EXPLORATION	REQUIRED LABORATORY TESTS
		height shall require boring. For RCBC with 50 meters or greater in length will require one (1) boring at the start and one (1) at the end of the project. Additional intermediate boring for every 500 meters. This applies to the cross-drains.		specified depth and penetrate a minimum of four (4) consecutive split spoon samples into material having a standard penetration blow count of 30 or greater.		<ul> <li>Natural Moisture Content</li> <li>Soil/Rick Strength Test</li> </ul> Conditional Test <u>Requirements based on</u> <u>Initial Assessment of</u> <u>Actual Site Condition:</u> <ul> <li>Consolidation Test</li> <li>Permeability Test</li> <li>Hydrometer Test</li> </ul>
Active Slope Protection Structures (Retaining Structures such as Crib Wall, Gabion Wall, Mattresses, Etc.)	Every 60 to 120 meters. One (1) at the top and one (1) at the toe.	One (1) at every proposed slope protection structure with a vertical height of less than 5.0 meters, to be located at the highest vertical point or at an identified critical location. Additional intermediate borehole for every 100 meters.	0.75 to 1.50 times the height of the wall or until three (3) consecutive SPT N - Value > 30 is obtained, whichever is greater.	Extend boring depth from 0.75 to 1.50 times the height of the wall. Where stratification indicates a possible deep stability or settlement problem, boring shall extend until three (3) consecutive SPT N -	<u>Minimum</u> <u>Requirements:</u> - Borehole Drilling	Minimum Requirements:         - Mechanical Sieve         Analysis         - Specific Gravity         - Atterberg Limits         - Natural Moisture         Content         - Soil/Rick Strength Test         Conditional Test         Requirements based on         Actual Site Condition:         - Consolidation Test

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DPWH DGCS 2015 EDITION: VOLUME 2C – GEOLOGICAL	SPACING /	FREQUENCY	DE	РТН	TYPE OF SUBSURFACE	
GEOTECHNICAL INVESTIGATION	EXISTING	REVISION	EXISTING	REVISION	EXPLORATION	LABORATORY TESTS
		One (1) at the top and one (1) at the toe of the slope for sections with a vertical height of 5.0 meters or more, to be located at a section with the highest vertical point or at an identified critical location. Additional intermediate borehole for every 100 meters. Note: No borehole drilling to be conducted, if the existing slope is designed for reshaping only.		Value > 40 are obtained.		<ul> <li>Permeability Test</li> <li>Hydrometer Test</li> </ul>
Embankment (Vertical Height = 3.0 meters or more)	Every 60 to 120 meters.	One (1) boring for continuous 100 meters length of embankment, to be located at the highest vertical height or at an identified critical location.	Twice the height of the proposed embankment, unless a bearing layer is encountered.	Extend boring to a minimum depth equal to twice the embankment height, unless a bearing layer (dense soil or rock formation) is	<u>Minimum</u> <u>Requirements:</u> - Borehole Drilling	Minimum Requirements: - Mechanical Sieve Analysis - Specific Gravity - Atterberg Limits - Natural Moisture Content - Soil/Rick Strength Test

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DPWH DGCS 2015 EDITION: VOLUME	SPACING / FREQUENCY		DEPTH		TYPE OF	REQUIRED
AND GEOTECHNICAL INVESTIGATION	EXISTING	REVISION	EXISTING	REVISION	SUBSURFACE EXPLORATION	LABORATORY TESTS
		One (1) boring at every embankment section with a length of less than 100 meters but shall be the representative for other embankment section with 250 meters forward and backward distance, prioritizing the identified critical location. One (1) boring at every bridge approach.		encountered above this depth. Where stratification indicates a possible deep stability or settlement problem, boring shall extend until three (3) consecutive SPT N - Value > 40 are obtained.		<u>Conditional Test</u> <u>Requirements based on</u> <u>Actual Site Condition:</u> - Consolidation Test - Permeability Test - Hydrometer Test

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DPWH DGCS 2015 EDITION: VOLUME 2C – GEOLOGICAL	SPACING / FREQUENCY		DE	РТН		REQUIRED			
AND GEOTECHNICAL INVESTIGATION	EXISTING	REVISION	EXISTING	REVISION	SUBSURFACE EXPLORATION	LABORATORY TESTS			
B. BRIDGES PROJECTS									
Bridge or Flyover	For piers or abutment less than 30 meters wide, boring shall be one (1) each on both abutments, and one (1) per pier. For piers or abutment greater than 30 meters wide, provide a minimum of two (2) boreholes each. Note: Additional borings should be provided in areas of complex or variable subsurface conditions.	No Changes	If foundation design has not been identified, depth should be 30 meters in ordinary soil or to 3 meters into sound rock, if encountered. In case bearing layer is not yet encountered beyond 30 meters, boring shall continue until preferred layer is encountered and/or upon the instruction of the geotechnical engineer.	No Changes	<u>Minimum</u> <u>Requirement:</u> - Borehole Drilling	<ul> <li>Minimum Requirements:</li> <li>Mechanical Sieve Analysis</li> <li>Specific Gravity</li> <li>Atterberg Limits</li> <li>Natural Moisture Content</li> <li>Soil Strength Test</li> </ul> Conditional Test Requirements based on Initial Assessment of Actual Site Condition: <ul> <li>Consolidation Test</li> <li>Permeability Test</li> <li>Hydrometer Test</li> </ul>			
Underpass	No spacing specified.	Spacing shall be every 30 meters along the proposed alignment of the Slope Protection Structure.	No depth specified.	Plate Load Test or a minimum of 3.0 meters Test Pitting below proposed subgrade.	<u>Minimum</u> <u>Requirement:</u> - Test Pitting or Plate Load Test - Borehole Drilling	Minimum Requirements: - Mechanical Sieve Analysis - Specific Gravity - Atterberg Limits - Natural Moisture Content			

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DPWH DGCS 2015 EDITION: VOLUME 2C – GEOLOGICAL AND GEOTECHNICAL INVESTIGATION	SPACING /	<b>FREQUENCY</b> REVISION	DE	PTH REVISION	TYPE OF SUBSURFACE EXPLORATION	REQUIRED LABORATORY TESTS
		Note: Additional borings on outboard of the wall line to define the zone behind the wall every 30 meters along the proposed alignment; for estimation of lateral loads and anchorage capacities.		Note: Additional borings on outboard of the wall with depth of the height of the structure plus a minimum of 3.0 meters.		<ul> <li>Soil Strength Test</li> <li><u>Conditional Test</u></li> <li><u>Requirements based on</u></li> <li><u>Initial Assessment of</u></li> <li><u>Actual Site Condition:</u></li> <li>Consolidation Test</li> <li>Permeability Test</li> <li>Hydrometer Test</li> </ul>
Culvert (Exceeding 3 meters x 3 meters)	No spacing specified.	Spacing shall be one (1) at the start and one (1) at the end of the project. Additional intermediate borehole for every 500 meters increment, preferably at the most critical location.	Twice the height of the proposed culvert (minimum) below subgrade.	Plate load test or a minimum of 3.0 meters boring below bottom slab of proposed culvert.	<u>Minimum</u> <u>Requirement:</u> - Test Pitting or Plate Load Test - Borehole Drilling	Minimum Requirements: - Mechanical Sieve Analysis - Specific Gravity - Atterberg Limits - Natural Moisture Content - Soil Strength Test Conditional Test Requirements based on Initial Assessment of Actual Site Condition: - Consolidation Test - Permeability Test - Hydrometer Test

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DPWH DGCS 2015 EDITION: VOLUME 2C – GEOLOGICAL AND GEOTECHNICAL INVESTIGATION	<b>SPACING /</b> EXISTING	<b>FREQUENCY</b> REVISION	DEI	PTH REVISION	TYPE OF SUBSURFACE EXPLORATION	REQUIRED LABORATORY TESTS		
C. WATER ENGINEERING PROJECTS								
Riverbank Structures such as Dike, Levee, Embankment, Revetment, Etc.	30 meters along the proposed alignment.	Spacing shall be one (1) at each near both ends of the project. Additional intermediate borehole shall be conducted for every 500 meters increment or at identified critical section/s.	Depth of borehole below the riverbed shall be 2.0 times the height of the structure or until three (3) consecutive SPT N-Value > 40 is obtained, whichever is greater.	No Changes	<u>Minimum</u> <u>Requirement:</u> - Borehole Drilling	<ul> <li>Minimum Requirements:</li> <li>Mechanical Sieve Analysis</li> <li>Specific Gravity</li> <li>Atterberg Limits</li> <li>Natural Moisture Content</li> <li>Soil Strength Test</li> </ul> Conditional Test Requirements based on Initial Assessment of Actual Site Condition: <ul> <li>Consolidation Test</li> <li>Permeability Test</li> <li>Hydrometer Test</li> </ul>		
Spurdike & Groynes	No spacing specified.	Spacing shall be one (1) at the center of every structure.	No depth specified.	Depth of borehole below the riverbed shall be 2.0 times the height of the structure or until three (3) consecutive SPT N- Value > 40 is	<u>Minimum</u> <u>Requirement:</u> - Borehole Drilling	<ul> <li>Minimum Requirements:</li> <li>Mechanical Sieve Analysis</li> <li>Specific Gravity</li> <li>Atterberg Limits</li> <li>Natural Moisture Content</li> <li>Soil Strength Test</li> </ul>		

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DPWH DGCS 2015 EDITION: VOLUME 2C – GEOLOGICAL AND GEOTECHNICAL INVESTIGATION	SPACING / FREQUENCY		DEPTH		TYPE OF	REOUIRED
	EXISTING	REVISION	EXISTING	REVISION	SUBSURFACE EXPLORATION	LABORATORY TESTS
				obtained, whichever is greater.		<u>Conditional Test</u> <u>Requirements based on</u> <u>Initial Assessment of</u> <u>Actual Site Condition:</u> - Consolidation Test - Permeability Test - Hydrometer Test
Groundsill	No spacing specified.	Spacing shall be one (1) at the center and both edges of the proposed structure, and at every appurtenant structures, i.e. Apron, etc.	No depth specified.	Minimum depth of borehole shall be five (5) meters below the riverbed or until three (3) consecutive SPT N-Value > 40 is obtained, whichever is greater. Note: In case with protection works, depth of borehole below the riverbed shall be twice the height of the structure	<u>Minimum</u> <u>Requirement:</u> - Borehole Drilling	Minimum Requirements:         - Mechanical Sieve         Analysis         - Specific Gravity         - Atterberg Limits         - Natural Moisture         Content         - Soil Strength Test         Conditional Test         Requirements based on         Initial Assessment of         Actual Site Condition:         - Consolidation Test         - Permeability Test         - Hydrometer Test

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DPWH DGCS 2015 EDITION: VOLUME 2C – GEOLOGICAL AND GEOTECHNICAL	SPACING / FREQUENCY		DEPTH		TYPE OF SUBSURFACE EXPLORATION	REQUIRED LABORATORY TESTS
INVESTIGATION	EXISTING	REVISION	EXISTING	REVISION		
				or until three (3) consecutive SPT N- Value > 40 is obtained, whichever is greater.		
Dam like Small Dam / Sluiceways / Conduits	No spacing specified.	Along Dam Axis: Spacing shall be one (1) at the center and both edges of the proposed structure and at every appurtenant structures, i.e. Apron, etc. Along Spillway Alignment Centerline: Spacing shall be one (1) on the upstream end or approach channel section, one (1) at location nearest to the middle part or if possible exactly at the intersection of the spillway centerline with dam axis, and one (1) at the downstream end of	No depth specified.	Along Dam Axis: Depth of borehole shall be 1.50 times the height of the proposed dam from the natural grade line or until three (3) consecutive SPT N-Value > 40 is obtained, whichever is greater. Along Spillway Alignment Centerline: Minimum depth of six (6) meters shall be required unless hard and water tight rock foundation is already encountered above this level.	<u>Minimum</u> <u>Requirement:</u> - Borehole Drilling	Minimum Requirements: - Mechanical Sieve Analysis - Hydrometer Test - Specific Gravity - Atterberg Limits - Natural Moisture Content - Soil/Rock Strength Test - Consolidation Test - Permeability Test

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DPWH DGCS 2015 EDITION: VOLUME 2C – GEOLOGICAL AND GEOTECHNICAL INVESTIGATION	SPACING /	<b>FREQUENCY</b> REVISION	DE	<b>PTH</b> REVISION	TYPE OF SUBSURFACE EXPLORATION	REQUIRED LABORATORY TESTS
		the spillway or at the spillway energy dissipator / stilling basin location. Along Outlet Works Alignment Centerline: Spacing shall be one (1) on the upstream end or at the inlet channel section, one (1) at the location nearest to the middle part or if possible exactly at the intersection of the outlet works centerline with dam axis and one (1) at the downstream end of the energy dissipator / stilling basin location.		Along Outlet Works Alignment Centerline: Depth of borehole shall be dictated by the required level of competency of foundation material. However, a minimum depth equal to the height of the Dam shall be required on outlet / conduit structure crossing under / over the dam base unless hard and water tight rock or desired foundation is already encountered above this level.		
Sabo Dam	No spacing specified.	Spacing shall be one (1) at the center and both edges of the main sabo dam, and one (1) at the center of vertical wall /	No depth specified.	Depth of borehole below the streambed shall be one-half (0.50) times the height of the structure	<u>Minimum</u> <u>Requirement:</u> - Borehole Drilling	Minimum Requirements: - Mechanical Sieve Analysis - Hydrometer Test - Specific Gravity

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DPWH DGCS 2015 EDITION: VOLUME 2C – GEOLOGICAL AND GEOTECHNICAL INVESTIGATION	SPACING /	FREQUENCY	DE	РТН		REQUIRED
	EXISTING	REVISION	EXISTING	REVISION	EXPLORATION	LABORATORY TESTS
		sub-sabo dam and at every appurtenant structures, i.e., Apron, etc.		or until three (3) consecutive SPT N- Value > 60 is obtained		<ul> <li>Atterberg Limits</li> <li>Natural Moisture Content</li> <li>Soil/Rock Strength Test</li> <li>Consolidation Test</li> <li>Permeability Test</li> </ul>
Open Drains / Channels	No spacing specified.	Spacing shall be one (1) at the start and one (1) at the end of the project. Additional intermediate borehole shall be conducted for every 500 meters increment or at identified critical section/s.	No depth specified.	Minimum depth of borehole shall be five (5) meters below the riverbed.	<u>Minimum</u> <u>Requirement:</u> - Borehole Drilling	<ul> <li><u>Minimum Requirements:</u></li> <li>Mechanical Sieve Analysis</li> <li>Specific Gravity</li> <li>Atterberg Limits</li> <li>Natural Moisture Content</li> <li>Soil/Rock Strength Test</li> </ul> <u>Conditional Test</u> <u>Requirements based on</u> <u>Initial Assessment of</u> <u>Actual Site Condition:</u> <ul> <li>Consolidation Test</li> <li>Permeability Test</li> <li>Hydrometer Test</li> </ul>
Detention Basin / Load-Bearing Culverts	No spacing specified.	Long Sections: Spacing shall be one (1) at the start and one (1)	No depth specified.	Minimum depth of borehole shall be five (5) meters below the	<u>Minimum</u> <u>Requirement:</u> - Borehole Drilling	Minimum Requirements: - Mechanical Sieve Analysis

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DPWH DGCS 2015 EDITION: VOLUME 2C - GEOLOGICAL	SPACING /	FREQUENCY	DEPTH		TYPE OF	REQUIRED
AND GEOTECHNICAL INVESTIGATION	EXISTING	REVISION	EXISTING	REVISION	SUBSURFACE EXPLORATION	LABORATORY TESTS
		at the end of the project. Additional intermediate borehole shall be conducted for every 500 meters increment or at identified critical section/s. Short Sections (Across Road / Embankment): Spacing shall be one (1) at the center for every location.		structure, or until three (3) consecutive SPT N-Value > 40 is obtained, whichever is greater.		<ul> <li>Specific Gravity</li> <li>Atterberg Limits</li> <li>Natural Moisture Content</li> <li>Soil/Rock Strength Test</li> </ul> Conditional Test Requirements based on Initial Assessment of Actual Site Condition: <ul> <li>Consolidation Test</li> <li>Permeability Test</li> <li>Hydrometer Test</li> </ul>
Urban Drainage (Closed Conduit Network, Manhole and Access Chambers, Culverts)	No spacing specified.	For RCPC: Spacing shall be one (1) at the start and one (1) at the end of the project. Additional intermediate testing for every 50 meters or at identified critical section/s.	No depth specified.	Minimum depth of borehole shall be twice the structure diameter or width / height (whichever is greater) or twice the fill height, whichever is deeper. If rock is encountered within the proposed depth of excavation,	Minimum Requirement: For RCPC: - Test Pitting For RCBC: - Borehole Drilling	Minimum Requirements:         - Mechanical Sieve         Analysis         - Specific Gravity         - Atterberg Limits         - Natural Moisture         Conditional Test         Requirements based on         Initial Assessment of         Actual Site Condition:

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DPWH DGCS 2015 EDITION: VOLUME 2C – GEOLOGICAL AND GEOTECHNICAL INVESTIGATION	SPACING / FREQUENCY		DEPTH			REOUIRED
	EXISTING	REVISION	EXISTING	REVISION	SUBSURFACE EXPLORATION	LABORATORY TESTS
		Note: If RCPC length is less than 50 meters, provide one (1) test pitting only preferably at the midpoint or critical section, or location of highest fill. For RCBC: Spacing shall be one (1) at the start and one (1) at the start and one (1) at the end of the project. Additional intermediate borehole for every 250 meters or at identified critical section/s and location/s with maximum fill / embankment. Note: If the proposed RCBC crosses an existing ditch, creek, or stream channel, the		coring shall be performed with a minimum of 1.50 meters core.		<ul> <li>Consolidation Test</li> <li>Permeability Test</li> <li>Soil/Rock Strength Test</li> <li>Hydrometer Test</li> </ul>

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DPWH DGCS 2015 EDITION: VOLUME 2C – GEOLOGICAL AND GEOTECHNICAL INVESTIGATION	SPACING / FREQUENCY		DEPTH			REQUIRED
	EXISTING	REVISION	EXISTING	REVISION	SUBSURFACE EXPLORATION	LABORATORY TESTS
		requirements above shall still be followed, and an additional boring shall be conducted, located at the existing ditch, creek, or stream channel.				
Urban Drainage (Pumping Station)	No spacing specified.	<ul> <li>Minimum required spacing shall follow Table 303-1 of the National Structural Code of the Philippines (NSCP) 2015 Edition.</li> <li>For footprint area less than or equal to 50 sq. m., minimum required number of borehole shall be 1.</li> <li>For footprint area greater than 50 sq. m. but less than or equal to 50 sq. m., minimum required number of equal to 500 sq. m., minimum required number of equal to 500 sq. m., minimum required</li> </ul>	No depth specified.	Minimum depth of borehole shall be 30 meters depth from the natural ground line or until three (3) consecutive SPT N- Value > 40 is obtained, whichever is greater.	<u>Minimum</u> <u>Requirement:</u> - Borehole Drilling	<ul> <li>Minimum Requirements:</li> <li>Mechanical Sieve Analysis</li> <li>Specific Gravity</li> <li>Atterberg Limits</li> <li>Natural Moisture Content</li> <li>Soil/Rock Strength Test</li> </ul> Conditional Test Requirements based on Initial Assessment of Actual Site Condition: <ul> <li>Consolidation Test</li> <li>Permeability Test</li> <li>Hydrometer Test</li> </ul>

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DPWH DGCS 2015 EDITION: VOLUME 2C – GEOLOGICAL AND GEOTECHNICAL INVESTIGATION	<b>SPACING /</b> EXISTING	<b>FREQUENCY</b> REVISION	DE	PTH REVISION	TYPE OF SUBSURFACE EXPLORATION	REQUIRED LABORATORY TESTS
Coastal Structures (Coastal Revetment / Seawall / Breakwater / Jetty)	No spacing specified.	number of boreholes shall be 2. - For footprint area greater than 500 sq. m., minimum required number of boreholes shall be 2 + A/1000 where A is the footprint area. Spacing shall be one (1) near both ends of the project. Additional intermediate borehole shall be conducted for every 500 meters increment or at identified critical section/s.	No depth specified.	Minimum depth of borehole shall be: For structure with pile foundation: Five (5) consecutive SPT N- Value > 50 is obtained For structure without pile foundation: Five (5) consecutive SPT N-Value > 30 is obtained	Minimum Requirement: - Borehole Drilling	Minimum Requirements: - Mechanical Sieve Analysis - Specific Gravity - Atterberg Limits - Natural Moisture Content - Soil/Rock Strength Test Conditional Test Requirements based on Initial Assessment of Actual Site Condition: - Consolidation Test - Permeability Test - Hydrometer Test

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DPWH DGCS 2015 EDITION: VOLUME 2C – GEOLOGICAL AND GEOTECHNICAL			DEPTH		TYPE OF SUBSURFACE EXPLORATION	REQUIRED LABORATORY TESTS			
INVESTIGATION	EXISTING	REVISION	EXISTING	REVISION					
D. BUILDING PROJECTS									
One (1) Storey Building with Five (5) Meters Height or Less	Spacing shall be one (1) at each corner of the structure and one (1) at the center.	<ul> <li>Minimum required spacing shall adopt Table 303-1 of the National Structural Code of the Philippines (NSCP) 2015 Edition and/or its latest edition:</li> <li>For footprint area less than or equal to 50 sq. m., minimum required number of borehole shall be 1.</li> <li>For footprint area greater than 50 sq. m., minimum required number of boreholes shall be 2.</li> <li>For footprint area greater than 50 sq. m., minimum required number of boreholes shall be 2.</li> </ul>	Depth of borehole shall be thirty (30) meters below the natural ground line.	Plate load test or 1.50 meters of test pitting below the natural ground line.	Minimum Requirement: - Test Pitting / Plate Load Test	<ul> <li>Minimum Requirements:</li> <li>Mechanical Sieve Analysis</li> <li>Specific Gravity</li> <li>Atterberg Limits</li> <li>Natural Moisture Content</li> </ul> Conditional Test Requirements based on Initial Assessment of Actual Site Condition: <ul> <li>Consolidation Test</li> <li>Permeability Test</li> <li>Hydrometer Test</li> </ul>			

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DPWH DGCS 2015 EDITION: VOLUME 2C – GEOLOGICAL AND GEOTECHNICAL INVESTIGATION	SPACING /	SPACING / FREQUENCY		ртн	TYPE OF	REOUIRED
	EXISTING	REVISION	EXISTING	REVISION	SUBSURFACE EXPLORATION	LABORATORY TESTS
		m., minimum required number of boreholes shall be $2 + A/1000$ where A is the footprint area.				
Two (2) Storey Building and Above	Spacing shall be one (1) at each corner of the structure and one (1) at the center.	<ul> <li>Minimum required spacing shall adopt Table 303-1 of the National Structural Code of the Philippines (NSCP) 2015 Edition and/or its latest edition:</li> <li>For footprint area less than or equal to 50 sq. m., minimum required number of borehole shall be 1.</li> <li>For footprint area greater than 50 sq. m. but less than or equal to 50 sq. m., minimum required number of borehole shall be 1.</li> </ul>	Depth of borehole shall be thirty (30) meters below the natural ground line.	Minimum depth of borehole shall be thirty (30) meters or five (5) meters into bearing layer, whichever comes first.	<u>Minimum</u> <u>Requirement:</u> - Borehole Drilling	<ul> <li>Minimum Requirements:</li> <li>Mechanical Sieve Analysis</li> <li>Specific Gravity</li> <li>Atterberg Limits</li> <li>Natural Moisture Content</li> <li>Soil/Rock Strength Test</li> </ul> Conditional Test Requirements based on Initial Assessment of Actual Site Condition: <ul> <li>Consolidation Test</li> <li>Permeability Test</li> <li>Hydrometer Test</li> </ul>

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DPWH DGCS 2015 EDITION: VOLUME 2C – GEOLOGICAL AND GEOTECHNICAL INVESTIGATION	SPACING / FREQUENCY		DEPTH		TYPE OF	REQUIRED
	EXISTING	REVISION	EXISTING	REVISION	SUBSURFACE EXPLORATION	LABORATORY TESTS
		- For footprint area greater than 500 sq. m., minimum required number of boreholes shall be 2 + A/1000 where A is the footprint area.				
One (1) Storey Building with more than Five (5) Meters Height	Spacing shall be one (1) at each corner of the structure and one (1) at the center.	<ul> <li>Minimum required spacing shall adopt Table 303-1 of the National Structural Code of the Philippines (NSCP) 2015 Edition and/or its latest edition:</li> <li>For footprint area less than or equal to 50 sq. m., minimum required number of borehole shall be 1.</li> <li>For footprint area greater than 50 sq. m. but less than or equal to 50 sq. m.</li> </ul>	Depth of borehole shall be thirty (30) meters below the natural ground line.	Minimum depth of borehole shall be thirty (30) meters or five (5) meters into bearing layer, whichever comes first.	<u>Minimum</u> <u>Requirement:</u> - Borehole Drilling	Minimum Requirements: - Mechanical Sieve Analysis - Specific Gravity - Atterberg Limits - Natural Moisture Content - Soil/Rock Strength Test Conditional Test Requirements based on Initial Assessment of Actual Site Condition: - Consolidation Test - Permeability Test - Hydrometer Test

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Annex: Design Investigation Program Requirements for Geotechnical Investigation

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	EXISTING	REVISION	EXISTING	REVISION	SUBSURFACE EXPLORATION	LABORATORY TESTS
		<ul> <li>minimum required number of boreholes shall be 2.</li> <li>For footprint area greater than 500 sq. m., minimum required number of boreholes shall be 2 + A/1000 where A is the footprint area.</li> </ul>				

Note:

- In order to be considered as bearing layer, the soil layer shall passed thru "Refusal Criteria":
  - a. A total of 50 blows have been applied during any of one of the three (3) 0.50 feet or 0.15 meters increments;
  - b. A total of 100 blows have been applied;
  - c. There is no observed advance of the sampler during the application of 10 successive blows of the hammer; and
  - d. The sampler is advanced to complete 1.50 feet (0.45 meters) without the limiting blow counts occurring as described a, b, or c.
- Laboratory tests under "Conditional Test Requirements based on Initial Assessment of Actual Site Condition" shall be performed / programmed if a geotechnical failure/s is / are expected to occur on the project site.