

SECTION 31 00 00

EARTHWORK

PART 1 GENERAL

1.1 MEASUREMENT PROCEDURES

1.1.1 Excavation

The unit of measurement for excavation and borrow will be the cubic meter, computed by the average end area method from cross sections taken before and after the excavation and borrow operations, including the excavation for ditches, gutters, and channel changes, when the material is acceptably utilized or disposed of as herein specified. The measurements will include authorized excavation of rock (except for piping trenches that is covered below), authorized excavation of unsatisfactory subgrade soil, and the volume of loose, scattered rocks and boulders collected within the limits of the work; allowance will be made on the same basis for selected backfill ordered as replacement. The measurement will not include the volume of subgrade material or other material that is scarified or plowed and reused in-place, and will not include the volume excavated without authorization or the volume of any material used for purposes other than directed. The volume of overburden stripped from borrow pits and the volume of excavation for ditches to drain borrow pits, unless used as borrow material, will not be measured for payment. The measurement will not include the volume of any excavation performed prior to the taking of elevations and measurements of the undisturbed grade.

1.1.2 Piping Trench Excavation

Measure trench excavation by the number of linear meters along the centerline of the trench and excavate to the depths and widths specified for the particular size of pipe. Replace unstable trench bottoms with a selected granular material. Include the additional width at manholes and similar structures, the furnishing, placing and removal of sheeting and bracing, pumping and bailing, and all incidentals necessary to complete the work required by this section.

1.1.3 Rock Excavation for Trenches

Measure and pay for rock excavation by the number of cubic meters of acceptably excavated rock material. Measure the material in place, but base volume on a maximum 750 mm width for pipes 300 mm in diameter or less, and a maximum width of 400 mm greater than the outside diameter of the pipe for pipes over 300 mm in diameter. Provide the measurement to include all authorized overdepth rock excavation as determined by the Contracting Officer. For manholes and other appurtenances, compute volumes of rock excavation on the basis of 300 mm outside of the wall lines of the structures.

1.1.4 Topsoil Requirements

Separate excavation, hauling, and spreading or piling of topsoil and related miscellaneous operations will be considered subsidiary obligations of the Contractor, covered under the contract unit price for excavation.

1.1.5 Overhaul Requirements

Allow the unit of measurement for overhaul to be the station-meter. The overhaul distance will be the distance in stations between the center of volume of the overhaul material in its original position and the center of volume after placing, minus the free-haul distance in stations. The haul distance will be measured along the shortest route determined by the Contracting Officer as feasible and satisfactory. Do no measure or waste unsatisfactory materials for overhaul where the length of haul for borrow is within the free-haul limits.

1.1.6 Select Granular Material

Measure select granular material in place as the actual cubic meters replacing wet or unstable material in trench bottoms [within the limits shown] [in authorized overdepth areas]. Provide unit prices which include furnishing and placing the granular material, excavation and disposal of unsatisfactory material, and additional requirements for sheeting and bracing, pumping, bailing, cleaning, and other incidentals necessary to complete the work.

1.2 PAYMENT PROCEDURES

Payment will constitute full compensation for all labor, equipment, tools, supplies, and incidentals necessary to complete the work.

1.2.1 Classified Excavation

Classified excavation will be paid for at the contract unit prices per cubic meter for common or rock excavation.

1.2.2 Piping Trench Excavation

Payment for trench excavation will constitute full payment for excavation and backfilling, [including specified overdepth] except in rock or unstable trench bottoms.

1.2.3 Rock Excavation for Trenches

Payment for rock excavation will be made in addition to the price bid for the trench excavation, and will include all necessary drilling and all incidentals necessary to excavate and dispose of the rock. Select granular material, used as backfill replacing rock excavation, will not be paid for separately, but will be included in the unit price for rock excavation.

1.2.4 Unclassified Excavation

Unclassified excavation will be paid for at the contract unit price per cubic meter for unclassified excavation.

1.2.5 Classified Borrow

Classified borrow will be paid for at the contract unit prices per cubic meter for common or rock borrow.

1.2.6 Unclassified Borrow

Unclassified borrow will be paid for at the contract unit price per cubic meter for unclassified borrow.

1.2.7 Authorized Overhaul

The number of station-meters of overhaul to be paid for will be the product of number of cubic meters of overhaul material measured in the original position, multiplied by the overhaul distance measured in stations of 100 meters and will be paid for at the contract unit price per station-meter for overhaul in excess of the free-haul limit as designated in paragraph DEFINITIONS.

1.2.8 Sheeting and Bracing

Sheeting and bracing, when shown or authorized by the Contracting Officer to be left in place, will be paid for as follows: [_____].

1.2.8.1 Timber Sheeting

Timber sheeting will be paid for as the number of board feet of lumber below finish grade measured in place prior to backfilling. Include in the measurement sheeting wasted when cut off between the finished grade and 300 mm below the finished grade.

1.2.8.2 Steel Sheeting and Soldier Piles

Steel sheeting, soldier piles, and steel bracing will be paid for according to the number of pounds of steel calculated. Calculate the steel by multiplying the measured in-place length in meters below finish grade by the unit weight of the section in kg per meter. Obtain unit weight of rolled steel sections from recognized steel manuals. [Included in the measurement sheeting wasted when cut off between the finished grade and a distance of up to [_____] meters below the finished grade.]

1.3 CRITERIA FOR BIDDING

Base bids on the following criteria:

- a. Surface elevations are as indicated.
- b. Pipes or other artificial obstructions, except those indicated, will not be encountered.
- c. [Ground water elevations indicated by the boring log were those existing at the time subsurface investigations were made and do not necessarily represent ground water elevation at the time of construction.] [Ground water elevation is [_____] meters below existing surface elevation.]
- d. [Ground water elevation is [_____] meters below existing surface elevation.]
- e. [Material character is indicated by the boring logs.]
- f. [Hard materials [and rock] [will not] [will] be encountered [in [_____] percent of the excavations] [at [_____] meter below existing surface elevations]].

1.4 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

JAPANESE STANDARDS ASSOCIATION (JSA)

JIS A 1102	(2014) Method of Test for Sieve Analysis of Aggregates
JIS A 1103	(2014) Method of Test for Amount of Material Passing Test Sieve 75 µm in Aggregates
JIS A 1205	(2009) Test Method for Liquid Limit and Plastic Limit of Soils
JIS A 1210	(2009) Test Method for Soil Compaction Using a Rammer
JIS A 1211	(2009) Test Methods for the California Bearing Ratio (CBR) of Soils in laboratory
JIS A 1214	(2013) Test Method for Soil Density by the Sand Replacement Method
JIS A 1218	(2013) Test Methods for Permeability of Saturated Soils
JIS A 5001	(2008) Crushed Stone for Road Construction
JIS A 5005	(2009) Crushed Stone and Manufactured Sand for Concrete

MINISTRY OF THE ENVIRONMENT GOVERNMENT OF JAPAN (MOE)

Notification No.46	(2001) Environmental Quality Standards for Soil Contamination
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JAPANESE GEOTECHNICAL SOCIETY (JGS)

JGS 0051	(2000) Method of Classification of Geomaterials for Engineering Purposes
JGS 1614	(2003) Test Method for Soil Density Using Nuclear Gauge

U.S. DEPARTMENT OF DEFENSE HEADQUARTERS, U.S. FORCES JAPAN (USFJ)

JEGS	(Apr 2024) Japan Environmental Governing Standards
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1.5 DEFINITIONS

1.5.1 Satisfactory Materials

Satisfactory materials comprise any materials classified by JGS 0051 as G,

G-M, G-C, [G-O], [G-V], GM, GC, [GO], [GV], S, S-M, S-C, [S-O], [S-V], SM, SC, [SO], [SV], ML, MH, CL, CH, [OL], [OH], [OV], [VH1], [VH2].
Satisfactory materials for grading comprise stones less than 200 mm, except for fill material for pavements and railroads which comprise stones less than 75 mm in any dimension.

1.5.2 Unsatisfactory Materials

Materials which do not comply with the requirements for satisfactory materials are unsatisfactory. Unsatisfactory materials also include man-made fills; trash; refuse; backfills from previous construction; and material classified as satisfactory which contains root and other organic matter or frozen material. Notify the Contracting Officer when encountering any contaminated materials.

1.5.3 Cohesionless and Cohesive Materials

Cohesionless materials include materials classified in JGS 0051 as G, G-M, G-C, S, S-M, S-C. Cohesive materials include materials classified as GC, SC, ML, CL, MH, CH. Materials classified as GM, SM will be identified as cohesionless only when the fines are nonplastic. Perform testing, required for classifying materials, in accordance with JIS A 1205, JIS A 1102 and JIS A 1103.

1.5.4 Degree of Compaction

Degree of compaction required, except as noted in the second sentence, is expressed as a percentage of the maximum density obtained by the test procedure presented in JIS A 1210 (Methods C,D,E - non repeating method) abbreviated as a percent of laboratory maximum density (Modified Proctor Test).

1.5.5 Overhaul

Overhaul is the authorized transportation of satisfactory excavation or borrow materials in excess of the free-haul limit of [_____] stations. Overhaul is the product of the quantity of materials hauled beyond the free-haul limit, and the distance such materials are hauled beyond the free-haul limit, expressed in station meters.

1.5.6 Topsoil

Material suitable for topsoils obtained from [offsite areas] [excavations] [areas indicated on the drawings] is defined as: Natural, friable soil representative of productive, well-drained soils in the area, free of subsoil, stumps, rocks larger than 25 mm diameter, brush, weeds, toxic substances, and other material detrimental to plant growth. Amend topsoil pH range to obtain a pH of 5.5 to 7.

1.5.7 Hard/Unyielding Materials

Hard/Unyielding materials comprise weathered rock, dense consolidated deposits, or conglomerate materials which are not included in the definition of "rock" with stones greater than [_____] mm in any dimension or as defined by the pipe manufacturer, whichever is smaller. These materials usually require the use of heavy excavation equipment, ripper teeth, or jack hammers for removal.

1.5.8 Rock

Solid homogeneous interlocking crystalline material with firmly cemented, laminated, or foliated masses or conglomerate deposits, neither of which can be removed without systematic drilling, drilling and the use of expansion jacks or feather wedges, or the use of backhoe-mounted pneumatic hole punchers or rock breakers; also large boulders, buried masonry, or concrete other than pavement exceeding [0.375] [_____] cubic meter in volume. Removal of hard material will not be considered rock excavation because of intermittent drilling that is performed merely to increase production.

1.5.9 Unstable Material

Unstable materials are too wet to properly support the utility pipe, conduit, or appurtenant structure.

1.5.10 Select Granular Material

1.5.10.1 General Requirements

Select granular material consist of materials classified as [G], [G-M], [G-C], [S], [S-M], [S-C] or [_____] by JGS 0051 where indicated. [The liquid limit of such material must not exceed [35] [_____] percent when tested in accordance with JIS A 1205. The plasticity index must not be greater than [12] [_____] percent when tested in accordance with JIS A 1205, and not more than [35] [_____] percent by weight may be finer than 75 micrometers sieve when tested in accordance with JIS A 1103.] [Provide a minimum coefficient of permeability of [0.01] [_____] mm per second when tested in accordance with JIS A 1218.]

1.5.10.2 California Bearing Ratio Values

[Bearing Ratio: Provide Design CBR ratio in accordance with JIS A 1211 for a laboratory soaking period of not less than 4 days. [Provide [_____] percent maximum expansion.] [Conform the combined material to the following sieve analysis:]]

Sieve Size	Percent Passing by Weight
63 mm	100
4.75 mm	40 - 85
2.00 mm	20 - 80
425 µm	10 - 60
75 µm	5 - 25

1.5.11 Initial Backfill Material

Initial backfill consists of select granular material or satisfactory materials free from rocks [_____] mm or larger in any dimension or free from rocks of such size as recommended by the pipe manufacturer, whichever is smaller. When the pipe is coated or wrapped for corrosion protection, free the initial backfill material of stones larger than [_____] mm in any

dimension or as recommended by the pipe manufacturer, whichever is smaller.

1.5.12 Expansive Soils

Expansive soils are defined as soils that have a plasticity index equal to or greater than [_____] when tested in accordance with JIS A 1205 or have expansion/swelling ratios equal to or greater than [_____] when tested in accordance with JIS A 1211.

1.5.13 Nonfrost Susceptible (NFS) Material

Nonfrost susceptible material are a uniformly graded washed sand with a maximum particle size of [_____] mm and less than 5 percent passing the 0.075 mm size sieve, and with not more than 3 percent by weight finer than 0.02 mm grain size.

1.5.14 Pile Supported Structure

As used herein, a structure where both the foundation and floor slab are pile supported.

1.6 SYSTEM DESCRIPTION

Subsurface soil boring logs are [shown on the drawings] [appended to the SPECIAL CONTRACT REQUIREMENTS]. The subsoil investigation report and samples of materials taken from subsurface investigations may be examined at [_____]. These data represent the best subsurface information available; however, variations may exist in the subsurface between boring locations.

1.6.1 Classification of Excavation

[No consideration will be given to the nature of the materials, and all excavation will be designated as unclassified excavation.] [Finish the specified excavation on a classified basis, in accordance with the following designations and classifications.]

1.6.1.1 Common Excavation

Include common excavation with the satisfactory removal and disposal of all materials not classified as rock excavation.

1.6.1.2 Rock Excavation

Submit notification of encountering rock in the project. Include rock excavation with excavating, grading, disposing of material classified as rock, and the satisfactory removal and disposal of boulders 1/2 cubic meter or more in volume; solid rock; rock material that is in ledges, bedded deposits, and unstratified masses, which cannot be removed without systematic drilling; firmly cemented conglomerate deposits possessing the characteristics of solid rock impossible to remove without systematic drilling; and hard materials (see Definitions). Include the removal of any concrete or masonry structures, except pavements, exceeding 1/2 cubic meter in volume that may be encountered in the work in this classification. If at any time during excavation, including excavation from borrow areas, the Contractor encounters material that may be classified as rock excavation, uncover such material and notify the Contracting Officer. Do not proceed with the excavation of this material until the Contracting Officer has classified the materials as common

excavation or rock excavation and has taken cross sections as required. Failure on the part of the Contractor to uncover such material, notify the Contracting Officer, and allow ample time for classification and cross sectioning of the undisturbed surface of such material will cause the forfeiture of the Contractor's right of claim to any classification or volume of material to be paid for other than that allowed by the Contracting Officer for the areas of work in which such deposits occur.

1.6.2 Dewatering Work Plan

Submit procedures for accomplishing dewatering work.

1.7 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for [Contractor Quality Control approval.] [information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals
Shoring; G[, [____]]
Dewatering Work Plan; G[, [____]]

SD-06 Test Reports

Testing

Borrow Site Testing

Within 24 hours of conclusion of physical tests, submit [____] copies of test results, including calibration curves and results of calibration tests.

PART 2 PRODUCTS

2.1 REQUIREMENTS FOR OFFSITE SOILS

Test offsite soils brought in for use as backfill for Total Petroleum Hydrocarbons (TPH), Benzene, Toluene, Ethyl Benzene, and Xylene (BTEX) and full Toxicity Characteristic Leaching Procedure (TCLP) including ignitability, corrosivity and reactivity. Perform tests and verify threshold values in accordance with JAPAN Ministry of the Environment Notification No.46 guidelines and JEGS. Provide Borrow Site Testing for TPH, BTEX and TCLP from a composite sample of material from the borrow site, with at least one test from each borrow site. Do not bring material onsite until tests have been approved by the Contracting Officer.

2.2 BURIED WARNING AND IDENTIFICATION TAPE

Provide [polyethylene plastic] [and] [metallic core or metallic-faced, acid- and alkali-resistant, polyethylene plastic] warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 75 mm minimum width, color coded as specified below for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape length.

Warning and identification to read, "CAUTION, BURIED (intended service) LINE BELOW" or similar wording. Provide permanent color and printing, unaffected by moisture or soil.

Warning Tape Color Codes	
Red	Electric
Yellow	Gas, Oil; Dangerous Materials
Orange	Telephone and Other Communications
Blue	Water Systems
Green	Sewer Systems
White	Steam Systems
Gray	Compressed Air

2.2.1 Warning Tape for Metallic Piping

Provide acid and alkali-resistant polyethylene plastic tape conforming to the width, color, and printing requirements specified above, with a minimum thickness of 0.08 mm and a minimum strength of 10.3 MPa lengthwise, and 8.6 MPa crosswise, with a maximum 350 percent elongation.

2.2.2 Detectable Warning Tape for Non-Metallic Piping

Provide polyethylene plastic tape conforming to the width, color, and printing requirements specified above, with a minimum thickness of 0.10 mm, and a minimum strength of 10.3 MPa lengthwise and 8.6 MPa crosswise. Manufacture tape with integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 920 mm deep. Encase metallic element of the tape in a protective jacket or provide with other means of corrosion protection.

2.3 DETECTION WIRE FOR NON-METALLIC PIPING

Insulate a single strand, solid copper detection wire with a minimum of 12 AWG.

2.4 MATERIAL FOR RIP-RAP

Provide [Bedding material] [Grout] [Filter fabric] and rock conforming to [these requirements] [[_____] local Standard] for construction indicated.

2.4.1 Bedding Material

Provide bedding material consisting of sand, gravel, or crushed rock, well graded, [or poorly graded] with a maximum particle size of 50 mm. Compose material of tough, durable particles. Allow fines passing the 75 micrometers standard sieve with a plasticity index less than six.

2.4.2 Grout

Provide durable grout composed of cement, water, an air-entraining admixture, and sand mixed in proportions of one part portland cement to [two] [_____] parts of sand, sufficient water to produce a workable mixture, and an amount of admixture which will entrain sufficient air, as determined by the Contracting Officer. Mix grout in a concrete mixer. Allow a sufficient mixing time to produce a mixture having a consistency permitting gravity flow into the interstices of the rip-rap with limited spading and brooming.

2.4.3 Rock

Provide rock fragments sufficiently durable to ensure permanence in the structure and the environment in which it is to be used. Use rock fragments free from cracks, seams, and other defects that would increase the risk of deterioration from natural causes. Provide fragments sized so that no individual fragment exceeds a weight of [68] [_____] kg and that no more than 10 percent of the mixture, by weight, consists of fragments weighing 0.91 kg or less each. Provide rock with a minimum specific gravity of [2.50] [_____]. Do not permit the inclusion of more than trace [1 percent] [_____] quantities of dirt, sand, clay, and rock fines.

2.5 CAPILLARY WATER BARRIER

Provide capillary water barrier of clean, poorly graded crushed rock, crushed gravel, or uncrushed gravel placed beneath a building slab with or without a vapor barrier to cut off the capillary flow of pore water to the area immediately below. Conform to JIS A 5005 for fine aggregate grading with a maximum of 3 percent by weight passing JIS A 1103, 75 micrometers sieve, [or] [37.5 mm and no more than 2 percent by weight passing the 4.75 mm size sieve] [or coarse aggregate with "S-x" designation (where x is the maximum nominal gravel size) in accordance with JIS A 5001].

PART 3 EXECUTION

3.1 STRIPPING OF TOPSOIL

Where indicated or directed, strip topsoil to a depth of [100] [_____] mm. Spread topsoil on areas already graded and prepared for topsoil, or transported and deposited in stockpiles convenient to areas that are to receive application of the topsoil later, or at locations indicated or specified. Keep topsoil separate from other excavated materials, brush, litter, objectionable weeds, roots, stones larger than 50 mm in diameter, and other materials that would interfere with planting and maintenance operations. [Stockpile in locations indicated] [Remove from the site] any surplus of topsoil from excavations and gradings.

3.2 GENERAL EXCAVATION

Perform excavation of every type of material encountered within the limits of the project to the lines, grades, and elevations indicated and as specified. Perform the grading in accordance with the typical sections shown and the tolerances specified in paragraph FINISHING. Transport satisfactory excavated materials and place in fill or embankment within the limits of the work. Excavate unsatisfactory materials encountered within the limits of the work below grade and replace with satisfactory materials as directed. Include such excavated material and the satisfactory material ordered as replacement in excavation. Dispose

surplus satisfactory excavated material not required for fill or embankment in areas approved for surplus material storage or designated waste areas. Dispose unsatisfactory excavated material in designated waste or spoil areas. During construction, perform excavation and fill in a manner and sequence that will provide proper drainage at all times. Excavate material required for fill or embankment in excess of that produced by excavation within the grading limits from the borrow areas indicated or from other approved areas selected by the Contractor as specified.

3.2.1 Ditches, Gutters, and Channel Changes

Finish excavation of ditches, gutters, and channel changes by cutting accurately to the cross sections, grades, and elevations shown on Drawing Sheet No. [____]. Do not excavate ditches and gutters below grades shown. Backfill the excessive open ditch or gutter excavation with satisfactory, thoroughly compacted, material or with suitable stone or cobble to grades shown. Dispose excavated material as shown or as directed, except in no case allow material be deposited a maximum 1 meter from edge of a ditch. Maintain excavations free from detrimental quantities of leaves, brush, sticks, trash, and other debris until final acceptance of the work.

3.2.2 Drainage Structures

Make excavations to the lines, grades, and elevations shown, or as directed. Provide trenches and foundation pits of sufficient size to permit the placement and removal of forms for the full length and width of structure footings and foundations as shown. Clean rock or other hard foundation material of loose debris and cut to a firm, level, stepped, or serrated surface. Remove loose disintegrated rock and thin strata. Do not disturb the bottom of the excavation when concrete or masonry is to be placed in an excavated area. Do not excavate to the final grade level until just before the concrete or masonry is to be placed. Where pile foundations are to be used, stop the excavation of each pit at an elevation 300 mm above the base of the footing, as specified, before piles are driven. After the pile driving has been completed, remove loose and displaced material and complete excavation, leaving a smooth, solid, undisturbed surface to receive the concrete or masonry.

3.2.3 Drainage

Provide for the collection and disposal of surface and subsurface water encountered during construction. Completely drain construction site during periods of construction to keep soil materials sufficiently dry. Construct storm drainage features (ponds/basins) at the earliest stages of site development, and throughout construction grade the construction area to provide positive surface water runoff away from the construction activity [and] [or] provide temporary ditches, swales, and other drainage features and equipment as required to maintain dry soils. When unsuitable working platforms for equipment operation and unsuitable soil support for subsequent construction features develop, remove unsuitable material and provide new soil material as specified herein. It is the responsibility of the Contractor to assess the soil and ground water conditions presented by the plans and specifications and to employ necessary measures to permit construction to proceed.

3.2.4 Dewatering

Control groundwater flowing toward or into excavations to prevent sloughing of excavation slopes and walls, boils, uplift and heave in the excavation and to eliminate interference with orderly progress of construction. Do not permit French drains, sumps, ditches or trenches within 0.9 m of the foundation of any structure, except with specific written approval, and after specific contractual provisions for restoration of the foundation area have been made. Take control measures by the time the excavation reaches the water level in order to maintain the integrity of the in situ material. While the excavation is open, maintain the water level continuously, at least [_____] m below the working level. [Operate dewatering system continuously until construction work below existing water levels is complete. Submit performance records weekly.] [Measure and record performance of dewatering system at same time each day by use of observation wells or piezometers installed in conjunction with the dewatering system.] [Relieve hydrostatic head in previous zones below subgrade elevation in layered soils to prevent uplift.]

3.2.5 Trench Excavation Requirements

Excavate the trench as recommended by the manufacturer of the pipe to be installed. Slope trench walls below the top of the pipe, or make vertical, and of such width as recommended in the manufacturer's printed installation manual. Provide vertical trench walls where no manufacturer's printed installation manual is available. Shore trench walls more than [_____] meters high, cut back to a stable slope, or provide with equivalent means of protection for employees who may be exposed to moving ground or cave in. Shore vertical trench walls more than [_____] meters high. Excavate trench walls which are cut back to at least the angle of repose of the soil. Give special attention to slopes which may be adversely affected by weather or moisture content. Do not exceed the trench width below the pipe top of 600 mm plus pipe outside diameter (O.D.) for pipes of less than 600 mm inside diameter, and do not exceed 900 mm plus pipe outside diameter for sizes larger than 600 mm inside diameter. Where recommended trench widths are exceeded, provide redesign, stronger pipe, or special installation procedures by the Contractor. The Contractor is responsible for the cost of redesign, stronger pipe, or special installation procedures without any additional cost to the Government.

3.2.5.1 Bottom Preparation

Grade the bottoms of trenches accurately to provide uniform bearing and support for the bottom quadrant of each section of the pipe. Excavate bell holes to the necessary size at each joint or coupling to eliminate point bearing. Remove stones of [_____] mm or greater in any dimension, or as recommended by the pipe manufacturer, whichever is smaller, to avoid point bearing.

3.2.5.2 Removal of Unyielding Material

Where [overdepth is not indicated and] unyielding material is encountered in the bottom of the trench, remove such material [_____] mm below the required grade and replaced with suitable materials as provided in paragraph BACKFILLING AND COMPACTION.

3.2.5.3 Removal of Unstable Material

Where unstable material is encountered in the bottom of the trench, remove such material to the depth directed and replace it to the proper grade with select granular material as provided in paragraph BACKFILLING AND COMPACTION. When removal of unstable material is required due to the Contractor's fault or neglect in performing the work, the Contractor is responsible for excavating the resulting material and replacing it without additional cost to the Government.

3.2.5.4 Excavation for Appurtenances

Provide excavation for manholes, catch-basins, inlets, or similar structures [sufficient to leave at least 300 mm clear between the outer structure surfaces and the face of the excavation or support members.] [of sufficient size to permit the placement and removal of forms for the full length and width of structure footings and foundations as shown.] Clean rock or loose debris and cut to a firm surface either level, stepped, or serrated, as shown or as directed. Remove loose disintegrated rock and thin strata. Specify removal of unstable material. When concrete or masonry is to be placed in an excavated area, take special care not to disturb the bottom of the excavation. Do not excavate to the final grade level until just before the concrete or masonry is to be placed.

3.2.5.5 Jacking, Boring, and Tunneling

Unless otherwise indicated, provide excavation by open cut except that sections of a trench may be jacked, bored, or tunneled if, in the opinion of the Contracting Officer, the pipe, cable, or duct can be safely and properly installed and backfill can be properly compacted in such sections.

3.2.6 Underground Utilities

The Contractor is responsible for movement of construction machinery and equipment over pipes and utilities during construction. [Perform work adjacent to non-Government utilities as indicated in accordance with procedures outlined by utility company.] [Excavation made with power-driven equipment is not permitted within [600] [_____] mm of known Government-owned utility or subsurface construction. For work immediately adjacent to or for excavations exposing a utility or other buried obstruction, excavate by hand. Start hand excavation on each side of the indicated obstruction and continue until the obstruction is uncovered or until clearance for the new grade is assured. Support uncovered lines or other existing work affected by the contract excavation until approval for backfill is granted by the Contracting Officer.] Report damage to utility lines or subsurface construction immediately to the Contracting Officer.

3.2.7 Structural Excavation

Ensure that footing subgrades have been inspected and approved by the Contracting Officer prior to concrete placement. Excavate to bottom of pile cap prior to placing or driving piles, unless authorized otherwise by the Contracting Officer. Backfill and compact over excavations and changes in grade due to pile driving operations to 95 percent of JIS A 1210 maximum density.

3.3 SELECTION OF BORROW MATERIAL

Select borrow material to meet the requirements and conditions of the

particular fill or embankment for which it is to be used. Obtain borrow material from the borrow areas [shown on Drawing Sheet No. [____]] [within the limits of the project site, selected by the Contractor] [or] [from approved private sources]. Unless otherwise provided in the contract, the Contractor is responsible for obtaining the right to procure material, pay royalties and other charges involved, and bear the expense of developing the sources, including rights-of-way for hauling from the owners. Borrow material from approved sources on Government-controlled land may be obtained without payment of royalties. Unless specifically provided, do not obtain borrow within the limits of the project site without prior written approval. Consider necessary clearing, grubbing, and satisfactory drainage of borrow pits and the disposal of debris thereon related operations to the borrow excavation.

3.4 OPENING AND DRAINAGE OF EXCAVATION AND BORROW PITS

Notify the Contracting Officer sufficiently in advance of the opening of any excavation or borrow pit or borrow areas to permit elevations and measurements of the undisturbed ground surface to be taken. Except as otherwise permitted, excavate borrow pits and other excavation areas providing adequate drainage. Transport overburden and other spoil material to designated spoil areas or otherwise dispose of as directed. Provide neatly trimmed and drained borrow pits after the excavation is completed. Ensure that excavation of any area, operation of borrow pits, or dumping of spoil material results in minimum detrimental effects on natural environmental conditions.

3.5 SHORING

3.5.1 General Requirements

Submit a Shoring and Sheet piling plan for approval 15 days prior to starting work. Submit drawings and calculations, certified by a registered professional engineer, describing the methods for shoring and sheet piling of excavations. Finish shoring, including sheet piling, and install as necessary to protect workmen, banks, adjacent paving, structures, and utilities. Remove shoring, bracing, and sheet piling as excavations are backfilled, in a manner to prevent caving.

3.5.2 Geotechnical Engineer

Hire a Professional Geotechnical Engineer to provide inspection of excavations and soil/groundwater conditions throughout construction. The Geotechnical Engineer is responsible for performing pre-construction and periodic site visits throughout construction to assess site conditions. The Geotechnical Engineer is responsible for updating the excavation, sheet piling and dewatering plans as construction progresses to reflect changing conditions and submit an updated plan if necessary. Submit a monthly written report, informing the Contractor and Contracting Officer of the status of the plan and an accounting of the Contractor's adherence to the plan addressing any present or potential problems. The Contracting Officer is responsible for arranging meetings with the Geotechnical Engineer at any time throughout the contract duration.

3.6 GRADING AREAS

Where indicated, divide work into grading areas within which satisfactory excavated material will be placed in embankments, fills, and required backfills. Do not haul satisfactory material excavated in one grading

area to another grading area except when so directed in writing. Place and grade stockpiles of satisfactory [and unsatisfactory] [and wasted materials] as specified. Keep stockpiles in a neat and well drained condition, giving due consideration to drainage at all times. Clear, grub, and seal by rubber-tired equipment, the ground surface at stockpile locations; separately stockpile excavated satisfactory and unsatisfactory materials. Protect stockpiles of satisfactory materials from contamination which may destroy the quality and fitness of the stockpiled material. If the Contractor fails to protect the stockpiles, and any material becomes unsatisfactory, remove and replace such material with satisfactory material from approved sources.

3.7 FINAL GRADE OF SURFACES TO SUPPORT CONCRETE

Do not excavate to final grade until just before concrete is to be placed. [For pile foundations, stop the excavation at an elevation of from 150 to 300 mm above the bottom of the footing before driving piles. After pile driving has been completed, complete the remainder of the excavation to the elevations shown.] Only use excavation methods that will leave the foundation rock in a solid and unshattered condition. Roughen the level surfaces, and cut the sloped surfaces, as indicated, into rough steps or benches to provide a satisfactory bond. Protect shales from slaking and all surfaces from erosion resulting from ponding or water flow.

3.8 GROUND SURFACE PREPARATION

3.8.1 General Requirements

Remove and replace unsatisfactory material with satisfactory materials, as directed by the Contracting Officer, in surfaces to receive fill or in excavated areas. Scarify the surface to a depth of 150 mm before the fill is started. Plow, step, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so that the fill material will bond with the existing material. When subgrades are less than the specified density, break up the ground surface to a minimum depth of 150 mm, pulverizing, and compacting to the specified density. When the subgrade is part fill and part excavation or natural ground, scarify the excavated or natural ground portion to a depth of 300 mm and compact it as specified for the adjacent fill.

3.8.2 Frozen Material

Do not place material on surfaces that are muddy, frozen, or contain frost. Finish compaction by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, or other approved equipment well suited to the soil being compacted. Moisten material as necessary [to plus or minus [_____] percent of optimum moisture] [to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used].

3.9 UTILIZATION OF EXCAVATED MATERIALS

Dispose unsatisfactory materials removing from excavations into designated waste disposal or spoil areas. Use satisfactory material removed from excavations, insofar as practicable, in the construction of fills, embankments, subgrades, shoulders, bedding (as backfill), and for similar purposes. Submit procedure and location for disposal of unused satisfactory material. Submit proposed source of borrow material. Do not waste any satisfactory excavated material without specific written

authorization. Dispose of satisfactory material, authorized to be wasted, in designated areas approved for surplus material storage or designated waste areas as directed. Clear and grub newly designated waste areas on Government-controlled land before disposal of waste material thereon. Stockpile and use coarse rock from excavations for constructing slopes or embankments adjacent to streams, or sides and bottoms of channels and for protecting against erosion. Do not dispose excavated material to obstruct the flow of any stream, endanger a partly finished structure, impair the efficiency or appearance of any structure, or be detrimental to the completed work in any way.

3.10 BURIED TAPE AND DETECTION WIRE

3.10.1 Buried Warning and Identification Tape

Provide buried utility lines with utility identification tape. Bury tape 300 mm below finished grade; under pavements and slabs, bury tape 150 mm below top of subgrade.

3.10.2 Buried Detection Wire

Bury detection wire directly above non-metallic piping at a distance not to exceed 300 mm above the top of pipe. Extend the wire continuously and unbroken, from manhole to manhole. Terminate the ends of the wire inside the manholes at each end of the pipe, with a minimum of 0.9 m of wire, coiled, remaining accessible in each manhole. Furnish insulated wire over its entire length. Install wires at manholes between the top of the corbel and the frame, and extend up through the chimney seal between the frame and the chimney seal. For force mains, terminate the wire in the valve pit at the pump station end of the pipe.

3.11 BACKFILLING AND COMPACTION

Place backfill adjacent to any and all types of structures, in successive horizontal layers of loose material not more than 200 mm in depth. Compact to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials in accordance with JIS A 1210, to prevent wedging action or eccentric loading upon or against the structure. Backfill material must be within the range of -2 to +2 percent of optimum moisture content at the time of compaction.

Prepare ground surface on which backfill is to be placed and provide compaction requirements for backfill materials in conformance with the applicable portions of paragraphs GROUND SURFACE PREPARATION. Finish compaction by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

3.11.1 Trench Backfill

Backfill trenches to the grade shown. [Backfill the trench to [_____] meters above the top of pipe prior to performing the required pressure tests. Leave the joints and couplings uncovered during the pressure test.] [Do not backfill the trench until all specified tests are performed.]

3.11.1.1 Replacement of Unyielding Material

Replace unyielding material removed from the bottom of the trench with select granular material or initial backfill material.

3.11.1.2 Replacement of Unstable Material

Replace unstable material removed from the bottom of the trench or excavation with select granular material placed in layers not exceeding 150 mm loose thickness.

3.11.1.3 Bedding and Initial Backfill

[Provide bedding of the type and thickness shown.] Place initial backfill material and compact it with approved tampers to a height of at least 300 mm above the utility pipe or conduit. Bring up the backfill evenly on both sides of the pipe for the full length of the pipe. Take care to ensure thorough compaction of the fill under the haunches of the pipe. Except as specified otherwise in the individual piping section, provide bedding for buried piping in accordance with as shown in design drawings, except as specified herein. Compact backfill to top of pipe to 90 percent of JIS A 1210 maximum density. Provide plastic piping with bedding to spring line of pipe. Provide materials as follows:

3.11.1.3.1 Class I

Angular, 6 to 40 mm, graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone, and crushed shells.

3.11.1.3.2 Class II

Coarse sands and gravels with maximum particle size of 40 mm, including various graded sands and gravels containing small percentages of fines, generally granular and noncohesive, either wet or dry. Soil Types G, G-M, G-C, S, S-M, S-C are included in this class as specified in JGS 0051.

3.11.1.3.3 Sand

Clean, coarse-grained sand classified as [_____] in accordance with Section 31 23 00.00 20 EXCAVATION AND FILL, [gradation [_____] of the [local Standard] or [S], [S-M], [S-C] by JGS 0051 for [bedding] [and] [backfill] [as indicated]].

3.11.1.3.4 Gravel and Crushed Stone

Clean, coarsely graded natural gravel, crushed stone or a combination thereof identified as [_____] in accordance with Section 31 23 00.00 20 EXCAVATION AND FILL, [gradation [_____] of the [DOT] [State Standard]] or having a classification of [G], [G-M], [G-C] in accordance with JGS 0051 for [bedding] [and] [backfill] [as indicated]. [Do not exceed maximum particle size of [75] [_____] mm.]

3.11.1.4 Final Backfill

Fill the remainder of the trench, except for special materials for roadways, railroads and airfields, with satisfactory material. Place backfill material and compact as follows:

3.11.1.4.1 Roadways, Railroads, and Airfields

Place backfill up to the required elevation as specified. Do not permit water flooding or jetting methods of compaction.

3.11.1.4.2 Sidewalks, Turfed or Seeded Areas and Miscellaneous Areas

Deposit backfill in layers of a maximum of 300 mm loose thickness, and compact it to 85 percent maximum density for cohesive soils and 90 percent maximum density for cohesionless soils. [Allow water flooding or jetting methods of compaction for granular noncohesive backfill material. Do not allow water jetting to penetrate the initial backfill.] [Do not permit compaction by water flooding or jetting.] Apply this requirement to all other areas not specifically designated above.

3.11.2 Backfill for Appurtenances

After the manhole, catchbasin, inlet, or similar structure has been constructed [and the concrete has been allowed to cure for [_____] days], place backfill in such a manner that the structure is not be damaged by the shock of falling earth. Deposit the backfill material, compact it as specified for final backfill, and bring up the backfill evenly on all sides of the structure to prevent eccentric loading and excessive stress.

3.12 SPECIAL REQUIREMENTS

Special requirements for both excavation and backfill relating to the specific utilities are as follows:

3.12.1 Gas Distribution

Excavate trenches to a depth that will provide a minimum 450 mm of cover in rock excavation and a minimum 600 mm of cover in other excavation.

3.12.2 Water Lines

Excavate trenches to a depth that provides a minimum cover of [_____] meters from the existing ground surface, or from the indicated finished grade, whichever is lower, to the top of the pipe. [For fire protection yard mains or piping, an additional [_____] mm of cover is required.]

3.12.3 Heat Distribution System

Free initial backfill material of stones larger than 6.3 mm in any dimension.

3.12.4 Electrical Distribution System

Provide a minimum cover of 600 mm from the finished grade to direct burial cable and conduit or duct line, unless otherwise indicated.

3.12.5 Sewage Absorption Trenches or Pits

3.12.5.1 Porous Fill

Provide backfill material consisting of clean crushed rock or gravel having a gradation [such that 100 percent passes the 50 mm sieve and zero percent passes the 12.5 mm sieve.] [conforming to the requirements of gradation [4.75 mm] [_____] for coarse aggregate in JIS A 5005.]

3.12.5.2 Cover

[Filter fabric] [Concrete] [or a layer of straw at least 50 mm thick] as

indicated.

3.12.6 Rip-Rap Construction

Construct rip-rap [on bedding material] [on filter fabric] [with grout] [in accordance with [_____] local Standard, paragraph [_____] in the areas indicated. Trim and dress indicated areas to conform to cross sections, lines and grades shown within a tolerance of 30 mm.

3.12.6.1 Bedding Placement

Spread [filter fabric] bedding material uniformly to a thickness of at least [75] [_____] mm on prepared subgrade as indicated. [Compaction of bedding is not required. Finish bedding to present even surface free from mounds and windrows.]

3.12.6.2 Stone Placement

Place rock for rip-rap on prepared bedding material to produce a well graded mass with the minimum practicable percentage of voids in conformance with lines and grades indicated. Distribute larger rock fragments, with dimensions extending the full depth of the rip-rap throughout the entire mass and eliminate "pockets" of small rock fragments. Rearrange individual pieces by mechanical equipment or by hand as necessary to obtain the distribution of fragment sizes specified above. [For grouted rip-rap, hand-place surface rock with open joints to facilitate grouting and do not fill smaller spaces between surface rock with finer material. Provide at least one "weep hole" through grouted rip-rap for every 4.65 square meters of finished surface. Provide weep holes with columns of bedding material, 100 mm in diameter, extending up to the rip-rap surface without grout.]

3.12.6.3 Grouting

[Prior to grouting, wet rip-rap surfaces. Grout rip-rap in successive longitudinal strips, approximately 3 m in width, commencing at the lowest strip and working up the slope. Distribute grout to place of final deposit and work into place between stones with brooms, spades, trowels, or vibrating equipment. Take precautions to prevent grout from penetrating bedding layer. Protect and cure surface for a minimum of 7 days.]

3.13 EMBANKMENTS

3.13.1 Earth Embankments

Construct earth embankments from satisfactory materials free of organic or frozen material and rocks with any dimension greater than 75 mm. Place the material in successive horizontal layers of loose material not more than 200 mm in depth. Spread each layer uniformly on a soil surface that has been moistened or aerated as necessary, and scarified or otherwise broken up so that the fill will bond with the surface on which it is placed. After spreading, plow, disk, or otherwise break up each layer; moisten or aerate as necessary; thoroughly mix; and compact to at least 90 percent laboratory maximum density in accordance with JIS A 1210 for cohesive materials or 95 percent laboratory maximum density for cohesionless materials. Backfill material must be within the range of -2 to +2 percent of optimum moisture content at the time of compaction, when required.

Compaction requirements for the upper portion of earth embankments forming subgrade for pavements are identical with those requirements specified in paragraph SUBGRADE PREPARATION. Finish compaction by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

3.13.2 Rock Embankments

Construct rock embankments from material classified as rock excavation, as defined above, placed in successive horizontal layers of loose material not more than [_____] mm in depth. Do not use pieces of rock larger than [_____] mm in the greatest dimension. Spread each layer of material uniformly, completely saturate, and compact to a minimum density of [_____] kg/cubic meter. Adequately bond each successive layer of material to the material on which it is placed. Finish compaction with vibratory compactors weighing at least [_____] metric tons, heavy rubber-tired rollers weighing at least [_____] metric tons, or steel-wheeled rollers weighing at least [_____] metric tons. [Do not use rock excavation as fill material for the construction of pavements.] [In embankments on which pavements are to be constructed, do not use rock above a point [_____] mm below the surface of the pavement.]

3.14 SUBGRADE PREPARATION

3.14.1 Proof Rolling

Finish proof rolling on an exposed subgrade free of surface water (wet conditions resulting from rainfall) which would promote degradation of an otherwise acceptable subgrade. [After stripping,] proof roll the existing subgrade of the [_____] with six passes of a [dump truck loaded with 6 cubic meters of soil] [13.6 meter tons, pneumatic-tired roller.] Operate the [roller] [truck] in a systematic manner to ensure the number of passes over all areas, and at speeds between 4 to 5.5 km/hour. [When proof rolling, provide one-half of the passes made with the roller in a direction perpendicular to the other passes.] Notify the Contracting Officer a minimum of 3 days prior to proof rolling. Perform proof rolling in the presence of the Contracting Officer. Undercut rutting or pumping of material [as directed by the Contracting Officer] [to a depth of [_____] mm] and replace with [fill and backfill] [select] material. [Prepare bids based on replacing approximately [_____] square meters, with an average depth of [_____] mm at various locations.]

3.14.2 Construction

Shape subgrade to line, grade, and cross section, and compact as specified. Include plowing, disking, and any moistening or aerating required to obtain specified compaction for this operation. Remove soft or otherwise unsatisfactory material and replace with satisfactory excavated material or other approved material as directed. Excavate rock encountered in the cut section to a depth of 150 mm below finished grade for the subgrade. Bring up low areas resulting from removal of unsatisfactory material or excavation of rock to required grade with satisfactory materials, and shape the entire subgrade to line, grade, and cross section and compact as specified. [After rolling, the surface of the subgrade for roadways shall not show deviations greater than 13 mm when tested with a 4 m straightedge applied both parallel and at right angles to the centerline of the area.] [After rolling, do not show deviations for the surface of the subgrade for airfields greater than

[_____] mm when tested with a [_____] meter straightedge applied both parallel and at right angles to the centerline of the area.] Do not vary the elevation of the finish subgrade more than 15 mm from the established grade and cross section.

3.14.3 Compaction

Finish compaction by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. Except for paved areas and railroads, compact each layer of the embankment to at least [_____] percent of laboratory maximum density.

3.14.3.1 Subgrade for Railroads

Compact subgrade for railroads to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials in accordance with JIS A 1210.

3.14.3.2 Subgrade for Pavements

Compact subgrade for pavements to at least [_____] percentage laboratory maximum density in accordance with JIS A 1210 for the depth below the surface of the pavement shown. When more than one soil classification is present in the subgrade, thoroughly blend, reshape, and compact the top [_____] mm of subgrade.

3.14.3.3 Subgrade for Shoulders

Compact subgrade for shoulders to at least [_____] percentage laboratory maximum density in accordance with JIS A 1210 for the [depth below the surface of shoulder shown] [full depth of the shoulder].

3.14.3.4 Subgrade for Airfield Pavements

Compact top 600 mm below finished pavement or top 300 mm of subgrades, whichever is greater, to [100] [_____] percent of JIS A 1210; compact fill and backfill material to [100] [_____] percent of JIS A 1210.

3.15 SHOULDER CONSTRUCTION

Construct shoulders of satisfactory excavated or borrow material or as otherwise shown or specified.. Submit advanced notice on shoulder construction for rigid pavements. Construct shoulders immediately after adjacent paving is complete. In the case of rigid pavements, do not construct shoulders until permission of the Contracting Officer has been obtained. Compact the entire shoulder area to at least the percentage of maximum density as specified in paragraph SUBGRADE PREPARATION above, for specific ranges of depth below the surface of the shoulder. Finish compaction by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. Finish shoulder construction in proper sequence in such a manner that adjacent ditches will be drained effectively and that no damage of any kind is done to the adjacent completed pavement. Align the completed shoulders true to grade and shaped to drain in conformity with the cross section shown.

3.16 FINISHING

Finish the surface of excavations, embankments, and subgrades to a smooth and compact surface in accordance with the lines, grades, and cross

sections or elevations shown. Provide the degree of finish for graded areas within 30 mm of the grades and elevations indicated except that the degree of finish for subgrades specified in paragraph SUBGRADE PREPARATION. Finish gutters and ditches in a manner that will result in effective drainage. Finish the surface of areas to be turfed from settlement or washing to a smoothness suitable for the application of turfing materials. Repair graded, topsoiled, or backfilled areas prior to acceptance of the work, and re-established grades to the required elevations and slopes.

3.16.1 Subgrade and Embankments

During construction, keep embankments and excavations shaped and drained. Maintain ditches and drains along subgrade to drain effectively at all times. Do not disturb the finished subgrade by traffic or other operation. Protect and maintain the finished subgrade in a satisfactory condition until ballast, subbase, base, or pavement is placed. Do not permit the storage or stockpiling of materials on the finished subgrade. Do not lay subbase, base course, ballast, or pavement until the subgrade has been checked and approved, and in no case place subbase, base, surfacing, pavement, or ballast on a muddy, spongy, or frozen subgrade.

3.16.2 Capillary Water Barrier

Place a capillary water barrier under concrete floor and area-way slabs grade directly on the subgrade and compact with a minimum of two passes of a hand-operated plate-type vibratory compactor.

3.16.3 Grading Around Structures

Construct areas within 1.5 m outside of each building and structure line true-to-grade, shape to drain, and maintain free of trash and debris until final inspection has been completed and the work has been accepted.

3.17 PLACING TOPSOIL

On areas to receive topsoil, prepare the compacted subgrade soil to a 50 mm depth for bonding of topsoil with subsoil. Spread topsoil evenly to a thickness of [_____] mm and grade to the elevations and slopes shown. Do not spread topsoil when frozen or excessively wet or dry. Obtain material required for topsoil in excess of that produced by excavation within the grading limits from [offsite areas] [areas indicated].

3.18 TESTING

Perform testing by a Corps validated commercial testing laboratory or the Contractor's validated testing facility. Submit qualifications of the Corps validated commercial testing laboratory or the Contractor's validated testing facilities. If the Contractor elects to establish testing facilities, do not permit work requiring testing until the Contractor's facilities have been inspected, Corps validated and approved by the Contracting Officer.

- a. Determine field in-place density in accordance with [JIS A 1214][JGS 1614] . [When JGS 1614 is used, check the calibration curves and adjust using only the sand cone method as described in JIS A 1214. results in a wet unit weight of soil in determining the moisture content of the soil when using this method. Since JGS 1614 uses equipment that contains radioactive materials, notify the Base

BioEnvironmental and/or Environmental Office and the Contracting Officer if this method is used.

- b. Check the calibration curves furnished with the moisture gauges along with density calibration checks as described in JGS 1614; check the calibration of both the density and moisture gauges at the beginning of a job on each different type of material encountered and at intervals as directed by the Contracting Officer.] When test results indicate, as determined by the Contracting Officer, that compaction is not as specified, remove the material, replace and recompact to meet specification requirements.
- c. Perform tests on recompacted areas to determine conformance with specification requirements. Appoint a registered professional civil engineer to certify inspections and test results. These certifications shall state that the tests and observations were performed by or under the direct supervision of the engineer and that the results are representative of the materials or conditions being certified by the tests. The following number of tests, if performed at the appropriate time, will be the minimum acceptable for each type operation.

3.18.1 Fill and Backfill Material Gradation

One test per [_____] cubic meters stockpiled or in-place source material. Determine gradation of fill and backfill material in accordance with [JIS A 1102] [JIS A 1103].

3.18.2 In-Place Densities

- a. One test per [_____] square meters, or fraction thereof, of each lift of fill or backfill areas compacted by other than hand-operated machines.
- b. One test per [_____] square meters, or fraction thereof, of each lift of fill or backfill areas compacted by hand-operated machines.
- c. One test per [_____] linear meters, or fraction thereof, of each lift of embankment or backfill for [roads] [airfields].
- d. One test per [_____] linear meters, or fraction thereof, of each lift of embankment or backfill for railroads.

3.18.3 Check Tests on In-Place Densities

If JGS 1614 is used, check in-place densities by JIS A 1214 as follows:

- a. One check test per lift for each [_____] square meters, or fraction thereof, of each lift of fill or backfill compacted by other than hand-operated machines.
- b. One check test per lift for each [_____] square meters, of fill or backfill areas compacted by hand-operated machines.
- c. One check test per lift for each [_____] linear meters, or fraction thereof, of embankment or backfill for [roads] [airfields].
- d. One check test per lift for each [_____] linear meters, or fraction thereof, of embankment or backfill for railroads.

3.18.4 Moisture Contents

In the stockpile, excavation, or borrow areas, perform tests as required, to meet compaction requirements, per type of material or source of material being placed during stable weather conditions. During unstable weather, perform tests as dictated by local conditions and approved by the Contracting Officer.

3.18.5 Optimum Moisture and Laboratory Maximum Density

Perform tests for each type material or source of material including borrow material to determine the optimum moisture and laboratory maximum density values. One representative test per [_____] cubic meters of fill and backfill, or when any change in material occurs which may affect the optimum moisture content or laboratory maximum density.

3.18.6 Tolerance Tests for Subgrades

Perform continuous checks on the degree of finish specified in paragraph SUBGRADE PREPARATION during construction of the subgrades.

3.18.7 Displacement of Sewers

After other required tests have been performed and the trench backfill compacted to [[_____] meters above the top of the pipe] [the finished grade surface], inspect the pipe to determine whether significant displacement has occurred. Conduct this inspection in the presence of the Contracting Officer. Inspect pipe sizes larger than 900 mm, while inspecting smaller diameter pipe by shining a light or laser between manholes or manhole locations, or by the use of television cameras passed through the pipe. If, in the judgment of the Contracting Officer, the interior of the pipe shows poor alignment or any other defects that would cause improper functioning of the system, replace or repair the defects as directed at no additional cost to the Government.

3.19 DISPOSITION OF SURPLUS MATERIAL

Remove surplus material or other soil material not required or suitable for filling or backfilling, and brush, refuse, stumps, roots, and timber [to a Government disposal area [as indicated][which is located within a haul distance of [_____] km]][from Government property to an approved location] [from Government property and delivered to a licensed/permited facility or to a location approved by the Contracting Officer.].

-- End of Section --