

SECTION 02200

EARTHWORK

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Provide labor and materials to complete the earthwork within the limit of work as shown on the Drawings and/or herein specified.
 - 1. Clearing and preparation of site.
 - 2. Stripping of topsoil
 - 3. Protection.
 - 4. Excavation:
 - a. General excavation to lines and grades indicated.
 - b. Trench excavation for footings, piers, etc.
 - c. Excavation for buried pipes, wires and conduits under ground floor.
 - d. Excavation for buried structures, pipes, wires and conduits outside the building.
 - 5. General exterior rough grading, cutting and filling as required.
 - 6. Filling and backfilling for excavations, including furnishing of extra material required.
 - 7. Compacted gravel under buildings.
 - 8. Compacted gravel for roadways, drives and walks.
 - 9. Shoring, bracing, sheathing, and cribbing as required and removal of the same.
 - 10. Pumping of excavation as may be required.
 - 11. Crushed stone, including drains inside building.
 - 12. Rip rap.

1.02 SUBMITTALS

- A. Submit manufacturer's product literature and test results for approval on all materials in accordance with Division 1 Submittals section.

1.03 PROTECTION

- A. Prior to excavation, verify the underground utilities, pipes, structures, and facilities; utilizing at least the following minimum measures:
 - 1. Pre-mark the boundaries of your planned excavation with white paint, flags or stakes, so utility crews know where to mark their lines.
 - 2. Call Dig Safe, at 1-888-DIGSAFE, at least three business days - but no more than 30 calendar days - before starting work. Don't assume someone else will make the call.
 - 3. If blasting, notify Dig Safe at least one business day in advance.
 - 4. Wait three business days for lines to be located and marked with color-coded paint, flags or stakes. Note the color of the marks and the type of utilities they indicate. Transfer these marks to the As-Built drawings.
 - 5. Contact the landowner and other "non-member" utilities (water, sewer, gas, etc.), for them to mark the locations of their underground facilities. Transfer these marks to the As-Built drawings.
 - 6. Re-notify Dig Safe and the non-member utilities if the digging, drilling or blasting does not occur within 30 calendar days, or if the marks are lost due to weather conditions, site work activity or any other reason.
 - 7. Hand dig within 18 inches in any direction of any underground line until the line is exposed. Mechanical methods may be used for initial site penetration, such as removal of pavement or rock.
 - 8. Dig Safe requirements are in addition to town, city and/or state DOT street opening permit requirements.
 - 9. For complete Dig Safe requirements, call the PUC or visit their website.
 - 10. If you damage, dislocate or disturb any underground utility line, immediately notify the affected utility. If damage creates safety concerns, call the fire department and take immediate steps to safeguard health and property.

11. Any time an underground line is damaged or disturbed, or if lines are improperly marked, you must file an Incident Report with the PUC. For an Incident Report form visit www.state.me.us/mpuc or call the PUC at 800-452-4699.

- B. Excavation, sidewalks, trenches, etc., shall be kept properly fenced and guarded. Lights shall be provided and maintained wherever and whenever necessary. Trees which are within the area of operations (and are to remain) shall be protected with suitable boarding or fencing.
- C. Shoring: Do shoring, bracing, etc., necessary to support soil adjoining the excavation and to protect foundation of existing building, in compliance with OSHA and all other Federal, State, and local codes.
- D. Protect newly filled areas from traffic and erosion. Repair and re-establish grades to the specified tolerances in settled, eroded and rutted areas. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify the surface, re-shape and compact to the required density prior to further construction.
- E. Protect structures, utilities, sidewalks, culverts, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations. Repair, or have repaired, all damage to existing utilities, structures, culverts, pavement, lawns, other public and private property which results from construction operations, at no additional expense to the Owner, to the complete satisfaction of the Architect, the utility, the property owner, and the Owner.

1.04 QUALITY ASSURANCE

- A. Compaction Control: Wherever a percentage of compaction for backfill is indicated or specified, it shall be the in-place dry density divided by the maximum dry density and multiplied by 100.
- B. The maximum dry density shall be the dry density at optimum moisture as determined by ASTM D 1557-91 "Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort," latest revision. Method A, B or C shall be selected by the testing agency based on the gradation results of the sample taken. Adjustments to the laboratory density for oversize aggregate shall be made (if required) as specified in ASTM D 1557-91. These adjustments shall be made in accordance with ASTM D 4718-87, latest revision.
- C. The in-place density shall be determined in accordance with ASTM Standard Method of Test for Density of Soil in Place by the Sand Cone Method, Designation D 1556; or density of soil and soil aggregate in-place by nuclear methods (shallow depth), Designation D2922.
- D. Materials used on-site are subject to the approval of the Architect and Geotechnical Engineer and unsuitable materials shall be removed from the site.

1.05 MEASUREMENTS AND CLASSIFICATION

- A. Measurements: Measurements used for calculating amounts of excavation shall be within a vertical line placed 2'-0" outside the wall or 1'-0" outside footing, whichever is greater, and to the depth indicated. Trench excavation for underground utilities shall be based on a trench width 2'-6" greater than the diameter of the pipe with vertical walls, and the depth of 4" below the pipe. Excavation shall be taken to a minimum of 1'-0" below finish floor, and slabs on grade, unless a different backfill thickness is indicated.
- B. Classification:
 - 1. Earth excavation includes any and all material not having the qualities to classify as rock excavation.
 - 2. Rock excavation includes the satisfactory removal and disposal of solid rock material which cannot be removed without systematic drilling and blasting. This includes rock material which is in ledges, bedded deposits, unstratified masses, and conglomerate deposits which are so firmly cemented that they possess the characteristics of solid rock. Fragmented "weathered" rock which can be removed by excavation equipment with "ripper" teeth will be considered earth. Boulders will be included only if each is two (2) cubic yard size or greater and cannot be excavated without drilling and blasting or pneumatic splitting. When, during the progress of excavation, ledge is encountered, the Architect shall be notified. Adjustments will be by unit price. The Architect shall determine the extent of rock excavation and classification.

3. The unit price for rock excavation is net and is not subject to credit for any other material which it may replace.
4. Excavation which measures 6'-0" or less in width, regardless of length, shall be classified as trench excavation. Measurements to be determined as outlined herein.
5. Excavation which does not meet the above requirements for trench excavation shall be classified as open excavation.
6. The Owner will take credit for excavation omitted through changes in the Plans and/or Specifications at the unit price stated.

C. Rock excavation shall not be included under the basic Contract Price. Rock excavation required for the building project will be paid for on the basis of unit prices set forth in the Bid Form. Prior to blasting and rock excavation, provide survey grades of the top of the ledge surface, and calculations of the expected rock quantities to be excavated. Submit this data and obtain Architect's approval prior to proceeding with rock excavation.

1.06 SOIL TESTING

- A. Soil compaction control including laboratory testing, on site testing, and geotechnical inspection will be done by a testing agency hired by the Owner.
- B. Provide samples of each fill material from the proposed source of supply. Allow sufficient time for testing and evaluation of results before material is needed. Submit samples from alternate sources if proposed material does not meet the specifications. Submit test results to the Architect.
- C. Tests of soil as delivered may be performed from time to time. Materials in question may not be used, pending test results. Remove rejected material and replace with new, approved soil.
- D. Cooperate with the laboratory in obtaining field samples of in-place, bank-run, or stockpiled materials. Samples should be obtained by laboratory personnel from various suppliers, but other individuals may obtain and deliver samples if approved by the Architect.
- E. Coordinate schedule with testing agency and Architect to allow testing agency representative to be on site prior to foundation formwork and at the start of filling operations.
- F. The Contractor shall bear cost of retesting when initial test results indicate non-compliance with specifications, or when alternate sources are submitted.
- G. In-place Compaction Test Frequency for Each Layer Placed:
 Subgrade, Proof-compact Building and Paved Areas: 1 test per 500 sq. ft.
 Building Interior Fill: 1 test per 500 sq. ft.
 Parking, Roads and Walks: 1 test per 500 sq. ft.
 Trench - Utilities: 1 test per 50 lin. ft.

PART 2 - PRODUCTS

2.01 GRAVEL BASE AND SUB-BASE

- A. Clean screened or crushed gravel free from organic material or clay. The portion that passes a 3" sieve shall conform to the following gradation requirements:

SIEVE SIZE	% PASSING	
	Base	Sub-Base
2"	100	-

1"	80 - 100	50 - 100
1/2"	35 - 75	-
1/4"	25 - 60	25 - 70
#40	0 - 25	0 - 30
#200	0 - 5	0 - 7

- B. Maximum size stone for base passes 2" sieve. Maximum size stone for sub-base passes 6" sieve.
- C. Gradations in the table represent the limits which shall determine suitability of gravel for use from the sources of supply. The gradations shall be uniformly graded from course to fine within the limits designated in the table and shall not vary from the low limit on one sieve to the high limit on the adjacent sieves, or vice versa.

2.02 GRANULAR BORROW

- A. Uniformly graded bank-run gravel which can be compacted to the required density, free of debris, roots, topsoil, vegetable matter, frozen material, and any other deleterious material. The portion that passes a 3" sieve shall meet the following gradation requirements:

SIEVE SIZE	PERCENT PASSING BY WEIGHT
#40	0 - 50
#200	0 - 15

- B. Maximum size stone passes 6" sieve.

2.03 GRANULAR BEDDING MATERIAL

- A. Clean sand or gravel free from organic material or clay conforming to the following gradation:

SIEVE SIZE	PERCENT PASSING BY WEIGHT
2"	100
1/4"	25 - 100
#40	0 - 30
#200	0 - 7

2.04 COMMON BORROW

- A. Soil which is free from vegetable matter, roots, stumps, lumps of clay, perishable rubbish or peat, or frozen material, which can be placed and compacted to the required densities. 8-inch maximum stone size. Soil or loam "screenings" are not acceptable, since they are mostly stones and roots.

2.05 BEDDING SAND

- A. Clean, coarse, sharp, durable particles free from organic material or clay conforming to the following gradations:

SIEVE SIZE	PERCENT PASSING
3/8"	100%
#4	95 - 100
#16	50 - 85
#50	10 - 30
#100	2 - 10
#200	0 - 5

2.06 STONES FOR RIP-RAP

- A. Size the stone mixture such that 50% of the stones, by weight, are larger than the specified d50 size. Stones shall not be schistose.
- B. Plain Rip-Rap: 4" to 12" diameter, hard, sound angular stones, d50 = 6".

2.07 CRUSHED STONE

- A. Screened or crushed natural stone, free from shale, organic matter and debris conforming to the following gradation: (ASTM C-33 Size No.56)

SIEVE SIZE	PERCENT PASSING
1-1/2"	100%
1"	90 - 100
3/4"	40 - 85
1/2"	10 - 40
3/8"	0 - 15
#4	0 - 5

2.08 FLOWABLE FILL

- A. Flowable fill shall consist of a low strength mix of cement, fly ash, fine aggregate, water and an admixture (Darafill, or approved equal). The mix design shall consist of 75 pounds of cement, 2,500 pounds of fine aggregate and 2-1/4 ounces of admixture per cubic yard of fill. Mix design to provide 75 psi at 28 days compressive strength.

2.09 BURIED WARNING AND IDENTIFICATION TAPE

- A. For non-metallic pipe use metallic core or metallic-faced, acid and alkali-resistant, polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. For metallic pipe use non-metallic polyethylene plastic warning tape. Provide tape on rolls, 3 inch 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. Color and printing shall be permanent, unaffected by moisture or soil.
- B. Minimum thickness of the tape shall be 0.004 inch. Tape shall have a minimum strength of 1500 psi lengthwise and 1250 psi crosswise. Metallic tape shall be manufactured with integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 3 feet deep.

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

PART 3 - EXECUTION

3.01 CLEARING AND SITE PREPARATION

- A. Trees, brush, boulders, etc., within the limits of grading shall be removed from the site (except trees indicated as remaining or undisturbed) including grubbing and removal of organic material, stumps and roots.
- B. Remove debris and deposit it in suitable disposal areas as specified below. Conform to Federal, State and local solid waste disposal regulations.
- C. Remove fences, curbs, catchbasin and manhole frames and covers, light poles, signs, and other site features to be salvaged and stock-piled for later installation, or disposed of, as directed by the Owner.

3.02 STRIPPING OF TOPSOIL

- A. Topsoil within areas where excavation or filling will occur shall be stripped, cleaned of all stumps, roots, rocks, and debris and stockpiled on site.
- B. Following construction, remove the excess topsoil from the site.
- C. Prior to re-use, topsoil must conform to the requirements of Section 02930. Soil which does not meet these requirements, either naturally, or by additives supplied by the Contractor, shall not be used as finished loam.

3.03 ROUGH GRADING

- A. Rough grade the area within the limits of work to conform to grades indicated, making provision for finish materials, including necessary cutting and filling. Provide additional material from off-site sources as necessary to complete the rough grading.

3.04 DISPOSAL

- A. Dispose of unsuitable material, organic material, wood waste, rock material, and surplus excavated soil in excess of that required for rough grading off the site in a disposal area obtained by the Contractor. Conform to Federal, State and local solid waste disposal regulations.
- B. If hazardous waste or special waste as defined by the U. S. Environmental Protection Agency or State Department of Environmental Protection is encountered during excavation, the Contractor shall avoid disturbance of that material, and shall notify the Owner immediately. The State Bureau of Oil and Hazardous Waste Control must be notified and consulted prior to disturbance of the waste or contaminated soil. Removal and disposal of contaminated materials is not included in the Contract Bid, since it must be handled as directed by the regulatory agencies on a case-by-case basis.

3.05 REMOVAL OF EXISTING BITUMINOUS PAVEMENT

- A. Where it is necessary to excavate and make cuts in bituminous pavement, the Contractor shall saw cut paving along neat straight lines where new pavement meets existing pavement.
- B. Dispose of excavated pavement in suitable off-site recycling disposal area obtained by the Contractor.

3.06 EXCAVATION

- A. Excavation shall be made to the proper depths required by design, including the proper allowance for forms, utilities, etc. Excavation shall be approximately level, clean and clear of loose material. Debris, rock material, organic material or unsuitable material encountered in the excavation shall be removed and disposed of as specified above. Excavation beyond the design limits, made without authorization from the Owner or Geotechnical Engineer, shall be refilled with gravel subbase material compacted to 95% maximum dry density at the Contractor's expense.
- B. Excavate the area within the building lines level to 12 inches below the underside of the concrete floor slab. Excavate foundation wall footings and column footings level to the bottom of the footing. Excavate for pipes, utilities, pits, and incidentals. Proof-roll the sub-grade for footings and slabs to 95% maximum dry density in the presence of the Geotechnical Engineer prior to further construction.
- C. If bearing is not suitable at levels shown on the Drawings, within the design limits, the Architect or Geotechnical Engineer shall be notified so that adjustments in level or changes may be made immediately. The Geotechnical Engineer will determine the extent of excavation of unsuitable material. Payment for excavation of unsuitable material, beyond the design limits, and replacement with granular borrow will be made under the unit price listed in the Bid Form, when the excavation has received prior approval from the Owner or Geotechnical Engineer. Excavate unsuitable material such that the approved backfill material beneath the building will slope 1H to 1V down and away from the footings.
- D. Draining of Excavation: The Contractor shall, by use of pumps, wells, well-points, or other approved means as may be necessary, prevent the accumulation of water in the excavated areas. Surface runoff and infiltration of groundwater must be controlled so that excavation, filling, foundation construction, and backfilling will be completed in-the-dry. Water from construction dewatering operations shall be cleaned of sediment before reaching wetlands, water bodies, streams, or site boundaries. Conform to the requirements of the Department of Environmental Protection, and specification Section 02270.
- E. Prior to excavation, obtain confirmation from the City and Utility Company that all buried pipes and

utilities are located accurately on the Drawings and in the field. Completeness or accuracy of subsurface information is not guaranteed. Obtain the services of 'Dig-Safe' or other qualified detection firm. Provide test pits as necessary to verify location and depth of buried pipes and utilities.

- F. When excavating within State or City right-of-way, coordinate work with State Transportation Department and City Public Works Department, remove material immediately and do not stockpile material in road or along edge of trench.

3.07 BLASTING

- A. Set no charges and do no blasting prior to coordinating schedule and locations with the Owner. When explosives are used for rock removal, the work shall be done by experienced blasters, with a minimum of 5 years documented experience. Avoid blasting which will disturb new building foundations and compacted soil backfill. Perform surveys and monitoring as described in this specification. Following blasting activity, blasting records, pre-blast survey, and seismograph readings shall be compiled in a report and submitted to the Owner.
- B. Comply with applicable laws, rules, ordinances, and regulations of the federal government, State of Maine, and the local Town or City, governing the transportation, storage, handling and use of explosives. Prior to blasting, obtain applicable State and local permits, including the local Fire Department permit.
- C. Prior to the start of blasting work, perform a "pre-blast survey" of all structures and wells within 500 ft. of blasting locations. The pre-blast survey firm shall have 5-years experience in similar survey work. For the survey, interview the land owner of the buildings and wells, obtain a certified water test for nitrates and coliform of each well, photograph and videotape glass, plaster, chimneys, concrete foundations, and other masonry components of each structure. When blasting along roadways, take still photos at 50' maximum spacing along the construction area, and videotape the entire construction length with commercial grade equipment.
- D. Prior to the start of blasting work, submit a Blasting Plan containing details of proposed blasting and construction operations to the State or Local regulatory agencies, and copy the Owner and Architect for their records, including:
 - 1. Sequence and schedule of blasting rounds including the general sequence of drilling, blasting, and excavating, etc.
 - 2. Specifics of typical trench blast rounds and open cut blast rounds in deepest rock cut areas and areas closest to existing structures.
 - 3. Methods of matting or covering of the blast area to prevent flyrock and excessive airblast overpressure.
 - 4. Name and qualifications of the licensed blaster who will be on site at all times directly supervising the loading and detonation of each blast round.
 - 5. Details of an audible advance signal system to be employed at the job site as a means of informing workers, Owner, and the general public that a blast is about to occur.
 - 6. Listing of instrumentation that the Contractor proposes to use monitor vibrations and airblast overpressure levels complete with performance specifications and user's manuals supplied by the manufacturer.
- E. Conduct blasting in accordance with 25 M.R.S.A. ch. 318, and 38 M.R.S.A. sec. 490, and meet the listed standards. Limit the charge pounds-per-delay to minimize particle velocity in strict accordance with current Department of Interior Rules 816.61-68 and 817.610-68, and the Blasting Guidance Manual, Office of Surface Mining, Reclamation and Enforcement, covering this type of work. Conduct blasting activity in such a manner that the peak particle velocity of ground vibration measured at the nearest property line and the locations of the nearest structures to the blast does not exceed the "safe limits" recommended by the U.S. Bureau of Mines in Appendix B of BUMINES RI 8507, as indicated on Figure B-1.-1.
- F. Control airblast overpressure to the limits specified in Maine Department of Environmental Protection, Site Location of Development Regulations, Chapter 375.10(C)(4)(c), which limit sound levels to a range of 123 dBL to 129 dBL, depending on the number of blasts per day. Measure blast sound in peak linear sound level(dBL) with a linear response down to 5 Hz.

- G. Blast monitoring and reporting shall be conducted by a qualified professional trained in the use of a seismograph. Blasts shall be monitored by seismographs to record the effects at the nearest property line and on structures within the survey area, and demonstrate compliance with the regulations. A record of each blast must be kept for at least one year, and must be submitted to the Department of Environmental Protection upon request.
- H. Blast Monitoring Instrumentation: All instrumentation proposed for use on the project shall have been calibrated within the previous six (6) months to a standard which is traceable to the National Bureau of Standards. Characteristics of required instrumentation are listed below:
 - 1. Measure the three (3) mutually perpendicular components of particle velocity in directions vertical, radial, and perpendicular to the vibration source.
 - 2. Measure and display the maximum peak particle velocity component and airblast overpressure. These readings must be displayed and be able to be read in the field, immediately after each blast.
 - 3. Furnish a permanent time history record of particle velocity waveforms and airblast overpressure waveforms, so that frequency and time of maximum peak particle velocity or airblast overpressure can be determined.
- I. Blast Monitoring Reports: Within 24 hours following each blast, the Contractor shall submit to the Owner a Blast Monitoring Report. Blast Monitoring Reports shall consist of the information listed in 38 M.R.S.A. sec. 490-Z(14)(L), including the following items:
 - 1. Blast round design data.
 - 2. Blast Monitoring Location Plan, indicating the location of the blast, the monitoring locations, and the distances from the blast to monitoring locations.
 - 3. Vibration and airblast overpressure data from each seismograph, including a copy of the strip chart (or other permanent record of velocity/time waveform) with calibration and monitoring record marked with date, time, and location of the blast.
- J. Review by the Owner or Architect of blast designs and techniques shall not relieve the Contractor of the complete responsibility for the accuracy, adequacy and safety of the blasting, exercising proper supervision and field judgment, and producing the results within the blasting limits required by these specifications.
- K. Blasting shall be limited to between the hours of 9:00 am and 4:00 pm, Monday through Friday.
- L. Blasting mats shall be utilized for blast rounds detonated to prevent the throw of flyrock from the blasting area, unless the Contractor's Independent Seismologist determines that the overburden is sufficient to prevent flyrock. At a minimum, flyrock must not leave the project boundary or enter a protected natural resource. Damage to structures caused by improper use of explosives shall be corrected at the Contractor's expense.

3.08 FILLING AND COMPACTION

- A. General:
 - 1. Fill shall be compacted in 6" to 12" layers to avoid settlement. In filling against walls or pipelines, the fill shall be placed and compacted on both sides at the same time to avoid undue strain.
 - 2. Fill material within 2 feet of outside building lines shall be gravel sub-base for the full depth to the footing. Where pavement is within 10 feet of the foundation wall, extend gravel subbase at least 10 feet wide from building foundations, sloping to 2 feet wide at footing elevation. Fill beyond this limit may be suitable on-site excavated material or granular borrow, unless noted otherwise. This limit does not pertain to sloped granular fill beneath footings. Common borrow may be used beneath grass areas, unless noted otherwise.
 - 3. Compact fill under pavements and gravel areas to 95% of maximum dry density; and under grass or mulch areas to 90% of maximum dry density.
 - 4. Provide additional material necessary to complete the filling.
 - 5. Place gravel base material under concrete pads a minimum of 12" deep, compacted to 95% maximum dry density.
 - 6. Fill above underdrain geotextile wrap with gravel sub-base for full depth to ground surface.
 - 7. Excavate, grade, and re-compact areas of settlement or improper backfill and compaction, at no additional cost to the Owner.

- B. Inside Building Lines:
1. Prior to placing any concrete or soil, obtain approval of the exposed subgrade soil from the Geotechnical Engineer.
 2. Do not use excavated native soil beneath the building.
 3. Fill from bottom of excavation to within 12 inches of the bottom of the slab with gravel sub-base material. Place a 12-inch layer of gravel base material directly under the slab, following filling of interior trenches. Compact material in 6" to 12" layers, watered to optimum moisture content, to 95% maximum dry density.
 4. Fill shall be placed under direct supervision of a Geotechnical Engineer. Fill placed without the presence of the Geotechnical Engineer shall be removed and refilled under his supervision.
 5. Place wall footings directly on undisturbed native soil subgrade exposed by excavation.
 6. Where ledge rock is encountered at footing grade, excavate rock 12" deeper and place footing on a 12" layer of gravel base material compacted to 95% maximum dry density.
- C. Roads, Parking Lots and Walks:
1. Prepare subgrade to proper grade and proof-roll to 95% maximum dry density. Place fill in 6" to 12" layers compacted to 95% maximum dry density.
 2. Place gravel sub-base and gravel base courses in 6" to 12" layers compacted to 95% max.dry density.
 3. Do no work when subgrade is muddy or frozen.
 4. Finish surface tolerance shall be 3/8" above or below the required grade. Puddling in paved or unpaved areas will not be acceptable except in areas designated as ponds.
- D. Sewer Lines, Storm Drain Lines and Water Lines:
1. Bed plastic, metal, or concrete pipes on 4-inch layer of granular bedding material compacted to 95% maximum dry density. Fill the first layer to half the height of the pipe, and compact to 95% maximum dry density. Fill to 12 inches over the top of pipe with granular bedding material compacted to 95% maximum dry density. Fill remainder of trench with excavated materials compacted to 95% maximum dry density beneath slabs on grade, paved areas, and gravel areas; or compacted to 90% maximum dry density beneath grassed or mulched areas. Inside building lines use materials specified in paragraph 'B'. Layer thickness shall be 6" to 12".
 2. Ductile iron pipe may be placed directly on the prepared subgrade shaped to provide uniform bearing along the entire pipe length, and backfilled with excavated material with no rocks larger than 4-inch diameter within 12 inches of the pipe; compaction as described above.
 3. Provide a 6-inch bedding layer between pipes and ledge rock.
- E. Underslab Utilities: Surround underslab piping and conduit with 6 inches of sand or granular bedding material, compacted to 95% maximum dry density.
- F. Site Utility Lines:
1. Electrical Conduits: Bury beneath finish grade a minimum of 29 inches to top of conduit, or as required by the National Electrical Code or local utility company, whichever is deeper. Surround conduits by [reinforced concrete encasement] [a minimum of 6 inches of sand or bedding material, compacted to 95% maximum dry density].
 2. Telephone and Communication Conduits: Bury beneath finish grade a minimum of 29 inches to top of conduit, or as required by the local utility company, whichever is deeper. Surround conduits by a minimum of 6 inches of sand or bedding material, compacted to 95% maximum dry density.

3.09 RIP-RAP

- A. The stones shall be [hand-]placed with their beds at right angles to the slope, the larger stones being used in bottom courses. They shall be laid in close contact so as to break joints, and in such manner that the weight of the stone is carried by the earth and not the adjacent stones.
- B. The spaces between the larger stones shall be filled with spalls securely rammed into place. The finished work shall present an even, tight and reasonably smooth surface conforming to the required contour, and have a neat orderly appearance without scattered stones.

END OF SECTION