THE BAY HOUSE

CONTRACT SPECIFICATIONS

for

Site Work

Within The

City of Portland Right-of-Way

And

Building Earthworks

City of Portland Right-of-Way Specifications
Standard Specifications
Special Provisions

Supplemental Specifications
Section 202 Removing Structures and Obstructions
Section 203 Excavating and Embankment
Section 206 Structural Excavation

Section 304 Aggregate Base and Subbase Course

Section 401 Hot Mix Asphalt Pavement
Section 403 Hot Bituminous Pavement
Section 409 Bituminous Tack Coat

Section 603 Installation of Storm Drains, Sewer Pipe, and Water Main
Section 604 Manholes, Inlets and Catch Basins
Section 605 Underdrains
Section 608 Sidewalks
Section 608A Sidewalk Ramps
Section 609 Curb
Section 614 Masonry Plug
Section 615 Loam
Section 621 Planting
Section 623 Monuments
Section 625 Water Service Supply Lines
Section 627 Pavement Markings
Section 637 Dust Control
Section 652 Maintenance of Traffic
Section 654 Soil Backfill Compaction Testing
Section 656 Temporary Soil Erosion and Water Pollution Control

Division 700 - Materials
Section 703 Aggregates

Building Earthwork Specifications
Section 02401 Lateral Support of Excavation
Section 02145 Dewatering and Predrainage
Section 02300 Structure Earthwork
Section 02450 Impact Rammed Aggregate Piers

STANDARD SPECIFICATIONS

The City of Portland, Maine has adopted for this project the "State of Maine, Department of Transportation, Standard Specifications, Revision of December, 2002", including all current additions or modifications thereof.

Special Provisions and Supplemental Specifications contained hereinafter shall take precedence and shall govern in any case of conflict with the Standard Specifications.

Any reference to the "Standard Specifications" shall in no way supersede the "Division One General Requirements" of the Contract's Master Specification.

The method of measurement and basic of payment shall be as indicated in the "Division One General Requirements".

SPECIAL PROVISIONS

The following Supplemental Specifications and Special Provisions shall amend the "State of Maine, Department of Transportation, Standard Specifications, Revision of December, 2002".
In case of conflicts, these Supplemental Specifications (1) and Special Provisions (2) shall take precedence and shall govern.

(1) Supplemental Specifications - modifications, additions and deletions to the existing Standard Specifications.
(2) Special Provisions - specifications in the contract which are for additional items not covered in the Standard Specifications.

1. Working Hours

No work shall proceed on this project prior to the hour of 7:00 A.M. or after 7:00 P. M. (prevailing time) on any working day. The definition of work for this specification shall include the starting or moving of equipment, machinery, or materials.

2. Utility Coordination

The sewer separation project includes construction in close proximity to water and gas utility service and transmission lines. The Contractor will be responsible for notifying utility representatives of the anticipated construction schedule. The Contractor will be responsible for all utility coordination, protection of existing infrastructure and any damages to existing utilities as a result of the work at no additional cost.

3. Notification of Residents

Residents shall be notified by the Contractor sufficiently in advance of any construction affecting the resident's driveway and sidewalk to allow adequate time for his removal of personal vehicles. Locations of curb cuts for drive access affecting individual residents shall be brought to their attention.

4. Traffic Signs

All existing traffic signs which are to be removed during construction shall be carefully dismounted and the posts removed and shall be stacked in an area approved by the Engineer. The Contractor shall protect the signs from damage while in his possession and shall repair, at no additional cost, any damages cause by his operations.

Stop signs are to be maintained at their original locations at all times during the progress of the work.

Prior to the start of any construction work, the Contractor and Engineer shall prepare a mutually acceptable inventory of all signs within the project limits which shall be used as a guide for replacement should signs be removed for construction purposes. The signs shall be inventoried by station location and approximate offset, legend of sign and post.

This work shall be considered as subsidiary obligation of the contract for which no specific payment will be made.

5. Protection of Trees

The Contractor shall be responsible for the preservation of all trees on the project which are not called to be removed. Any trees damaged by the Contractor's operations shall be repaired using approved tree dressing or paint.

6. Maintenance and Protection of Traffic

The Contractor shall be responsible for the maintenance and protection of all vehicular and pedestrian traffic at all times during construction and shall erect suitable warning signs, flashers, barriers or temporary lighting devices of sufficient size and number to afford protection to the traveling public. The Contractor shall be held responsible for all damage to the work due to any failure of the warning devices to properly protect the work from the traffic, pedestrians or other causes.

A traffic plan may be included in the plan set, but responsibility for preparation of the actual plan shall be the contractor's. The Contractor must submit his/her traffic plan to the City of Portland Transportation Engineer for review and approval, 3 working days prior to the pre-construction meeting.

Guidelines for the construction and erection of barricades, lighting devices, warning signs, etc. may be found in the most recent edition of "Manual on Uniform Traffic Control Devices for Streets and Highways" published by the Department of Transportation of the Federal Highway Administration. This work shall be considered a subsidiary obligation of the contract for which no specific payment will be made.

7. Materials

Materials shall meet the requirements specified for the various subsections of the specifications. Equals shall be approved only prior to the bid opening.

8. Survey

The Contractor shall be responsible for construction layout and providing all additional survey required, which shall be done by a Registered Surveyor.

9. Sheeting and Bracing

Any sheeting and/or bracing required for the satisfactory installation of drainage and/or sanitary sewerage structures will not be paid for separately but shall be considered as incidental.

10. Occupational Safety and Health

The Contractor is hereby advised that all work to be furnished to the Owner shall be performed with equipment, methods, and use of personnel in conformance with the pertinent Occupational Safety and Health Act requirements of the State of Maine and with the regulations for construction as specified by the Department of Labor and Occupational Safety and Health Administration (OSHA) as currently amended.

11. Setting of Pipes to Line and Grade

If laser beam equipment is used for laying storm drain and/or sanitary sewer pipe, frequent checks shall be made to assure close adherence to line and grade. If lasers are not used, batter boards are to be set at maximum twenty-five foot (25') intervals and grades transferred to the boards with a transit, level, or line level. Setting pipes to grade by use of "pop" levels or carpenter levels will not be permitted.

12. Extent of Open Excavation

The extent of excavation open at any one time shall be controlled by OSHA regulations and by existing conditions and location of work area.

13. Limitation of Operations

The Contractor shall conduct the work at all times in such a manner and in such sequence as will assure the least interference with traffic. He shall not open up work to the prejudice or detriment of work already started. The Engineer may require the Contractor to finish a section on which work is in progress before work is started on any additional sections, if finishing such section is essential to public convenience.

The Contractor shall be required to construct his roadway subbase concurrent to his trench backfilling operation if the street is not being reconstructed.

14. Dust Control For Street

Calcium chloride shall be spread only on disturbed unpaved areas. Calcium chloride shall not be spread on paved areas that are covered by granular material. These areas shall be swept clean of all granular material. Dust on paved areas shall be controlled with water before sweeping.

15. Trench Pavement Replacement

The Contractor shall be responsible for repairing any trench pavement that has experienced excess settlement, cracking or opening of pavement joints. Repair may include overlay, removal of unacceptable material and complete replacement, joint sealing or recutting pavement as required. This work may be necessary after final acceptance of the work

16. City of Portland's Street Excavation Ordinance

The Contractor is hereby advised that all work shall conform to the regulations of Chapter 25 of the Municipal Code, "Excavations in Public Places", as currently amended. The Contractor shall be responsible for obtaining and completing the Street Opening Application but will not be charged for the Street Opening Permit for the Excavation.

17. Record Drawings

The Contractor shall keep daily records of all changes in the work, ties to all new service connections, and elevations of all inverts. Upon completion of the project, the Contractor shall deliver to the Engineer a marked-up set of plans with all changes and required information indicated in red. The Contractor shall maintain a record of all service lead locations and locations of buried fittings, etc., throughout the project. The locations shall be recorded by 3 ties from fixed permanent points. Prior to requesting final payment, the Contractor shall submit the records in triplicate bound form. The records shall be clearly legible and include the street, tax map, lot number and reference contract drawing number. A blank form is provided at the end of this section and is to be used by the Contractor for preparation of record ties. Final payment will not be made until Engineer receives marked-up set of plans and service lead information.

18. Waste Material

All waste material shall be removed from the site and the area left clean upon completion of work. Any equipment or structures damaged by the Contractor shall be repaired or replaced at no additional cost. The Contractor shall notify the Owner of the final waste disposal location and if so located in the City shall be responsible to provide evidence of all necessary local fill permits and State permits at no extra cost to the Owner.

19. Quality Assurance

The Contractor shall be responsible at all times for maintaining top quality assurance during performance of his work. Particular attention to compaction shall be paid during backfilling operation. Strict adherence to Section 203.11 and 304.04 of the Maine Department of Transportation Standard Specifications will be required for all subgrade and subbase/base operations.

If required, in-place density tests of the backfill material will be conducted by an independent testing laboratory. The amount and frequency of testing will be determined at the time of construction. A minimum of one density test per 100 feet of trench may be required. The Contractor shall be responsible for procuring and paying for the testing services. Satisfactory compaction shall be a minimum of 90% of the maximum density for the embankment and a minimum of 95% of the maximum density for gravel base course and subbase gravel course.

20. Subsurface Soils Information

All subsurface soils information, including but not limited to ledge, boring, refusal, or groundwater elevations, is approximate only and is shown on the Drawings for design purposes only and the convenience of the Contractor. The Contractor shall make his own investigations regarding the actual location and/or nature of such information and shall not rely on nor make claims for any extra payments based on the information shown on the drawings.

21. Unauthorized Use of Fire Hydrants

In conformance with the Maine State Department of Human Services, the Portland Water District requires the use of an approved air gap or reduced pressure zone back flow-device to assure the protection of the public water supply when filling tank trucks, street sweepers, jet machines or any other related equipment, or any other needs that require a connection to a public or private hydrant. The approved applicants will pay for the installation and removal of the hydrant meter and back flow device and all water recorded by the meter. The District considers any other connection or usage from a public or private hydrant as an unauthorized use of a hydrant and a theft of services. All Contractors must apply to The District for the installation of a back flow device and meter for each usage. The District will operate the hydrant and install and remove and relocate the back flow device and meter as needed. A valve is provided at the connection so the applicant can control the water without operating the hydrant. Please note size of meter requested (2" or 1"). The District can be contacted at 774-5961. All cost associated with these requirements is incidental to the contract.

SECTION 202 - REMOVING STRUCTURES AND OBSTRUCTIONS

The provisions of Section 202 of the Standard Specifications shall apply with the following additions and modifications:

202.04 Removing Portland Cement Concrete Pavement

This work shall include the removal and disposal of the existing concrete slab building foundations, pavers beneath the bituminous pavement. The concrete slab may include steel trolley track rails.

The Contractor shall excavate the concrete slab if encountered along with trolley tracks if encountered, shall dispose of the excavated material off site, and shall furnish material as indicated on the plans, for backfill in place of the excavated concrete slab.

202.05 Removing Manholes or Catch Basins

The first sentence of this subsection shall be modified be deleting “600 mm [2 feet] below subgrade” and substituting the following: “4 feet below finish grade.”

202.06 Removing Bituminous Concrete Pavement

Prior to the removal of bituminous pavement the limit of the removal area shall be saw cut to the appropriate depth for this given location where new pavement will be matched to existing pavement. Existing bituminous asphalt or Portland Cement Concrete pavement areas to be totally removed shall be saw cut to the full existing pavement depth. The preparation of a butt joint will not require saw cutting.

The cutting equipment used shall be exclusively designed for the purpose. It shall be capable of establishing a straight and vertical cut and to minimize chipping of the edge of the existing surface to remain.

202.061 Removing Pavement Surface (Milling)

The milled surface shall have a uniform texture and provide acceptable rideability for vehicles. Should resurfacing be delayed or the resulting milled surface be unsatisfactory for any reason, a bituminous leveling course or temporary pavement may be required. The Contractor shall clean the milled surface and surrounding area of all loose material prior to use by traffic.

SECTION 203 - EXCAVATION AND EMBANKMENT

The provisions of Section 203 of the Standard Specifications shall apply with the following additions and modifications:

203.01 Description:

Paragraph (b) Rock Excavation shall be modified to read: "each having a volume of one-half cubic yard or more".

203.04 General:

The Contractor shall excavate rock if encountered to the lines and grades indicated on the drawings, shall dispose of the excavated material, and shall furnish acceptable material for backfill in place of the excavated rock, if required.

In general, rock in pipe trenches shall be excavated so as to be not less than six inches (6") from the pipe after it has been laid. If needed, before the pipe is laid, the trench shall be backfilled to the established trench profile with thoroughly compacted, suitable material or, when so specified or indicated on the drawings, with the same material as that required for bedding the pipe, furnished and placed at no additional cost.

203.041 Explosives:

The Contractor shall keep explosives on the site only in such quantity as may be needed for the work under way and only during such time as they are to be used. He shall notify the Engineer, in advance, of his intention to store and use explosives. Explosives shall be stored in a secure manner and separate from all tools. Caps or detonators shall be safely stored at a point over 100 feet distant from the explosives. When the need for explosives has ended, all such materials remaining on the work shall be promptly removed from the premises.

The Contractor shall observe all municipal ordinances and State and Federal laws relating to the transportation, storage, handling, and use of explosives. In the event that any of the above mentioned laws, ordinances, or regulations require a licensed blaster to perform or supervise the work of blasting, said licensed blaster shall, at all times, have his license on the work and shall permit examination thereof by the Engineer or other officials having jurisdiction.

203.042 Blasting Precautions:

All operations involving explosives shall be conducted with all possible care to avoid injury to persons and property. Blasting shall be done only with such quantities and strengths of explosives and in such manner as will break the rock approximately to the intended lines and grades and yet will leave the rock not excavated in an unshattered condition. Care shall be taken to avoid excessive cracking of the rock upon or against which any structure will be built, and to prevent injury to existing pipes or other structures and property above or below ground. Rock shall be well covered with logs or mats, or both, when required. Sufficient warning shall be given to all persons in the vicinity of the work before a charge is exploded.

All blasting shall be completed within a distance of 50 feet before any portion of a masonry structure is placed or any pipe is laid.

Any site where electric blasting caps are located or where explosive charges are being placed or have been placed shall be designated as a "Blasting Area". A "Blasting Area" within three hundred (300) feet of any traveled way shall be marked by approved signs with information similar to the following:

"BLASTING AREA - TURN OFF RADIO TRANSMITTERS"

and on the reverse side:

"END OF BLASTING AREA"

The Contractor shall notify each public utility company having structures in proximity to the site of the work of his intention to use explosives and such notice shall be given sufficiently in advance to enable the companies to take such steps as they may deem necessary to protect their property from injury. Such notice shall not relieve the contractor of responsibility for any damage resulting from his blasting operations.

All persons within the danger zone of blasting operations shall be warned by the Contractor, and no blasting shall be done until the zone is cleared. Flagmen, furnished by the Contractor, shall be so stationed as to stop all approaching traffic during blasting operations.

The Contractor shall be liable for all damages to persons or property caused by blasting or explosions, or arising from neglect to properly guard and protect the excavations and all portions of the work, and he shall wholly indemnify the Owner against all claims on such account. No compensation will be allowed the Contractor in any event, or under any circumstances, for loss incurred by him or arising from his neglect to fully comply with these requirements.

203.044 Blasting Records:

The Contractor shall keep and submit to the Engineer an accurate record of each blast. The record shall show the general location of the blast, the depth and number of drill holes, the kind and quantity of explosives used, and other data required for a complete record.

203.045 Shattered Rock:

If the rock below normal depth is shattered due to drilling or blasting operations of the Contractor, and the Engineer considers such shattered rock to be unfit for foundations, the shattered rock shall be removed and the excavation shall be backfilled with concrete as required, except that in pipe trenches crushed stone may be used for backfill, if approved. All such removal and backfilling shall be done by the Contractor, at no additional cost to the Owner.

203.046 Preparation of Rock Surfaces:

The Contractor shall remove all dirt and loose rock from the designated areas and shall clean the surface of the rock thoroughly, using steam to melt snow and ice, if necessary. Water in depressions shall then be removed as required so that the whole surface of the designated area can be inspected to determine whether seams or other defects exist.

The surface of rock foundations shall be left sufficiently rough to bond well with the masonry and embankments to be built thereon; and, if required, shall be cut to rough benches or steps.
Before any masonry or embankment is built on or against the rock, the rock shall be scrupulously freed from all vegetation, dirt, sand, clay, boulders, scale, excessively cracked rock, loose fragments, ice, snow, and other objectionable substances. Picking, barring, wedging, streams of water under sufficient pressure, stiff brushes, hammers, steam jets, and other effective means shall be used to accomplish this cleaning. All free water left on the surface of the rock shall be removed.

203.047 Removal of Boulders:

Piles of boulders or loose rock encountered within the limits of earth embankments shall be removed to a suitable place of disposal.

203.048 Disposal of Excavated Rock:

Excavated rock may be used in backfilling trenches subject to the following limitations:

1. Pieces of rock larger than permitted under the section titled Excavation and Embankment: Section 203.01, shall not be used for this purpose.
2. The quantity of rock used as backfill in any location shall not be so great as to result in the formation of voids.
3. Rock backfill shall not be placed within 18 inches of the surface of the finish grade.

Surplus excavated rock shall be disposed of as specified in Section 203.06, "Waste Areas".

203.049 Backfilling Rock Excavations:

When rock has been excavated and the excavation is to be backfilled, the backfilling above normal depth shall be done as specified under the "Excavation and Embankment, Section 203". If material suitable for backfilling is not available in sufficient quantity from other excavations, the Contractor shall furnish suitable material from outside sources, under pay item 203.25 "Granular Borrow".

203.06 Waste Area: This subsection is revised to read as follows:

1. Surplus Earth and Rock Excavation:
   The disposal of surplus earth and rock unacceptable as trench backfill materials and excavated rock shall be the responsibility of the Contractor.
2. Trees, Stumps and other Material, Excepting Granular Material:
   The disposal of trees, stumps, stubs and brush shall be the responsibility of the Contractor.
   If the disposal site is within private property, the Contractor shall be required to obtain written permission from the landowner for use of the disposal site for the above mentioned materials.

Cobblestones, bricks and curbing removed shall remain the property of the City and shall be disposed of, after removing all excess granular materials there from, at a site to be determined at the time of construction and as directed by the project engineer. Bricks shall be palletized and curbing shall be stockpiled in an organized manner at the approved location.

SECTION 206 - STRUCTURAL EXCAVATION

The provisions of Section 206 of the Standard Specifications shall apply with the following additions and modifications:

206.01 Description:

For Structural Earth Excavation, only that trench excavation for pipe below the established trench profile as indicated on the Typical Trench Detail shall be included under this section. Trench excavation to the established profile shall be considered as incidental to the appropriate pipe item.
For Structural Rock Excavation, the trench shall be excavated to the established trench profile as indicated on the Typical Trench Detail.

(a) Drainage and Minor Structures shall include sewer and storm drain pipes, culverts, manholes and catch basins, structural plate culverts, box and pipe culverts, underdrains, berm ditches, cut slope down spout ditches, culvert end walls, concrete steps and other minor structures.

(c) Special Backfill. The Contractor shall furnish, place and compact special backfill material as indicated on the plans or as directed and herein specified.

The special backfill shall be a sandy, granular material and shall meet the requirements of Section 703.06 (b) Aggregated Subbase - Sand of the Supplemental and Standard Specifications.

The special backfill shall be spread in layers of uniform thickness not exceeding eight inches (8") before compaction and moistened and allowed to dry. Then it shall be thoroughly compacted by means of suitable power driven tampers or other power driven equipment to a uniform density of 95% of maximum density.

206.02 Construction Methods:

The fourth (4th) paragraph of the Standard Specifications shall be modified to read as follows:

When the foundation is to be placed on solid rock, the rock shall be excavated to a firm surface, either level, stepped or serrated. In trenches for sewer and storm drain pipes, culverts, manholes, and catch basins, box and pipe culverts, structural plate pipes and structural plate pipe arches, when solid or disintegrated rock or boulders are encountered, the rock shall be excavated to a minimum depth of six inches (6") below the bottom of the proposed pipe or structure, unless otherwise indicated on the plans or ordered. The six inch (6") level below the bottom of the proposed pipe shall be defined as "Established Trench Profile". For installation of underdrain, the rock shall be excavated to a minimum of three inches (3") below the bottom of the proposed pipe, unless otherwise ordered. Underdrain shall be installed at the proper elevation in accordance with Section 605 and the typical underdrain detail.

SECTION 304 - AGGREGATE BASE AND SUBBASE COURSE

The provisions of Section 304 of the Standard Specifications shall apply with the following additions and modifications:

304.02 Aggregate:

Sources of Aggregate and preliminary test results shall be submitted ten working days prior to any placement of material on the job. Failure of these preliminary tests will be grounds for rejection of material from that source. Aggregates will be tested on the job and shall meet these specifications as the material is incorporated into the work.

SECTION 401 – HOT MIX ASPHALT PAVEMENTS

The provisions of Section 401 of the Standard Specifications shall apply with the following additions and modifications:

401.12 Conditioning Of Existing Surfaces:

All streets to be paved shall be swept of all debris (sand, grass, etc.) prior to paving. Any grass or other vegetation growing in the street shall be removed prior to paving. Tack coat shall be applied per section 409.

Where pavement placed under this Contract joins an existing pavement, the existing pavement, when directed by the Engineer, shall be removed a minimum of 1' wide and 1 ½" deep in order to provide a vertical butt joint. The butt joint shall also be tack coated.

All streets to be shimmed or leveled shall be reviewed with Paving Inspector prior to placement to determine depth or grade to be achieved.

All vertical cuts in existing pavements shall be treated with an approved asphaltic tack coat material. The surface of the joint once completed shall be flush with the existing pavement.

All work necessary for the construction of this joint shall be considered incidental to the related job items. Vertical joints in Grading "B", "C", "D", and "E" shall be offset from each other horizontally by at least one foot (1').

Specified compaction of bituminous pavement in all work included in this contract shall be achieved without the assistance of vibratory action of the roller unless otherwise directed.

All work under this section shall be considered incidental to this Contract.

SECTION 403 – HOT BITUMINOUS PAVEMENT

The provisions of Section 403 of the Standard Specifications shall apply with the following additions and modifications.

- Hot Bituminous Pavement, Grading “B”
- Hot Bituminous Pavement, Grading “C”
- Hot Bituminous Pavement, Grading “E”-Shim

SECTION 409 – BITUMINOUS TACK COAT

The provisions of Section 409 of the Standard Specifications shall apply with the following additions or modifications.

SECTION 603 - PIPE CULVERTS AND STORM DRAINS

The provisions of Section 603 of the Standard Specifications shall apply with the following additions and modifications:

603.011 Description:

This work shall consist of the construction of storm drains, sewer pipes by means of trenched or trenchless installation, casing pipe, service leads, force mains hereinafter referred to as "pipe" as shown on the plans, details, and specified herein.

When the alternative of pipe material is listed in the Proposal, the Contractor shall signify his choice of pipe to be used by inserting his mark in the proper space provided.

The Contractor shall install locating/warning tape over the centerline of all sanitary, storm, and combined sewer pipes including main lines, service leads and catch basin laterals both within the right of way and outside of the established street as required by City ordinance. Both a green warning tape and a number 10 or 12 gauge single strand coated wire shall be installed at a maximum of 24 inches below finish surface grade for the entire length of the pipe. Magnetic warning tape may be used in place of the separate warning tape and wire. The end of all services stubs shall be recorded on the included sheet entitled Storm Sewer Service Location and submitted to the City upon completion of the work.

All connections shall be made in conformance with the Plumbing Code of the City of Portland and the Maine State Plumbing Code.

603.012 Materials:

Materials shall meet the requirements specified for the various subsections of the specifications listed below:

Reinforced Concrete Pipe	Stand. Spec.	706.02
P.V.C. Ring Type Sewer Pipe - (SDR 35 or Equal)	ASTM	D3034
Aggregate Base - Screened or Crushed	Stand. Spec.	703.06 (a)
Aggregate Subbase – Sand	Stand. Spec.	703.06 (b)
Crushed Stone for Pipe Bedding	Stand. Spec.	703.30
Ductile Iron Pipe	AWWA	Class 52

603.013 Construction Requirements:

PSM POLY VINYL CHLORIDE SEWER AND STORM DRAIN PIPE AND FITTINGS:

Each pipe length shall be inspected before being laid. Pipe shall be laid to conform to the lines and grades indicated on the drawings. Each pipe shall be so laid as to form a close joint with the next adjoining pipe and bring the inverts continuously to the required grade.

Bell holes shall be excavated or provided in the base material to receive the bell or coupling so that only the barrel of the pipe receives bearing pressure from the supporting material.

When each pipe has been properly bedded, enough of the backfill material shall be placed and compacted between the pipe and the sides of the trench to hold the pipe in correct alignment.

No pipe or fitting shall be permanently supported on blocks, wedges, boards or stones.

All joints shall be made in a dry trench and in accordance with the manufacturer's recommendations.

All PVC Gravity Sewer Pipe supplied shall conform to all aspects of ASTM specification D3034-73A and/or ASTM Spec. F789 for PVC sewer pipe, joints and fittings. Joints shall be rubber gasketed "Bell and Spigot" type. Installation of materials shall be as suggested in ASTM D2321. Minimum "pipe stiffness" at 4% deflection shall be 46 psi for all sizes when tested in accordance with ASTM D2421.

It is the responsibility of the Contractor to assure that the trench and the backfill around the pipe has been compacted sufficiently to limit deflection in the pipe to no more than 4%. All flexible pipe installed under this contract shall be tested by a "go-no-go" mandrel permitting no greater than

4% deflection. Testing of the pipe shall be done in the presence of a city inspector. The inspector shall be given a minimum of 24 hour advance notice before testing is to take place. All pipe not passing the 4% deflection limit test shall be removed and replaced at no additional cost to the City.

Pipe bundles shall be stored on a flat surface so as to support the barrels evenly. This is important as in hot weather PVC pipe will deflect or warp causing installing problems in line and grade. If a warped section is found, the Contractor shall not use such length of pipe.

In order to ensure proper compaction, alignment, and grade, and eliminate any construction problems that may be encountered, the Contractor shall be required to use only the 12-1/2 foot lengths of PVC pipe.

Pipe shall remain stacked in the original shipping bundles, and only pipe taken off the bundle for one day's laying shall be distributed along the trench.

PVC pipe will not bond to concrete or mortar and therefore connection to a cast-in-place or brick manhole and catch basin shall be made as shown on the pipe connection detail of the project plans.

Reinforced Concrete Pipe:

Reinforced concrete pipe shall be obtained only from a manufacturer of established good reputation in the industry. The pipe shall have a smooth and even interior surface, free from projections, indentations, or irregularities of any kind.

The joint shall be such that when joined the pipes will form a continuous and uniform line without projections, off-sets or irregularities and be capable of satisfying the specified leakage requirements.

Pipes shall be joined with rubber or rubber type gaskets that conform to the requirements established in ASTM Designation 443-67.

Each length of pipe shall be provided with proper ends made either of concrete formed on machined rings to ensure accurate joint surfaces or of metal rings. The diameters of the joints surface, depended upon to compress the gasket, shall not vary from the theoretical diameters by more than 1/16 inch. The joint shall be sealed by the rubber gasket so that the joint will remain tight under all conditions of service.

The rubber gasket shall be applied in accordance with the manufacturer's recommendations.

After the pipes are aligned in the trench and are ready to be jointed, all joint surfaces shall be cleaned. Immediately before jointing the pipe, the inside surface of the groove shall be thoroughly lubricated with a recommended lubricant. Pipe shall then be coupled immediately by carefully pushing each pipe into place without damage to pipe or gasket. The position of the gasket in the joint shall then be inspected to be sure it is properly put together and is tight.

Pipes shall be coupled by any suitable arrangement of come-along, winch, jack, or other power equipment that can exert sufficient force to couple pipe to its tightest position.

All pipe thirty-six inches in diameter or larger shall be sealed on the inside with cement mortar or with gunite by the grout-weld method using a pneumatic machine of the Nicholson, Bondactor, or equal type. Cement mortar if used shall be applied by trowel and the joint shall be thoroughly filled and finished smoothly with the inside surface of the pipe. The grout-weld seal shall be applied only by experienced and skilled workmen in accordance with the instructions of the manufacturers of the machine.

The pipe shall be laid accurately to line and grade. Pipe bedded in compacted crushed stone shall not be supported on blocking, wedges, brick, or anything except the bedding material. Pipe on concrete cradle shall be supported on solid concrete blocks or precast concrete saddles which become part of the completed cradle.

Each length of pipe shall be shoved home against the pipe previously laid, and held securely in position. Joints shall not be "pulled" or "cramped". Holes provided for jointing shall be filled and compacted.

Pipe from which a core has been cut and the resulting hole repaired, shall be placed with the cored hole located forty-five degrees above or below the horizontal centerline of the pipe.

To prevent the entrance of earth and other materials when pipe laying is not actually in progress, the open ends of pipe shall be closed by suitable temporary bulkheads. The Contractor shall take all necessary precautions to prevent floatation of the pipe because of flooding of the trench. If water is in the trench when work is resumed, the bulkheads shall not be removed until the danger of earth and other materials entering the pipe has passed.

All pipe joints and structures shall be made water tight. There shall be no visible leakage, spurting or gushing of water, sand, silt, clay or soil of any description entering the pipe lines at the joints or structures. Where there is evidence of water or soil entering the pipeline, connecting pipes or structures, defects shall be repaired.

603.014 Testing:

Gravity sewers shall be tested by one of the following methods:

A. Low pressure air
B. Infiltration
C. Exfiltration
D. Water main shall be tested in accordance with PWD Standards

Approval of method will be made by the Engineer with due consideration for subsurface conditions and size and type of pipe.

The Contractor shall have the proper plugs, weirs, and other equipment to perform all required tests. Testing of each section of sewer installed shall include the portions of service laterals installed under this contract.

A. Low Pressure Air:

When low pressure air test is used, it shall be conducted in compliance with the following:

After completing backfill of the wastewater line, the Contractor shall, at no additional cost to the City, conduct a line acceptance test using low pressure air. The test shall be performed according to stated procedures and in the presence of the Engineer.

Procedures:

All pneumatic plugs shall be seal tested before being used in the actual test installation. One (1) length of pipe shall be laid on the ground and sealed at both ends with the pneumatic plugs to be checked. Air shall be introduced into the plugs at 25 psig. The sealed pipe shall be pressured to 5 psig. The plugs shall hold against this pressure without bracing and without movement of the plugs out of the pipes.

After a manhole to manhole reach of pipe has been backfilled and cleaned, and the pneumatic plugs are checked by the above procedure, the plugs shall be placed in the line at each manhole and inflated to 25 psig. Low pressure air shall be introduced into this sealed line until the internal air pressure reaches 4 psig greater than the average back pressure off any ground water that may be over the pipe. At least two minutes shall be allowed for the air pressure to stabilize.

After the stabilization period (3.5 psig minimum pressure in the pipe), the air hose from the control panel to the air supply shall be disconnected. The portion of line being tested shall be termed "acceptable" if the time required in minutes for the pressure to decrease from 3.5 to 2.5 psig (greater than average back pressure of any ground water that may be over the pipe) shall not be less than the time shown for the given diameters in the following table:

Pipe Diameter (In Inches)	Minutes
4	2.0
6	3.0
8	4.0
10	5.0
12	5.5
15	7.5

18……8.5
21……10.0
24……11.5

In areas where groundwater is known to exist, the Contractor shall install a one-half inch diameter capped pipe nipple, approximately 10" long, through the manhole wall on top of one of the sewer lines entering the manhole. This shall be done at the time the sewer line is installed. Immediately prior to the performance of the Line Acceptance Test, the groundwater shall be determined by removing the pipe cap, blowing air through the pipe nipple into the ground so as to clear it, and then connecting a clear plastic tube to the nipple. The hose shall be held vertically and a measurement of the height in feet shall be divided by 2.3 to establish the pounds of pressure that will be added to all readings. (For example, if the height of the water is 11-1/2 feet, then the added pressure will be 5 psig, and the 2.5 psig to 7.5 psig. The allowable drop of one pound and the timing shall remain the same.)

If the installation fails the air test, the contractor shall, at no additional cost to the Owner, determine the source of the leakage. He shall then repair or replace all defective materials and/or workmanship.

B. Infiltration:

An infiltration test requires groundwater levels to be a minimum of one foot above the crown of the pipe of the high end of the section being tested. Infiltration test procedures are:

1. Engineer to determine length of sewer main and the connecting lines to be tested.
2. With all connecting pipes plugged (other than those included in test section) install a V notch weir in downstream end of pipe. The V notch weir must be constructed accurately and installed to maintain a watertight seal between weir and pipe.
3. Allow time for water to build up behind weir until steady, uniform flow passes through V notch.
4. Readings shall be taken and recorded.

C. Ex-filtration:

Ex-filtration test procedures are:

1. Engineer to determine length of sewer to be tested.
2. Properly cap or plug and block service laterals, stubs and fittings into sewer lines being tested.
3. Plug upstream and downstream ends of test section providing a water supply connection downstream and standpipe in manhole upstream.
4. Fill test section and upstream standpipe and allow time for water absorption in manholes.
5. Measure drop in upstream standpipe over 3 or 4 -15 minute periods and compute leakage. Note: The upstream manhole may be used as the standpipe. Test sections shall be kept short enough to maintain a reasonably low head to prevent excess pressures.

Leakage in gravity sewers shall not exceed 300 gallons per inch diameter, per day, per mile of pipe when tested by either internal pressure or external pressure means. Should the pipe as laid fail to meet these requirements, the Contractor shall perform the necessary work, at no additional cost to the Owner, to meet these requirements.

603.015 Inspection:

Pipe may be inspected at the manufacturing plant, or on the work site and shall be subject to rejection at any time, even though sample pipes may have been accepted as satisfactory at the manufacturing plant.

All pipe shall be subject to thorough inspection and tests. All tests shall be made in accordance with the methods prescribed by, and the acceptance or rejections shall be based on, applicable ASTM specifications.

Pipe will be inspected upon delivery and all pipe which does not conform to the requirements of this contract will be rejected and shall be immediately removed from the work area by the Contractor.

Unsatisfactory pipe will be either permanently rejected or minor repairs made. After delivery, any pipe will be rejected which has been damaged beyond the possibility of satisfactory repair.

If such pipe is found in the pipeline, it shall be removed and replaced or encased in a Class A concrete collar or envelope as directed, at no additional cost to the Owner.

An inspection of the interior of all mainline pipe and catch basin lateral connections installed as part of the project shall be completed prior to final paving of the project by experienced personnel trained in locating breaks, obstacles and service connections by closed circuit television. A video tape and suitable log shall be provided to the City for review prior to final paving.

SECTION 604 - MANHOLES, INLETS, AND CATCH BASINS

The provisions of Section 604 of the Standard Specifications shall apply with the following additions and modifications:

604.03 Construction Requirements

Concrete Blocks shall not be used in any way in the construction or alteration of manholes or catch basins.

All manhole bases, barrel sections and top sections shall be marked, by the manufacturer, with the appropriate manhole station (and offset if applicable) and the street name, if more than one street is incorporated within a single contract.

Between the third and fourth paragraphs of the Subsection insert the following paragraphs. Sanitary sewer inverts shall be constructed by brick masonry or approved fiberglass insert.

Special precautions shall be taken to provide adequate ventilation and attending personnel for the safety of all workers who may be required to enter existing sewers or sewers under construction.

It is emphasized to the Contractor that sanitary sewer and drainage construction under this contract shall be coordinated with existing sewer facilities so that continuous service and handling of existing flows is accomplished.

In the existing fifth paragraph, first sentence of that Subsection delete only "Metal frames and traps", and substitute therefore "Metal frames, steps, other appurtenances, and traps".

The outside surface of any masonry work for catch basins and manholes shall be plastered with mortar from 1/4 inch to 3/8 inch thick. The masonry shall be properly wetted before the plaster is applied. The plaster shall be carefully spread and troweled so that all cracks are thoroughly worked out. After hardening, the plaster shall be carefully checked by being tapped for bond and soundness.

All brick masonry surfaces with mortar shall be waterproofed with one coat of DEHYDRATINE 6 TROWEL MASTIC, DEHYDRATINE 10 SEMI-MASTIC or approved equal.

All poured concrete or precast concrete surfaces shall be waterproofed with two heavy coats of bituminous waterproofing materials. The material shall be MINWAX FIBROUS BRUSH COAT made by the Minwax Company, New York, New York; TREMCO 121 FOUNDATION COATING, made by the Tremco Manufacturing Company, Cleveland, Ohio; INERTOL NO-7 made by Inertol Company, Newark, New Jersey or approved equal.

All waterproofing material shall be applied according to the manufacturer's specifications and directions.

Catch basins shall be constructed as shown on the "Standard Details, Catch Basins and Inlets" of the contract drawings. Unless otherwise indicated, catch basins shall have A-4 inlet stones, granite tipdowns and Casco traps which shall be incidental to the contract unit price of the structure.

All sanitary street sewers and sanitary interceptors shall be constructed using solid manhole covers unless otherwise indicated.

Leakage tests may be required on each manhole. The tests, if ordered, shall be the exfiltration test made as described below:

After the manhole has been assembled in place, all lifting holes and all exterior joints shall be filled and pointed with an approved non-shrinking grout or approved bituminous mastic as shown on the construction drawings. The test shall be made prior to placing the shelf and invert and before filling and pointing the horizontal joints. If the groundwater table has been allowed to rise above the bottom of the manhole, it shall be lowered for the duration of the test. All pipes and other openings into the manhole shall be suitably plugged and the plugs braced to prevent blow out.

The manhole shall then be filled with water to the top of the cone section. If the excavation has not been backfilled and observation indicates no visible leakage, that is, no water visibly moving down the surface of the manhole, the manhole may be considered to be satisfactorily water-tight. If the test, as described above is unsatisfactory, or if the manhole excavation has been backfilled, the

test shall be continued. A period of time may be permitted if the Contractor so wishes, to allow for absorption. At the end of this period, the manhole shall be refilled to the top of the cone, if necessary, and the measuring time of at least 8 hours begun. At the end of the test period, the manhole shall be refilled to the top of the cone, measuring the volume of water added. This amount shall be extrapolated to a 24-hour rate and the leakage determined on the basis of depth. The leakage for each manhole shall not exceed 1 gallon per vertical foot for a 24-hour period. If the test fails this requirement, but the leakage does not exceed 3 gallons per vertical foot per day, repairs by approved methods may be made to bring the leakage within the allowable rate of 1 gallon per foot per day.

Leakage due to a defective section or joint or exceeding the 3 gallon per vertical foot per day shall be the cause for the rejection of the manhole. It shall be the Contractor's responsibility to uncover the manhole as necessary and to disassemble, reconstruct or replace it. The manhole shall then be retested and, if satisfactory, interior joints shall be filled and pointed.

No adjustment in the leakage allowance will be made for unknown causes such as leaking plugs and absorptions. It will be assumed that all loss of water during the test is a result of leaks through the joints or through the concrete. Furthermore, the Contractor shall take any steps necessary to assure the Engineer that the water table is below the bottom of the manhole throughout the test.

604.040 Drainage Structures Abandoned or Removed

The existing castings on manholes and/or catch basins to be abandoned or removed shall be carefully removed, cleaned and delivered to the City stockyard as directed. All such castings shall become the property of the City.

Inlet stones for catch basins to be abandoned or removed shall be carefully removed, cleaned and delivered to the City Stockyard as directed.

The inlets and outlets of structures to be abandoned shall be plugged with bricks and mortar. The upper portions of the masonry shall be removed to a depth of three (3') feet below the finished grade, and the structures shall be completely filled with selected excavated material placed in six (6") inch layers and thoroughly compacted. Prior to backfilling, the sump shall be pumped and cleared of all water and foreign materials.

The existing masonry of structures to be removed shall be completely removed. The inlets and outlets shall be fully plugged with bricks and mortar. The cavity shall be completely filled with selected excavated materials placed in six (6") inch layers and thoroughly compacted.

604.041 Remove Existing Drainage Structures and Replace with New Drainage Structures

The existing castings on manholes and/or catch basins to be removed and replaced shall be carefully removed, cleaned and delivered to a City stockyard as directed. All such castings shall become the property of the City. Existing inlet stones for catch basins to be replaced shall be carefully removed, cleaned and delivered to a City Stockyard as directed and shall be incidental to the cost of said item.

604.042 Altering, Adjusting and Rebuilding Catch Basins and Manholes

Existing manholes to be altered shall be reconstructed as indicated on the plans or as required due to field conditions. Alterations include adjustments to manhole invert channel caused by new pipe connections, waterproofing, installation of new steps and adjusting to grade.

Altering existing catch basins shall include the removal and replacement of inlet stone, frame, grate, Casco Trap, adjustment to grade, connection of underdrain to basin, and reconnection of existing inlet/outlet.

Relocating existing catch basins shall include the removal and replacement of inlet stone, frame, grate, Casco Trap, adjustment to grade, connection of underdrain to basin, and installation of new inlet/outlet.

604.045 Winterization

The Contractor will have the choice of two methods for winterizing the new catch basin and manhole frames and covers.

A. The Contractor may elect to leave the frames and covers at grade with the binder pavement during the Winter. This item would then include the removal of pavement in the Spring from around the frame, the raising of the frame to the proper elevation for the final paving and the replacement of the binder pavement that was removed from around the frame.

B. Or, the Contractor may elect to set the frame and cover at the finish grade for the street and provide a 4 foot wide hand placed pavement ramp/taper around the frame to protect it during the Winter plowing operations. This item would then include the placement of pavement ramp around the frame in the Fall and the removal of pavement ramp in the Spring.

In either event, the Contractor maintains responsibility for the frame and cover during with Winter months. In the event of a loose frame and cover, the removal of the pavement ramp, or damage to the frame and cover, it is the Contractors responsibility to respond with replacement of damaged structure or additional pavement material to safeguard the public and structure.

In the event the Contractor does not bring the frame and cover to grade for the Winter months then the work to install the frame and cover in the Spring will not be considered a Winterization item but considered the completion of the initial manhole installation.

In the event of a structure requiring additional winterizing mix after surface is no longer available, QPR mix may be substituted as an alternate material.

SECTION 605 - UNDERDRAINS

The provisions of Section 605 of the Standard Specifications shall apply with the following additions and modifications:

605.01 Description

The proposed underdrain shall be 6" in diameter and shall be constructed as shown on the plans and specified herein. The type of pipe material used for this purpose shall be SDR-35 or HDPE as shown on the details. Coiled pipes shall not be used.

605.02 Materials

Bedding material around underdrain shall conform to the requirements of Subsection 703.30 of these specifications. Material for pipe shall conform to the appropriate subsection of Section 700 of the Standard Specifications for the particular type of pipe supplied. Underdrain filter fabric material shall be equal to Mirafi 140 by Fiber Industries, Inc.

605.04 Underdrain Construction

Underdrain shall be constructed in accordance with the Standard Specifications and as shown on the plans and detail sheets of the Contract Drawings.

SECTION 608 - SIDEWALKS

Brick Sidewalk

608.10 Description

This work shall consist of the construction of brick sidewalks and driveways on bituminous concrete base in accordance with these specifications and in reasonably close conformity with the lines and grades as shown on the plans.

608.11 Materials

Materials shall conform to the requirements of the various subsections of the specifications listed below:

Used Brick: The Contractor shall salvage existing bricks from the project area as specified in Section 203 of the Supplemental Specifications. The Engineer shall have full authority in the choice of brick to be disposed of.

The discarded brick shall become the property of the City and shall be delivered by the Contractor a designated City Stockyard.

New Brick: Conform to the various subsections of the specifications listed below.

Brick - Brick shall conform to requirements of ASTM Standard Specifications for Building Brick (made of clay or shale) Designation C62-66 for Grade SW with the following modifications:

a. The absorption limits shall be from 8 to 12 per cent for the average of 5 bricks.
b. The compressive strength shall not be less than 8000 pounds per square inch (psi).
c. The modulus of rupture shall not be less than 1000 pounds per square inch (psi).
d. The bricks shall be No. 1, wire cut type for paving.

Bricks shall be of standard size (2-1/4" x 3-3/4" x 8") with permissible variations not to exceed 1/16" in depth, 1/8" in width or 1/4" in length.

Bricks shall be as manufactured by the Morin Brick Co. of Danville, Maine or an approved equal. Prior to ordering the brick, samples shall be submitted in whole straps to show color range.

All base courses and joints shall conform to the applicable subsections of Division 700 of the Standard Specifications.

608.12 Construction Methods

a. Subgrade: The subgrade for the sidewalks and driveways shall be shaped parallel to the proposed surface of the walks and drives and shall be thoroughly compacted. All depressions occurring shall be filled with a suitable material and again compacted until the surface is smooth and hard.
b. Foundation: After the subgrade has been prepared, a foundation of crushed gravel shall be placed upon it. After being thoroughly compacted, the foundation shall have a thick-ness as shown on the plans and typical details and shall be parallel to the proposed surface of the work.
c. Bituminous Base: A layer of hot bituminous pavement grading "B" shall be spread upon the properly prepared crushed gravel. After being thoroughly compacted, the bituminous base course shall have a minimum thickness of two (2") inches and shall be parallel to the proposed finish grade.
d. Sand-Cement Base: A layer of sand-cement base course material one (1") inch in thickness shall be spread upon the properly prepared bituminous base course. The course shall be thoroughly compacted and present a hard smooth surface parallel to the proposed finished slope and grade of the walks and drives. The ratio shall be six (6) parts of washed mortar sand to one (1) part Portland Cement.
e. Brick Placement: After the sand base course has been properly prepared, the brick shall be placed in the pattern shown on the plans and typical details. The brick shall be placed as closely together as possible and the sand joints between the brick shall be no wider than that allowed by the natural texture of the brick itself. NO OPEN JOINTS WILL BE ALLOWED.

Brick shall be saw cut to fit spaces requiring less than a whole brick. No cut brick shall be less than two (2") inches in length. A journeyman brick mason shall supervise all brick placement.

After the bricks are carefully set upon the properly prepared sand-cement base, a plank or heavy sheet of plywood covering several course of brick shall be placed upon the bricks and carefully rammed with a heavy hammer until the bricks reach a firm, unyielding bed and present a surface of the proper slope and grade. Any divergence from line and grade shall be corrected by taking up and relaying the bricks. After the ramming of the bricks, a sufficient amount of sand-cement shall be spread over the surface and thoroughly swept or raked so as to fill the joints. All surplus sand-cement remaining on the sidewalk and driveway after the joints have been properly filled, shall be carefully removed by sweeping. Care shall be taken to avoid raking out the joints during removal of excess sand-cement. A final application of sand only shall be spread on the sidewalk. The application of sand shall then be removed by sweeping while the aforementioned precautions are being exercised.

A 12" wide bituminous strip shall be placed at the gutter line and at the back edge of the brick driveway as a transition between the brick and adjoining surfaces.

Hot Bituminous Concrete Sidewalks

608.20 Description

This work shall consist of the construction of bituminous concrete sidewalks and driveways in accordance with these specifications and in reasonably close conformity to the lines and grades as shown on the plans.

608.21 Materials

Material for bituminous concrete base courses and surface courses for sidewalks and driveways shall conform to the requirements of Section 403 of the Standard Specifications for Hot Bituminous Pavement, Grading "B" and Grading "C" respectively. Crushed gravel base shall conform to the requirements of Section 304 of these specifications for Aggregate Base Course - Crushed, Type "A".

608.22 Construction Methods

a. Excavation: Excavation shall be made to the required depth and width. The foundation shall be shaped and compacted to a firm even surface conforming to the section shown on the plans and typical details. All soft and yielding material shall be removed and replaced with acceptable material.
b. Sidewalk Construction: Sidewalks shall be constructed with a two (2") inch course of bituminous pavement, Grading "C" laid on a thoroughly compacted six (6") inch deep crushed gravel base.
c. Driveway Construction: Driveways shall be constructed with a one (1") inch course of bituminous pavement, Grading "C" over a two (2") inch course of Grading "B". The crushed gravel base shall be ten (10") inches deep and thoroughly compacted.
d. Placing Bituminous Material: Bituminous material shall be placed on the compacted base course in two courses, one base and one surface, so as to give the required depth when rolled. Compaction shall be accomplished by means of a power roller having a minimum total weight of 2,000 pounds with a minimum of 65 pounds per inch of width of the drive roll or by satisfactory power vibratory compaction equipment. In areas inaccessible to other equipment, hand tamping will be permitted. In any case the bituminous material shall be uniformly compacted.

608.42 Construct Sidewalk

Limits of the work where new bituminous asphalt or Portland Cement Concrete pavement or sidewalk will match existing shall be cleanly saw cut prior to demolition operations.

SECTION 608A - SIDEWALK RAMPS

608A.01 Description

This work shall consist of the construction of sidewalk ramps at locations as shown on the plans and shall be in accordance with the sidewalk ramp typical details, with Section 608 of these Specifications and with the current Americans with Disabilities Act requirements.

608A.02 Materials

Each sidewalk ramp shall be constructed using materials as required for sidewalk construction as specified in Section 608 and as indicated on the details.

SECTION 609 - CURB

The provisions of Section 609 of the Standard Specifications shall apply with the following additions and modifications:

609.01 Description

This work shall include all existing (5") straight and circular Vertical Curb Type #1 to be set including new tipdown curb and sidewalk ramp curb. Material shall be in accordance with Section 712.04 except that drill holes through the curb will not be allowed.

609.03 Vertical Stone Curb, Terminal Section and Transition Sections

e. All joints of the curb shall have a four inch (4") by eight and one half inch (8-1/2") pad on the back side. The pad shall be filter fabric such as that used for underdrain or for roadway stabilization. The pad shall be placed in full contact with the curb from a half inch (1/2") below top of curb to two inches (2") below gutter grade and backfilled to hold in place.

609.082 Removing and Stacking Vertical Curbing, Terminal Curbing, Transition Sections, Curb Inlets, and Curb Corners (Type 1)

The Contractor shall be responsible for the removal without damage, cleaning and stacking a City designated location, all straight and curved curbing, terminal sections and curb corners which are designated to be removed and stacked (R & S). Removal of curbing so designated shall be in accordance with the requirements of Subsection 609.08.

Each section of straight curbing shall have its overall length painted legibly and plainly on one end. Each section of circular curbing shall have its overall arc length and radius painted on one end.

Removing and stacking curb or edging shall include all labor, equipment, tools and materials for excavating, removing, cleaning, backfilling, handling, stacking and any incidental work necessary.

SECTION 614 - MASONRY PLUG

614.01 Description:

This work shall consist of the construction of Masonry Plugs as shown on the plans and details, and specified herein. This work shall also include the placement of flowable concrete in abandoned pipelines.

614.02 Materials:

Materials shall meet the requirements for the various subsections of the specifications listed below:

Bricks shall conform to requirements of ASTM Standard Specifications for Sewer Brick, Designation C-32-63, Grade MA and SA.

Masonry Mortar shall conform to Section 705 of the Standard Specifications.

614.03 Construction Methods:

Excavation shall be made to the required depth and width to perform the work as required.

SECTION 615 - LOAM

The provisions of Section 615 of the Standard Specifications shall apply with the following additions and modifications:

615.01 Description

This work shall consist of furnishing and placing loam for seeding or sodding, in reasonably close conformity with the thicknesses specified on the plans or as authorized.

615.02 Materials

Loam and its applications shall conform to the requirements of Section 615 of the Standard Specifications. Loam shall be screened through a one (1") inch square mesh screen.

SECTION 621 –PLANTING

621.01 Description**:**
This work shall consist of furnishing labor, equipment and materials necessary to complete the planting, maintaining, and guaranteeing of plants in accordance with the drawings, lists, and specifications herein.

621.02 Trees and Shrubs:
All trees shall comply with the standards as set forth by the American Association of Nurserymen (ANSI z60.1-1990).

Dimensions of plants, planting materials, placement, and methods shall be in accordance with the requirements specified and indicated on the Tree Planting Detail and Shrub Planting Detail.

All trees and shrubs shall be nursery grown and shall be first class representatives of their species or variety. The shall be healthy, free from disease and insect pests, and shall have a well developed and compact root system. Plant material showing signs of lack of pruning, cultivation, and other proper nursery care will be classified as collected stock regardless of their source and shall be rejected.

All plants are to be dug with the ball of earth in which they are growing and are to be balled and burlapped unless otherwise specified herein. Broken, loose, or manufactured balls will be rejected.

All plants shall conform to the measurements specified on the plant lists and address lists attached. The only exception to this is that plants larger than those specified in the plant list may be used, but only with prior written approval of the City Arborist, and the use of such plants shall not increase the contract price.

Method of Installation

Time of Planting	No planting will be allowed after September 30 unless so authorized by the Owner.
Layout	All plants shall be placed in designated areas.

Setting of Plants

Each tree or shrub shall be placed as specified in the appropriate detail. Existing soil and rubble may be removed and replaced with suitable material as specified under "Fill".

The plants shall be set plumb and straight in the prepared pits and at a level such as will result, after settlements, in a satisfactory relationship between the plant and the surrounding ground surface.

Excavation Material
All material excavated from the hole shall be hauled from the site and not be used as fill for the newly planted tree.

Fill
Whenever possible, the fill around the root ball is to be of a similar nature and texture to that of the root ball. Otherwise, fill is to be 50% organic/50% topsoil. Another acceptable material may be substituted upon inspection and written authorization of the Owner. Loam shall be loose and friable and shall be free from subsoil, refuse, large stones, clods, roots or other undesirable foreign matter.

Staking and Guying

Staking and guying of trees shall be accomplished using the standards as set forth in the Tree Planting Detail. Stakes shall be set on opposite sides of the tree and set firmly at least 24" in the ground and at the perimeter of the ball.

Mulching

Bark mulch shall consist of soft wood bark fragments of such a size and texture as to successfully resist washing and blowing under normal conditions but capable of being easily and uniformly spread around the plants. Tree wells are to be mulched such that the mulch is mounded and approximately 2" above the level of the sidewalk.

Pruning

Pruning shall be done to each plant individually in such a manner as to preserve the natural character of the plant and shall be done only after delivery and inspection. All pruning shall be done with sharp tools by experienced personnel in accordance with the best horticultural practice. Plants pruned in such a manner as to seriously impair the appearance or character of the plant will be rejected.

At the time of final acceptance all plants shall be approximately the size called for in the specifications, due allowance made for moderate pruning.

Watering

Suitable water for the execution of this work and maintenance shall be provided by the Contractor.

Establishment Period, Maintenance, Guarantee, Replacements

The acceptability of the plant material furnished and planted under this contract will be determined at the end of the period of establishment as outlined herein. During the period of establishment, the Contractor shall employ all possible means to preserve the plants in a healthy and vigorously growing condition and to insure their successful establishment. During the establishment period, Contractor shall water, cultivate, repair wires and stakes, as may be required and do any other work to maintain the plants in a healthy growing condition. All dead or rejected plants shall be promptly removed and replaced by live healthy plants meeting the same specifications. If such plants are declared unacceptable during the planting season, they shall be replaced during the next subsequent planting season. No payment will be made for unsatisfactory work during the establishment period. All replacements are subject to the same requirements as the original plants.

The establishment period shall commence as soon as all plant material has been planted. This commencement shall be initiated by written notification from the Contractor to the Owner requesting an inspection of the work. If the work meets the specifications of the contract, the City will notify Contractor in writing that the project has been accepted preliminarily and the date of that letter shall mark the beginning of the twelve month establishment period. Contractor will be considered responsible for the plants until the time of Final Acceptance at the end of the twelve-month period.

The Owner will make a Final Inspection of the project at the end of the establishment period. All replacements of dead, unhealthy, or unsatisfactory trees shall have been made by the Contractor by

this date. Final Acceptance will not be given to the project until every plant is replaced as necessary and all plants found to be in a satisfactory condition by the Owner.

Inspection Prior to Planting

No plants shall be planted which have not been inspected by the Owner. In order to facilitate this inspection, the Contractor shall inform the Owner at least 24 hours in advance as to what plants are to be planted and in what locations. Any plants which are planted without receiving this inspection may be rejected and shall be removed by the Contractor and replaced by the Contractor with inspected stock. The Owner reserves the right to inspect plant material at the nursery, staging area, or at the job site. Inspection will continue throughout the life of the contract up to the time of Final Acceptance. Plants which are not true to name, do not conform to the specifications, show evidence of improper handling or lack of proper care or which appear to be in a seriously unhealthy condition shall be removed by the Contractor at once and replaced by acceptable plants as soon as the planting season allows.

SECTION 623 - MONUMENTS

The provisions of Section 623 and the Standard Specifications shall apply with the following additions and modifications.

623.02 Materials:

All right-of-way monuments and bench monuments shall be of granite unless otherwise ordered by the Engineer and shall conform to the dimensions as shown on the Standard Details.

The concrete fill around the monuments shall meet the requirements of Section 502 of the Standard Specifications for Structural Concrete, Class "A".

623.03 Construction Requirements:

Existing monuments in gravel which are designated to be removed shall be completely removed, cleaned, and delivered to a City stockyard as directed. Existing granite monuments in concrete which are designated to be removed shall be completely removed and disposed of at the Riverside Land Reclamation Site. All granite monuments removed shall remain the property of the City.

Existing right-of-way and bench monuments as shown on the plans which are not designated to be removed shall not be disturbed during construction. Any monuments so disturbed shall be replaced by new granite monuments at no additional cost to the City.

SECTION 625
WATER SERVICE SUPPLY LINE

The provision of Section 625 of the Standard Specifications shall apply with the following additions and modifications.

The contractor shall furnish and install all water mains, valves, service lines and accessories material in accordance with Portland Water District Standard Specifications

SECTION 627 – PAVEMENT MARKINGS

The provisions of Section 627 of the Standard Specifications shall apply with the following additions and modifications.

SECTION 637 - DUST CONTROL

The provisions of Section 637 of the Standard Specifications shall apply with no additions or modifications.

SECTION 652 - MAINTENANCE OF TRAFFIC

The provisions of Section 652 of the Standard Specifications shall apply with the following additions and modifications:

GENERAL REQUIREMENTS

A traffic plan may be included in the plan set, but responsibility for preparation of the actual plan shall be the contractor's.

Approaches. Project approach signing shall include the following signs for two-way traffic.

Road Work Ahead
Road Work 1000 Feet
Road Work 500 Feet with 25 MPH Advisory Speed Plate
End Road Work

Work Areas. At each work site, signs and channelizing devices shall be used as directed by the Engineer.

Signs may include:

Work Zone
Speed Plate Limit
Fines Double
Work Area Ahead with 25 MPH Advisory Speed Plate
Work Area Ahead
One Lane Road Ahead
Flagger sign
Trucks Entering
Be Prepared To Stop
Sidewalk Closed

The above lists of signs are representative of the contract requirements. Other sign legends may be required.

The contractor shall provide a minimum roadway width of 22 feet for two way traffic whenever possible and at all times when the contractor is not working. Where the City of Portland approves one-way traffic, it shall be controlled through work areas by flaggers and the minimum roadway width shall be 11 feet for one lane. Flaggers equipped with radios or other means of direct communication shall be used to control one-way traffic when one-way traffic is approved.

It is anticipated that most, if not all, of the work on this project can be completed while maintaining two lanes of traffic and two-way traffic flow. The contractor's attention is drawn to Sec. 25-121 of the City of Portland's Code of Ordinances for specific traffic control requirements while working in public streets. Construction shall not interfere with the normal flow of traffic on arterial streets. The full inbound roadway lane width shall be maintained between 7:00 a.m. and 9:00 a. m. and the full outbound roadway lane width shall be maintained between the hours of 3:30 p. m. and 6:00 p. m.

All Contractor requests for temporary lane closures and road closures shall be presented in writing to the City Transportation Engineer as part of a traffic control plan. Lane and road closures must be approved by the City Transportation Engineer before the contractor takes any steps toward closure.

Channelization. Channelization devices shall includes drums, cones, and Type I barracades. Channelization devices shall be installed and maintained at the spacing determined by the MUTCD through the work area.

Roadside Recovery Area. The Contractor shall not store material or park equipment within 10 feet of the edge of the established travel lanes. Equipment parked overnight within 25 feet of the edge of a travel lane shall be clearly marked by channelizing devices or other reflectorized devices.

Speed Limits in Work Zones. The contractor shall sign all approved reduced speed limits on construction projects according to APM #431 – A Policy on the Establishment of Speed Limits in Work Zones.

SECTION 654 - SOIL BACKFILL COMPACTION TESTING

654.01 Description

This work shall consist of furnishing an approved certified soil testing laboratory, when required, to conduct in-place density tests of backfill materials in the field and all related laboratory tests. The testing shall be bid under the appropriate line item.

654.02 General

Upon completion of the field test, the results shall be made available to the Owner on site. Copies of all test results shall be transmitted to the Engineering Department of the City of Portland.

The minimum in-place densities shall meet or exceed the laboratory maximum density as determined by ASTM D 1557 - 78 as follows:

Embankment	Ninety percent	(90%)
Trench Backfill	Ninety-three percent	(93%)
Aggregate Base Course and Aggregate Subbase Course	Ninety-five percent	(95%)

SECTION 656 - TEMPORARY SOIL EROSION AND WATER POLLUTION CONTROL

The provisions of Section 656 of the Standard Specifications shall apply with no additions or modifications.

DIVISION 700 - MATERIAL DETAILS

The following are revisions and additions to the Material Details Division of the Standard Specifications, Highways and Bridges, Revision of April, 1995. Provisions contained herein shall be considered to supplement or supersede those portions of the Standard Specifications as they apply to the Contract.

The GENERAL STATEMENT of this Division is hereby revised to read as follows:
All materials which are to be used in the work for which there is no prescribed testing by the project inspectors or other certified laboratories, the Contractor shall, prior to final acceptance as specified in subsection 105.17(b), submit a Materials Certification Letter similar to:

Company Letterhead

Mr._____Resident Date_____

Address_____ Project No._____

_____ Town_____

"This is to certify that the below listed materials, which are incorporated into the above designated project, comply with the pertinent specified material requirements of the contract. Processing, project testing and inspection control of raw materials are in conformity with the applicable drawings and/or standards of all articles furnished. (List only those items used.)

Castings, Grates, Frames and Traps
Concrete Blocks, Bricks, Precast Sections, Appurtenant Structures
Culverts, Underdrain, Sanitary Sewer Pipe and Storm Drain Pipe
Regulatory Signs and Posts

All records and documents pertinent to this letter and not submitted herewith shall be maintained available by the undersigned for a period of not less than three (3) years from the date of completion of the project.

The Materials Certification letter shall be signed by a person having legal authority to bind the Contractor.

Materials for which the above Certificate is acceptable may be subject to random sampling and testing by the Owner. Certified materials which fail to meet specification requirements may not be accepted.

SECTION 703 - AGGREGATES

The provisions of Section 703 of the Standard Specifications shall apply with the following additions and modifications:

703.02 Coarse Aggregate for Concrete:

Designated Aggregate Size

	Per Cent Passing Sieve				
Sieve Size	2 in.	1½ in.	1 in.	¾ in.	½ in.
2 in.	95-100	100	-	-	-
1-1/2 in.	-	95-100	100	-	-
1 in.	50-70	-	90-100	100	-
3/4 in.	-	50-70	-	90-100	100
1/2 in.	15-30	-	25-60	-	90-100
3/8 in.	-	10-30	-	20-55	-
No. 4	0-5	0-5	0-10	0-10	0-15
F.M. (+0.20)	7.45	7.20	6.95	6.70	6.10

Aggregate used in concrete shall not exceed the following maximum designated sizes:

a. 2 inches for mass concrete
b. 1-1/2 inch for piles, pile caps, footings, foundation mats, and walls 8 inches or more thick
c. 3/4 inch for slabs, beams, and girders.
d. 1/2 inch for fireproofing on steel columns and beams

1 inch for all other concrete

703.06 (a) Aggregate Base:

Aggregate base - crushed, type "A" shall not contain particles of rock which will not pass the two inch (2") square mesh sieve, and shall conform to the type "A" aggregate, as listed in the subsection of the Standard Specifications.

"Crushed" shall be defined as consisting of rock particles with at least 50 per cent of the portion retained on the 1/4 inch square mesh sieve, having a minimum of 2 fracture faces.

703.06 (b) Aggregate Subbase:

Sand subbase shall not contain particles of rock which will not pass the one inch (1") square mesh sieve, and shall conform to the type "F" Aggregate, as listed in this subsection of the Standard Specifications.

Gravel subbase shall not contain particles of rock which will not pass the three inch (3") square mesh sieve, and shall conform to type "D" Aggregate, as listed in this subsection of the Standard Specifications.

703.18 Common Borrow:

Common borrow shall not contain any particle of bituminous material.

703.19 Granular Borrow:

Granular borrow shall contain no particles which will not pass a three inch (3") square mesh sieve.

703.20 Gravel Borrow:

Gravel borrow shall not contain particles of rock which will not pass three inch ("3") square mesh sieve.

703.30 Crushed Stone for Pipe Bedding and Underdrain:

"Crushed Stone" shall be defined as rock of uniform quality and shall consist of clean, angular fragments of quarried rock, free from soft disintegrated pieces or other objectionable matter.

Crushed stone used as a bedding material for pipe and underdrain shall be uniformly graded and shall meet the follow gradations.

Sieve Designation	Percentage by Weight Passing Square Mesh Sieve
3/4 – inch	100
3/8 – inch	20 - 55
No. 4	0 - 10

For pipe sizes 42 inches and larger:

Sieve Designation	Percentage by Weight Passing Square Mesh Sieve
1-1/4 – inch	100
3/8 – inch	20-55
No. 4	0-10

The stone shall be free from vegetable matter, lumps or balls of clay, and other deleterious substances.

BUILDING EARTHWORK SPECIFICATIONS

SECTION 02401 - LATERAL SUPPORT OF EXCAVATION

PART 1 - GENERAL

1.1 GENERAL

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

C. Coordinate work with that of all other trades affecting or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.2 DESCRIPTION OF WORK

A. The Contractor shall design, furnish, install, maintain and remove a temporary excavation support system, including bracing, installed to the depths required for support of the perimeter of the excavation at the locations shown on the drawings or as necessary to provide braced, temporary support of the excavation.

B. The Contractor is solely responsible to design, install, maintain, and remove any and all elements of the temporary excavation support system in a manner that protects nearby existing and new site improvements from impacts or damage associated with the excavation and lateral support work. Damage to site improvements shall be repaired or replaced by the Contractor to the satisfaction of the Owner at no additional cost to the Owner. The Contractor shall perform any and all preparatory work to discover, protect, maintain, relocate, and restore site improvements as necessary.

C. The Contractor shall coordinate the installation, maintenance and removal (as applicable) of the temporary excavation support systems with the Contractor's below-grade construction activities (i.e., excavation and foundation and slab construction). The Contractor's activities during construction of the below-grade structure shall be consistent with the approach and methodology outlined in the Contractor's temporary excavation support design submittals that are reviewed and commented on by the Architect.

D. The Contractor shall install monitoring instrumentation on and behind the temporary excavation support systems to monitor movements of the lateral support system, buildings, streets and other structures.

E. The Contractor shall develop and implement mitigating and remedial measures to address building, streets and other structure movements caused by the Contractor's construction activities. These measures shall be undertaken in accordance with the requirements of this Section at no additional cost to the Owner.

1.3 RELATED SECTIONS

A. Section 02145: Dewatering

B. Section 02300: Structure Earthwork

C. Section 02450: Rammed Aggregate Piers

1.4 DEFINITIONS AND REFERENCE STANDARDS

A. ASTM: Specifications of the American Society for Testing and Materials

B. AWS: Standard Code for Welding in Building Construction, of the American Welding Society

C. AASHTO: American Association of State Highway and Transportation Officials

D. ACI: American Concrete Institute

E. OSHA: Occupational Safety and Health Administration

F. AISC: American Institute of Steel Construction

G. AWPA: American Wood Preservatives Association

H. Architect: Authorized representatives of the Architect or Owner. For the work covered under this Section, this term will include Haley & Aldrich, Inc.

I. Site Improvements: When used in the context of "protecting adjacent site improvements," shall include, but not be limited to, buildings, utilities, pavements, roadways, slabs, sidewalks, curbs, foundations, and all other site improvements and features that are outside the limits of the site, or those elements within the limits of the site that are to remain.

1.5 JOB CONDITIONS

A. Prior to submitting a bid, the Contractor shall review and understand the information contained in the following report. This report is made available to the Contractor for information only and shall not be interpreted as a warranty of subsurface and/or environmental conditions whether interpreted from written text, boring logs, laboratory chemical test data or other data.
   1. "Report on Subsurface and Foundation Investigation, Proposed Village at Ocean Gate, Portland, Maine," prepared by Sebago Technics, Inc., dated October 3, 2007.

B. Available soil samples recovered from borings may be examined at the office of Sebago Technics, Inc., One Chabot Street, P.O. Box 1339, Westbrook, Maine 04098-1339. The boring information is considered to represent the conditions at the locations of test borings at the time the test borings were made. The Contractor should anticipate variations from the conditions disclosed by the borings in planning and estimating the work.

1.6 STRENGTH DESIGN CRITERIA

The Contractor's temporary excavation support systems shall be designed to support earth and surcharge loads (from adjacent buildings, streets, construction equipment and stockpiles, cranes, traffic using HS20-44 loading, and other sources) imposed on the systems during the construction and operation period. The Contractor's design shall also consider the means

and methods and construction process proposed by the Contractor to construct the below-grade structure.

B. The Contractor shall design and install the temporary excavation support systems to provide an excavation that permits safe and expeditious construction of foundations, underslab drainage system, base slabs and all components of the permanent structure, utilities, and other site improvements.

C. External Bracing Considerations and Restrictions:
   1. External bracing such as tiebacks extending below city streets and adjacent buildings are not allowed.
   2. Site improvements, existing structures and utilities are located in adjacent areas and streets.

1.7 PERFORMANCE DESIGN CRITERIA

A. The Contractor's temporary excavation support systems shall: (1) provide lateral support of excavation; (2) prevent damage to the adjacent buildings, new site improvements, existing streets and utilities; and (3) limit movements of the temporary excavation support system and adjacent buildings, new site improvements, existing streets and utilities to those specified herein.

B. Position the highest brace no deeper than 6 feet below existing grade.

C. Excavations shall not proceed more than 2 feet below any bracing level prior to the installation and loading of the brace.

D. The Contractor shall maintain the maximum cumulative horizontal movement at any point along the temporary excavation support system below the Limiting Values of 1.5 inches.

E. The Contractor shall maintain the maximum vertical movement of any buildings to less than 0.75 inch; and any utilities and streets to less than 1.0 inch.

F. The Contractor shall submit and implement a Movement Mitigation Plan immediately if the Limiting Values specified above are exceeded, or if other excessive movements occur as judged by the Architect. The proposed plan may include, but not be limited to, additional horizontal supports and bracing or other measures. The Contractor shall demonstrate that the proposed measures can be implemented immediately if required to prevent damage to the adjacent buildings and streets and utilities.

18. QUALITY ASSURANCE

A. The Architect will observe, as a minimum, the following Contractor activities: temporary lateral support system, excavation for the below-grade space, installation and removal of braces, and other activities related to construction of the below-grade structure.

B. The Contractor shall provide sufficient notice to the Architect to allow the Architect to be present to observe the Work. The Contractor shall cooperate with the Architect in all respects to facilitate any testing or observations.

C. The presence of the Architect shall not relieve the Contractor of its responsibility to perform the work in accordance with the Contract Documents, nor shall it be construed to relieve the Contractor from full responsibility for the means and methods of construction, protection of all site improvements against damage, and for safety on the construction site.

D. The Contractor shall adhere to the applicable requirements of the Standard Specifications, OSHA Standards, and to all other applicable ordinances, codes, statutory rules, and regulations of federal, state, and local authorities having jurisdiction over the Work of this Section.

E. The Contractor shall conduct testing and instrumentation monitoring at no additional cost to the Owner.

F. The Contractor shall perform any and all preparatory work at no additional cost to the Owner to discover, protect, maintain, relocate, and restore existing and new site improvements (i.e., utilities). The Contractor shall include and incorporate the findings of this preparatory work on his/her submittals.

1.9 SUBMITTALS

A. General

1. The Contractor shall forward submittals to the Architect a minimum of 3 weeks prior to any planned work related to the Contractor's submittals.
2. The time period(s) for submittals are the minimum required by the Architect to review, comment, and respond to the Contractor. The Architect may require resubmission(s) for various reasons. The Contractor is responsible for scheduling specified submittals and resubmittals so as to prevent delays in the work.
3. The Contractor's submittals shall be reviewed and accepted by the Architect prior to conducting any work.

4. The Contractor's submittals shall be prepared and stamped by a Professional Engineer(s) licensed in the State of Maine, retained by the Contractor. The Contractor's Professional Engineer(s) shall have a minimum of 5 years' experience in the design and performance of temporary excavation support systems similar to those required for this project.
5. Acceptance of the Contractor's submittals by the Architect does not relieve the Contractor of the responsibility for the adequacy, safety, and performance of the Work.

B. The Contractor shall provide the following submittals regarding the temporary excavation support systems:
   1. Evidence that the Contractor and the Contractor's Engineer(s) have a minimum of five years' experience in each specialty work item, and that each have completed a minimum of five projects with similar specialty work. The Contractor shall employ supervising personnel and labor with a minimum of five years' experience for each specialty work item.
   2. Plan layout of the systems indicating wall types; dimensions, material properties, locations, spacings, and depths of all brace members; and existing and new site improvements.
   3. Details of brace elements, including locations, layouts, sizes, and connections of all members. Locations of bracing members shall not interfere with the construction of the below-grade permanent structures and other structural features and shall permit access for their removal.
   4. Detailed narrative outlining the construction sequence (i.e., installation and maintenance (as applicable) temporary excavation support system elements with respect to excavation for the below-grade structures and construction of permanent structural elements). The narrative shall break down the brace installation, mass excavation, and maintenance process.
   5. Engineering calculations, assumptions, and methodologies for the design of the temporary excavation support systems considering all intermediate construction stages, as well as final conditions. The design shall consider, and indicate as necessary, the proposed methods for excavating and constructing the below-grade structures. The calculations shall include the following:
      a. Strength Design Submittals:
         i. Structural design of the support wall elements and brace elements for the temporary construction condition. A staged analysis that models all of the excavation and bracing stages of the proposed construction is required.
      b. Performance Design Submittals:

i. Analyses for lateral and vertical movement of the temporary excavation support systems, and adjacent ground and building foundations.

6. Proposed mitigation plans to arrest wall, building and/or ground movements if Limiting Values are approached or exceeded, or other unacceptable movements are occurring in the judgment of the Architect. These plans shall be submitted and approved prior to construction.
   a. If detrimental effects result from construction activities, the Contractor shall modify the design, revise construction procedures and implement measures to mitigate and abate further movement or groundwater impacts. These designs, procedures, and measures shall be submitted by the Contractor to the Architect for review before implementation.

PART 2 - MATERIALS

2.1 STRUCTURAL STEEL

A. Structural Steel: shall be new and unused and shall conform to the current edition of "AISC Specification for the Design, Fabrication and Erection of Structural Steel for Buildings."

B. Steel sheet piles shall be continuous interlocking type, ASTM A328, with cross-sections selected for their intended use in accordance with the designs required for submission under PART 1 of this section.

C. All welding shall conform to AWS D1.1.

2.2 WOOD LAGGING

A. Timber shall be structural grade having a minimum allowable working stress of 1,100 pounds per square inch in bending. All timber shall be a minimum 4-inch thickness.

B. Timber shall be treated with alkaline copper quaternary (ACQ) in accordance with AWPA Standard C1 and P5. All new timber shall be treated to a retention of 0.25 pounds per cubic foot of ACQ.

C. All timber subject to field cutting shall be treated with ACQ in accordance with AWPA Standard P5. Treatment for drilling and field cuts shall be two (2) coats of ACQ and shall be brushed on.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Provide fully equipped rig(s) and appropriate tools in full-time operation at the site to complete the Work of this Section on schedule. Mobilize additional equipment to the site at no additional cost to the Owner to complete the Work of this Section on schedule.

B. Perform preparatory work to discover, protect, maintain, restore, utilities, foundations or other facilities within the zone of influence of the temporary support systems.

C. Install the temporary excavation support systems to the limits shown on the Contract Drawings and reviewed submittals.

D. Install brace elements in accordance with the reviewed and accepted submittals. Include web stiffeners, plates, brackets, or angles as required to prevent rotation, crippling or buckling of connections and points of bearing between structural steel members. Allow for eccentricities due to fabrication and assembly. The bracing system shall consider and accommodate for the effects of temperature changes.

E. Excavate for and install bracing with the primary objectives of limiting wall and adjacent ground movements, and maintaining the structural integrity of adjacent structures, utilities, and streets.
   1. Excavation shall not proceed more than 2 ft below the bracing level anywhere within the excavation support limits until that entire level of bracing is installed to the satisfaction of the Architect.
   2. Install and maintain all support members in continuous tight contact with each other and with the wall being supported.

3.2 SOLDIER BEAMS AND LAGGING

A. Soldier Beams
   1. Install soldier beams by methods which prevent loss of ground in order to prevent disturbance to the adjacent buildings, new site improvements, existing streets and utilities.

B. Wood Lagging
   1. Install lagging with louvered openings (gaps) between boards in accordance with the ground conditions encountered in excavations and subject to the approval of the Architect. In no case will the louvered openings be allowed to exceed one (1) in.

2. As installation progresses, backpack the voids between the excavation face and the lagging to establish a tight contact.

3. Pack louvered openings between lagging with porous material to allow free drainage of groundwater without loss of retained soil.

4. The maximum possible height of unlagged face of excavation shall not exceed two (2) feet. If water is flowing from the face of the excavation, or if soil to be retained moves toward the excavation, the maximum height of unlagged face shall not exceed eight (8) inches.

5. If unstable ground is encountered, take suitable measures to retain the material in place and prevent loss of ground and/or movement, which may cause damage to the adjacent buildings, new site improvements, existing streets and utilities.

6. Maintain sufficient quantity of materials on hand throughout the conduct of work for lagging and bracing and other operations for protection of the work and for use in case of accident or emergency.

3.3 STEEL SHEET PILING

A. Drive sheet piling in plumb position such that each pile installed is continuously interlocked with adjacent piles over its entire length. Sheeting after driving shall be in direct contact with material to be retained.

B. Drive sheeting to the depths indicated on reviewed shop drawings. Do not overdrive sheeting so as to cause damage to sheet pile tips or interlocks. Drive sheeting with care such that it can be removed without damage to adjacent backfill.

C. Methods and equipment used in driving, cutting and splicing shall conform to reviewed shop drawings.

D. The installation and removal of sheeting shall be done with minimum vibrations to the ground. The work shall be controlled so that the peak particle velocity, measured at adjacent structures, shall not exceed 2.0 inches per second. Vibration monitoring measurements shall be made by the Contractor and will be verified by the Architect.

3.4 SURVEY REFERENCE POINTS

A. Install survey reference points on the temporary excavation support systems and the adjacent buildings and streets to monitor movements of these structures. Install at least two (2) points on each adjacent building and at least two (2) points each in the street on the north and east side of the

excavation. The Contractor shall survey the points on a weekly basis during excavation to final grade within 20 feet of the buildings and streets and on a monthly basis thereafter, or more frequently if conditions require, and report the data to the Architect within 24 hours. In the event measured movements approach or exceed the criteria established for acceptable movement, the Contractor shall take immediate steps to arrest further movement.

3.5 MOVEMENT CONTROL

A. Maintain the horizontal movements of the temporary excavation support systems below the specified Limiting Values. Horizontal movement of the wall in the direction away from the excavation that is recovered by jacking the brace elements or by other causes of the Work shall not be considered in the calculation of cumulative horizontal movement. Maintain the vertical movements of adjacent buildings and streets below the specified Limiting Values.

B. The Contractor shall notify the Architect, implement the accepted Movement Mitigation Plan, and take immediate steps to control further movement by revising his procedures, providing supplemental bracing or other measures (working 24 hours per day and temporarily terminating work in the area of movement if necessary), as required if any of the following occur:
   1. Field measurements indicate that any of the Limiting Values are or will be reached or exceeded.
   2. Field measurements or observations indicate that significant or sustained wall movements are occurring (total movement may be less than Limiting Values).
   3. Adverse movements of adjacent buildings, streets, utilities, site improvements or other facilities are detected.

C. If movement of the excavation support system reaches or exceeds the Limiting Value, the Architect, based on his/her judgment and review of the movement monitoring data, may require that the Contractor temporarily terminate the work in the area where such movement is occurring and the Contractor shall implement all necessary mitigation measures which are satisfactory to the Architect to arrest the movements at no additional cost to the Owner.

D. These criteria are intended to establish a minimum basis for the Contractor's design and procedures and in no way relieve the Contractor of his/her sole responsibility for preventing detrimental movements and damage to adjacent existing and new site improvements.

3.6 REMOVAL OF TEMPORARY EARTH SUPPORT SYSTEM

A. The removal of temporary earth support system members shall be performed in such a manner that there is no disturbance or damage to any portion of the new construction, as well as to adjacent buildings, structures, utilities, streets, or site improvements.

B. Soldier beams, steel sheet piles and other elements penetrating below the foundation level of the new garage and other construction shall be cutoff at the foundation level and left in place. The portion above foundation level may be removed after proper placement and compaction of backfill.

C. The bracing shall not be removed until the backfill has been placed and compacted to the required density to within two feet below the level of support.

D. The Contractor shall repair all damage to property resulting from temporary earth support removal at no additional cost to the Owner.

E. The Contractor shall leave in place to be embedded in the backfill any portion of the temporary earth support system which the Architect may direct him in writing to leave in place at any time during the progress of the work for the purpose of preventing damage to structures, utilities, property and the work and to maintain a stable excavation bottom. Elements left in place for the convenience of the Contractor which were not specifically directed in writing to be left in place by the Architect shall be at the Contractor's expense.

F. All temporary earth support systems left in place shall be cut off at least six feet below final grade.

SECTION 02145 - DEWATERING

PART 1 - GENERAL

1.1 GENERAL

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

C. Coordinate work with that of all other trades affecting or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.2 DESCRIPTION OF WORK

A. The Contractor shall design install, operate, monitor, maintain, and remove a temporary dewatering system as necessary to control water levels below the excavation subgrade to permit construction of the work in-the-dry, to maintain the bearing soils firm and undisturbed and to prohibit flotation of completed work. It is expected that sumps with open pumping will be required to accomplish dewatering.

B. The Contractor shall collect and properly dispose of discharge water from the dewatering and predrainage system.

C. The Contractor shall control and prevent surface water from entering the excavation, by means of ditches, berms or other suitable methods.

1.3 RELATED SECTIONS

A. Section 02300: Structure Earthwork

B. Section 02401: Lateral Support of Excavation

C. Section 02450: Rammed Aggregate Piers

1.4 DESIGN AND PERFORMANCE RESPONSIBILITY

A. The methods of controlling groundwater shall be designed by the Contractor, who shall be solely responsible for the location, arrangement and depth of the system selected to accomplish the work.

B. The Contractor shall be responsible for the proper installation, operation, monitoring and maintenance of the dewatering system. Modifications to the systems that may become necessary during construction shall be made under the direction of the Contractor. All cost of any modifications shall be borne by the Contractor at no additional cost to the Owner.

C. The Contractor shall be responsible for and shall repair without cost to the Owner, any damage to work in place, construction equipment, the excavation, and surrounding property that may result from his/her negligence, inadequate design and operation of the dewatering system, and any mechanical or electrical failure of the dewatering system.

D. Design review, and field monitoring activities of the Architect shall not relieve the Contractor of his/her responsibilities for proper design, installation, operation, monitoring and maintenance of the dewatering system.

1.5 JOB CONDITIONS

A. Prior to submitting a bid, the Contractor shall review and understand the information contained in the following report. This report is made available to the Contractor for information only and shall not be interpreted as a warranty of subsurface and/or environmental conditions whether interpreted from written text, boring logs, laboratory chemical test data or other data.

1. "Report on Subsurface and Foundation Investigation, Proposed Village at Ocean Gate, Portland, Maine," prepared by Sebago Technics, Inc., dated October 3, 2007.

B. Available soil samples recovered from borings may be examined at the office of Sebago Technics, Inc., One Chabot Street, P.O. Box 1339, Westbrook, Maine 04098-1339. The boring information is considered to represent the conditions at the locations of test borings at the time the test borings were made. The Contractor should anticipate variations from the conditions disclosed by the borings in planning and estimating the work. Water levels can be expected to vary with season, precipitation, temperature and other construction activity in the area. Therefore, water levels encountered during construction may differ from those shown.

C. The Contractor's attention is called to the groundwater levels prior to the start of construction. Water levels are up to 6 feet or more above the lowest excavation level.

1.6 QUALITY ASSURANCE

A. Comply with all rules, regulations, laws and ordinances of the State of Maine, the City of Portland and all other authorities having jurisdiction over the Work.

B. Full-time monitoring of dewatering and predrainage system will be required of the Contractor.

C. The Contractor shall have a minimum of five years experience within the last 10 years in construction dewatering installations of similar type and complexity as is required for the project.

D. The Contractor shall perform any and all preparatory work at no additional cost to the Owner to discover, protect, maintain, relocate, and restore existing and new site improvements (i.e., utilities). The Contractor shall include and incorporate the findings of this preparatory work on his/her submittals.

1.7 SUBMITTALS

A. The Contractor shall submit the following information to the Architect at least two (2) weeks prior to beginning excavation and predrainage,

1. Shop drawings showing arrangements, locations and depths of the dewatering system, berms, ditches, sump locations, etc. and discharge lines.
2. Capacities of pumps and standby equipment.
3. Detailed description of equipment, materials, sequence and procedures for installation, operation and maintenance, in relation to proposed sequence of excavation, temporary lateral support systems and backfilling.
4. Revisions to shop drawings, as necessary to accommodate field conditions and comply with design criteria.

PART 2 - MATERIALS

A. Filter sand or other materials used to prevent the loss of fine grained soil around the pumps shall consist of standard Ottawa sand or equivalent, in accordance with ASTM Designation C-778.

PART 3 - EXECUTION

3.1 GERNERAL

A. The Contractor shall control surface water and groundwater such that excavation to final grade and subgrade preparation are made in-the-dry, the bearing soils are maintained firm and undisturbed and softening and/or disturbance due to the presence of seepage of water does not occur. All subsequent construction and backfilling shall proceed in-the-dry and floatation of completed portions of the structure shall be prohibited.

3.2 SURFACE WATER CONTROL

A. The Contractor shall construct a surface water control system as necessary to intercept and divert precipitation and runoff away from the excavation. The system shall be removed when the excavation backfill is completed, or as approved by the Architect.

3.3 WATER LEVEL CRITERIA

A. The Contractor's attention is directed to data, which indicate that groundwater levels prior to construction are up to 6 feet or more above the lowest excavation level. The Contractor shall be required to lower the groundwater to at least 1 foot below the lowest excavation for the building and other site improvements and to maintain this level until dewatering is no longer required.

B. Water levels shall subsequently be maintained so as to prohibit floatation of completed portions of the structure.

C. Water level criteria are applicable to all saturated soils below the final excavation level, within the plan limits of the excavation.

D. The Contractor shall maintain water levels below the maximum levels specified until completion and backfilling of utility trenches, completion and start up of the perimeter and underslab drainage system for the building and other site improvements.

3.4 DESIGN AND INSTALLATION OF DEWATERING AND PREDRAINAGE SYSTEM

A. Design and installation of the dewatering system shall be compatible with the Contractor's design for rammed aggregate piers, excavation and temporary lateral support systems and utility construction.

B. The dewatering system shall be installed in accordance with shop drawings submitted to the Architect for review.

C. The dewatering system shall de designed and installed to provide water level control as specified. The system shall be modified, at no additional cost to the Owner, in the event that water level criteria cannot be achieved. Proposed modifications shall be submitted to the Architect for review.

D. Sumps and pumps shall be installed with suitable filters and other provisions necessary to prevent migration or piping of soil fines.

E. The Contractor shall locate the dewatering system components to minimize interference with other construction operations.

F. The Contractor shall install the system in a manner, which does not cause loss of ground, or affect stability of existing or future construction.

G. The Contractor shall provide adequate protection from erosion from any of the dewatering operations utilized during the course of the construction. Any damage, disruption or interference to newly constructed work or existing properties, buildings, structures, streets, utilities and/or other work resulting directly or indirectly from dewatering operations conducted under this Contract shall be remedied by the Contractor to the satisfaction of the Architect, at no cost to the Owner.

H. The Contractor shall provide such additional treatment of dewatering discharge as may be required to meet the provisions of the Contract. This may include the construction of sumps and/or settling basins, stone rip-rap, silt fences or other requirements. They shall be provided and later removed and/or filled in with acceptable backfill material, and restored to original conditions once they are no longer needed, at no additional cost to the Owner.

3.5 STANDBY EQUIPMENT

A. The Contractor shall be equipped with standby pumps and power generating equipment, in order to maintain continuous operation of the dewatering and predrainage system in the event of a disruptive occurrence such as equipment breakdown, power outage, or vandalism.

3.6 MAINTAINING EXCAVATION IN DEWATERED CONDITION

A. The Contractor shall operate and maintain the dewatering system around-the-clock from the time of installation until approval is given by the Architect to dismantle the system or portions thereof. The system operation shall be continuous and interruptions for any reason shall not be permitted.

B. Personnel skilled in operation and maintenance of the system shall operate the dewatering and predrainage system.

C. Operation of the dewatering system shall result in no soil particles in the discharge water after the initial 24 hours of pumping.

D. When the final excavation level is obtained, surface water entering the excavation shall be controlled by drainage to sumps and removed by pumping. Surface water shall be controlled to maintain a dry, stable subgrade.

3.7 SYSTEM REMOVAL

A. When construction is complete for utility trenches and the permanent underdrain and perimeter foundation drain is operational for the building and other site improvements, as approved by the Architect, the Contractor shall remove all dewatering equipment from the site. All sumps shall be backfilled. All ditches, berms and other temporary installations required for dewatering or control of surface water shall be removed. Removal of equipment shall not cause disturbance to the existing subgrade and bearing soils.

END OF SECTION

SECTION 02450 – IMPACT™ RAMMED AGGREGATE PIERS

1 - GENERAL

1.1 GENERAL

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

C. Coordinate work with that of all other trades affecting or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.2 DESCRIPTION OF WORK

A. Work shall consist of designing, furnishing and installing Impact Rammed Aggregate Pier elements to the lines and grades designated on the project foundation plan and as specified herein. Impact Rammed Aggregate Pier (RAP) elements shall be constructed by driving a displacement mandrel to the design depth and using the enlargened rammer head to ram thin lifts of aggregate into the cavity created by the mandrel. Grouted Impact Rammed Aggregate Piers (GAP) shall be constructed by placing cement grout during the installation of RAP elements. The Impact Rammed Aggregate Pier elements shall be in a columnar-type configuration and shall be used to reinforce soils for the support of compacted structural fill and slab-on-grade floor and Grouted Impact Rammed Aggregate Piers shall be used to support high bearing pressure spread footings.

B. Provide all equipment, material, labor, and supervision to design and install Impact Rammed Aggregate Pier elements. Design shall rely on subsurface information presented in the project geotechnical report. Layout of Impact Rammed Aggregate Pier elements, footing excavation, and subgrade preparation following Impact Rammed Aggregate Pier installation is not included.

C. The Contractor shall coordinate the installation of the impact rammed aggregate piers with the Contractor's below-grade construction activities (i.e., excavation and foundation and slab construction).

1.3 APPROVED INSTALLERS

A. Installers of Impact Rammed Aggregate Pier Intermediate Foundation Systems shall have a minimum of 5 years of experience with the installation of Rammed Aggregate Pier and shall have completed at least 50 projects.

B. Installers shall be licensed by Geopier Foundation Company, Inc. and shall have demonstrated experience in the construction of similar size and types of projects. The Impact Rammed Aggregate Pier Installer shall be approved by the Owner's Engineer and must be approved two weeks prior to bid opening. The Installer shall adhere to all methods and standards described in this Specification.

C. Installers currently approved for these works are:
    1. Helical Drilling – Braintree, MA.

1.4 RELATED SECTIONS

A. Section 02145: Dewatering

B. Section 02300: Structure Earthwork

C. Section 02401: Lateral Support of Excavation

1.5 REFERENCE STANDARDS

A. Design
1. Lawton, E.C., Fox, N.S., and Handy, R.L. "Control of Settlement and Uplift of Structures Using Short Aggregate Piers." ASCE. Proceedings of In-Situ Deep Soil Improvement. ASCE National Convention, Atlanta, Georgia. October 9-13, 1994.
2. Lawton, E.C. and Fox, N.S. *"Settlement of Structures Supported on Marginal or Inadequate Soils Stiffened with Short Aggregate Piers."* ASCE. Geotechnical Special Publication No. 40: Vertical and Horizontal Deformations of Foundations and Embankments, ASCE 2, 962-974.
3. Fox, N.S. and Cowell, M. 1998. Geopier Reference Manual. Published by Geopier Foundation Company, Inc., Mooresville, NC.
4. Wissmann, K.J., Lawton, E.C., and Farrell, T.M. 1999. "Behavior of Geopier-Supported Foundation Systems During Seismic Events." Technical Bulletin No. 1. Geopier Foundation Company, Inc., Mooresville, NC.

5. Wissmann, K.J. 1999. "Bearing Capacity of Geopier-Supported Foundation Systems." Technical Bulletin No. 2. Geopier® Foundation Company, Inc., Mooresville, NC.
6. Wissmann, K.J., Caskey, J.M., and FitzPatrick, B.T. 2001. "Geopier® Uplift Resistance." Technical Bulletin No. 3. Geopier® Foundation Company, Inc., Mooresville, NC.
7. Wissmann, K.J., FitzPatrick, B.T., and Lawton, E.C. 2001. "Geopier® Lateral Resistance." Technical Bulletin No. 4. Geopier® Foundation Company, Inc., Mooresville, NC.
8. Wissmann, K.J., Moser, K., and Pando, M.A. 2001. "Reducing Settlement Risks in Residual Piedmont Soils Using Rammed Aggregate Pier Elements." Proceedings, ASCE Specialty Conference. Blacksburg, VA. June 9-13.
9. Minks, A.G., Wissmann, K.J., Caskey, J.M., and Pando, M.A. 2001. "Distribution of Stresses and Settlements Below Floor Slabs Supported by Rammed Aggregate Piers." Proceedings, 54th Canadian Geotechnical Conference. Calgary, Alberta. September 16-19.
10. FitzPatrick, B.T. and Wissmann, K.J. 2002. "Geopier® Shear Reinforcement for Global Stability and Slope Stability." Technical Bulletin No. 5. Geopier® Foundation Company, Inc., Mooresville, NC.
11. Hall, K., Wissmann, K.J., Caskey, J.M., and FitzPatrick, B.T. 2002. "Soil Reinforcement Used to Arrest Bearing Capacity Failure at Steel Mill." Proceedings of the 4th International Conference on Ground Improvement Techniques. Kuala Lumpur, Malaysia. March 26-28.
12. FitzPatrick, B.T., Wissmann, K.J., and White, D.J. 2003. "Settlement Control for Embankments and Transportation-Related Structures Using Geopier® Soil Reinforcement." Technical Bulletin No. 6. Geopier® Foundation Company, Inc., Mooresville, NC.
13. Miller, J., FitzPatrick, B.T. and Wissmann, K.J. 2004. "Seismic Site Class Improvements using Geopier soil reinforcement." Technical Bulletin No. 7. Geopier Foundation Company, Inc., Mooresville, NC.
14. FitzPatrick, B.T. and Wissmann, K.J. 2005. "Support of Storage Tanks using Rammed Aggregate Piers." Technical Bulletin No. 8, Geopier Foundation Company, Inc., Mooresville, NC.
15. FitzPatrick, B.T. and Wissmann, K.J. 2006. "Vibration and Noise Levels." Technical Bulletin No. 9, Geopier Foundation Company, Inc., Mooresville, NC.

B. Modulus Testing

1. ASTM D-1143 – Pile Load Test Procedures

C. Materials and Inspection

1. ASTM D-1241 – Aggregate Quality
2. ASTM D-422 – Gradation Soils

3. ASTM C-150-05 – Standard Specification for Portland Cement
4. ASTM C-939-02 – Test Method for Flow of Grout
5. ASTM C-109/C109M-05 – Compressive Strength of Cube Specimens

D. Conflicts in Specifications/References

1. Where specifications and reference documents conflict, the Architect/Engineer shall make the final determination of the applicable document.

1.6 JOB CONDITIONS

A. Prior to submitting a bid, the Contractor shall review and understand the information contained in the following report. This report is made available to the Contractor for information only and shall not be interpreted as a warranty of subsurface and/or environmental conditions whether interpreted from written text, boring logs, laboratory chemical test data or other data.
   1. "Report on Subsurface and Foundation Investigation, Proposed Village at Ocean Gate, Portland, Maine," prepared by Sebago Technics, Inc., dated October 3, 2007.

B. Available soil samples recovered from borings may be examined at the office of Sebago Technics, Inc., One Chabot Street, P.O. Box 1339, Westbrook, Maine 04098-1339. The boring information is considered to represent the conditions at the locations of test borings at the time the test borings were made. The Contractor should anticipate variations from the conditions disclosed by the borings in planning and estimating the work.

1.7 DESIGN REQUIREMENTS

Impact Rammed Aggregate Pier Design.

1. The Grouted Impact Rammed Aggregate Pier elements (GAP) shall be designed for a pier stiffness modulus of 200 pounds per cubic inch (pci). The stiffness modulus value shall each be verified by the results of Impact Rammed Aggregate Pier modulus testing, described in this specification, based on a 20-inch nominal constructed pier diameter. No specified stiffness modulus is required for Impact Rammed Aggregate Piers (RAP) since these elements are designed primarily to provide radial drainage.

2. The Impact Rammed Aggregate Pier Intermediate Foundation system shall be designed in accordance with generally-accepted engineering practice and the methods described in Section 1 of these Specifications. The design shall meet the following criteria.

Maximum Allowable Bearing Pressure	3,500 pounds per square foot psf)
Minimum Impact Rammed Aggregate Pier Area Coverage (for square Spread Footings)	20%
Estimated Total Long-Term Settlement for Footings:	≤ 1-inch
Estimated Long-Term Differential Settlement of Adjacent Footings:	≤ ½-inch

3. The design submitted by the Installer shall consider the bearing capacity and settlement of all footings and floor slabs supported by Impact Rammed Aggregate Piers, and shall be in accordance with acceptable engineering practice and these specifications. Total and differential settlement shall be considered. The design life of the structure shall be 50 years.
4. The cement mix design used in the Grouted Impact™ Rammed Aggregate Pier system shall be designed with water to cement ratio w/c of 0.65 to 1.0 (by mass). The selected w/c mix design shall have a minimum unconfined compressive strength of 500 pounds per square inch (psi) after 7 days as determined by ASTM C-109/C109M-05 – Compressive Strength of Cube Specimens.
5. The Impact Rammed Aggregate Pier system shall be designed to preclude plastic bulging deformations at the top-of–pier design stress. The results of the modulus tests shall be used to verify the design assumptions.

Design Submittal

1. The Installer shall submit 6 sets of detailed design calculations, construction drawings, and shop drawings, (the Design Submittal), for approval at least 6 weeks prior to the beginning of construction. A detailed explanation of the design parameters for settlement calculations shall be included in the Design Submittal. Additionally, the quality control test program for Impact Rammed Aggregate Pier system, meeting these design requirements, shall be submitted. All computer-generated calculations and drawings shall be prepared and sealed by a Professional Engineer, licensed in the State or Maine.

1.8 QUALITY ASSURANCE

G. Independent Engineering Testing Agency.

1. The Owner is responsible for retaining an independent engineering testing firm to provide Quality Assurance/Quality Control services.
2. The Testing Agency shall monitor the modulus tests when they are performed. The Installer shall provide and install all dial indicators and other measuring devices.
3. The Testing Agency shall monitor the installation of Impact Rammed Aggregate Pier elements to verify that the production installation practices are similar to those used during the installation of the modulus test elements.
4. The Testing Agency shall immediately report any unusual conditions encountered during installation to the Installer, Design Engineer and the General Contractor. The quality procedures shall include the preparation of Impact Rammed Aggregate Pier progress reports completed during each day of installation and containing the following information:
   a. Footing and Impact Rammed Aggregate Pier location and pier type; RAP or GAP
   b. Volume of aggregate introduced into the hopper (number of buckets
   c. Impact Rammed Aggregate Pier installation depth.
   d. Number of lifts
   e. Procedure to construct each lift
   f. Time of mandrel raising and downward densification for each lift
   g. Total pier installation time
   h. Hydraulic pressures during installation. (from installation or data record)
   i. Base diameter and height of the remaining aggregate cone formed after constructing each pier and extracting the mandrel out of the ground
   j. Volume of aggregate used for pier construction (equal to the difference between the initial volume of aggregate introduced into the hopper and the volume of unused aggregate)
   k. Initial and total volume of initial grout added to mandrel at each GAP
   l. Grout mix design and pumping rate
   m. Results of grout consistency flow cone testing (as required)
   n. Planned and actual Impact Rammed Aggregate Pier elevations at the top and bottom of the element (based on installation depth)
   o. Type and size of hammer equipment used
   p. Aggregate description
   q. Record of flow rates of water or compressed air pressure (if applicable)

r. Documentation of any unusual conditions encountered

H. Modulus Test

1. A modulus test shall be performed to verify the parameter values selected for design of both Rammed Aggregate Piers (RAP) and Grouted Aggregate Piers (GAP). The modulus tests shall be of the type and installed in a manner specified herein.
   a. Prior to or after the installation of the modulus test pier, a 2-foot diameter hole shall be drilled to a depth equal to the depth of embedment on the project (typically 2- to 3-feet). The drilled hole will provide a location for the concrete cap.
   b. The test pier shall be installed in the center of the drilled hole in the same manner as the production piers.
   c. ASTM D-1143 general test procedures shall be used as a guide to establishing load increments, load increment duration, and load decrements.
   d. With the exception of the load increment representing approximately 115% of the design maximum top of Impact Rammed Aggregate Pier stress, all load increments shall be held for a minimum of 15 minutes, a maximum of 1 hour, and until the rate of deflection reduces to 0.01 inch per hour, or less.
   e. The load increment that represents approximately 115% of the design maximum stress on the Impact Rammed Aggregate Pier shall be held for a minimum of 15 minutes, a maximum of 4 hours and until the rate of deflection reduces to 0.01 inches per hour or less.
   f. A seating load equal to 5 percent of the total load shall be applied to the loaded steel plate prior to application of load increments and prior to measurement of deflections to compensate for surficial disturbance.
   g. Modulus testing shall be performed in accordance with the requirements outlined in the Design Submittal.
   h. The location of the modulus testing should be coordinated with the project Geotechnical Engineer of record.
   i. The modulus test pier shall be installed in a manner that will be consistently used throughout the project. The details of the installation procedure shall be recorded by the Quality Control Representative as described above.

I. The Contractor shall provide sufficient notice to the Testing Agency to allow the Testing Agency to be present to observe the Work. The Contractor shall cooperate with the Testing Agency in all respects to facilitate any testing or observations.

J. The presence of the Testing Agency shall not relieve the Contractor of its responsibility to perform the work in accordance with the Contract

Documents, nor shall it be construed to relieve the Contractor from full responsibility for the means and methods of construction, protection of all site improvements against damage, and for safety on the construction site.

K. The Contractor shall adhere to the applicable requirements of the Standard Specifications, OSHA Standards, and to all other applicable ordinances, codes, statutory rules, and regulations of federal, state, and local authorities having jurisdiction over the Work of this Section.

L. The Contractor shall conduct testing and instrumentation monitoring at no additional cost to the Owner.

M. The Contractor shall perform any and all preparatory work at no additional cost to the Owner to discover, protect, maintain, relocate, and restore existing and new site improvements (i.e., utilities). The Contractor shall include and incorporate the findings of this preparatory work on his/her submittals.

1.9 SUBMITTALS

A. General
1. The Contractor shall forward submittals to the Architect a minimum of 3 weeks prior to any planned work related to the Contractor's submittals.
2. The time period(s) for submittals are the minimum required by the Architect to review, comment, and respond to the Contractor. The Architect may require resubmission(s) for various reasons. The Contractor is responsible for scheduling specified submittals and resubmittals so as to prevent delays in the work.
3. The Contractor's submittals shall be reviewed and accepted by the Architect prior to conducting any work.
4. The Contractor's submittals shall be prepared and stamped by a Professional Engineer(s) licensed in the State of Maine, retained by the Contractor. The Contractor's Professional Engineer(s) shall have a minimum of 5 years' experience in the design and performance of impact rammed aggregate piers similar to those required for this project.
5. Acceptance of the Contractor's submittals by the Architect does not relieve the Contractor of the responsibility for the adequacy, safety, and performance of the Work.

B. The Contractor shall provide the following submittals regarding the impact rammed aggregate piers:
1. The Installer shall submit detailed design calculations and construction drawings prepared by the Impact Rammed Aggregate Pier Designer (the Designer) to the Owner or Owner's Engineer for approval at least

3 weeks prior to the start of construction. All plans shall be sealed by a Professional Engineer licensed in the State of Maine.

2. The Impact Rammed Aggregate Pier Designer shall have Errors and Omissions design insurance for the work. The insurance policy should provide a minimum coverage of $2 million per occurrence.
3. Modulus test data - The Installer shall furnish the General Contractor a description of the installation equipment, installation records, complete test data, analysis of the test data and recommended design parameter values for RAP and GAP based on the modulus test results. The report shall be prepared under supervision of a registered professional engineer licensed in the State of Maine.
4. Daily Impact Rammed Aggregate Pier Progress Reports – The Installer shall furnish a complete and accurate record of Impact Rammed Aggregate Pier installation to the General Contractor. The record shall indicate the pier location, length, volume of aggregate and cement grout used, densification forces during installation, and final elevations or depths of the base and top of piers. The record shall also indicate the type and size of the installation equipment used, and the type of aggregate and cement grout used. The Installer shall immediately report any unusual conditions encountered during installation to the General Contractor, to the Designer and to the Testing Agency.

PART 2 - PRODUCTS

2.1 MATREIALS

A. Aggregate used for Impact Rammed Aggregate Pier construction shall be #57 stone, or shall be other open-graded aggregate with a maximum nominal particle size of 1.5-inches and minimum nominal particle size of 0.5-inches selected by the Installer and successfully used in the modulus test. The aggregate must pass the flow rate tests described in section 3.1 below.

B. Cement shall be Type II Portland Cement.

C. To facilitate construction in soft or loose soils, the maximum particle size aggregate of 2 inches or larger may be used provided the flow of the aggregate is verified at the site with flow tests, the performance is verified with the modulus test and the Designer approves the type and gradation of the aggregate.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Installation of Demonstration Piers and Flow Tests.
   1. The installer shall install a minimum of three initial “demonstration piers” to provide project-specific construction procedures prior to installing the

modulus test pier or production piers. The demonstration pier installation shall be used to determine driving depths, the rate of mandrel withdrawal during the compaction process, appropriate flow of selected aggregate and grout out of the mandrel, the required initial and total volume of grout, and check grout consistency by flow cone testing. The results of the demonstration program shall be used to establish the site-specific installation criteria for the installation of production piers. The installation of the Demonstration Piers shall be observed and the details recorded by the Installer's Control Technician.

3.2 INSTALLATION PROCEDURES

A. A sacrificial tip shall be installed at the bottom of the mandrel prior to penetrating the mandrel into the ground.

B. The mandrel (and sacrificial tip) shall be driven to the design depth using crowd force and impact energy.

C. At Grouted Impact Aggregate Pier (GAP) locations, an initial volume of grout shall be pumped into the mandrel prior to filling the mandrel and hopper with aggregate. The initial volume of grout shall be sufficient to create a head of grout inside the mandrel that, following the placement of aggregate inside the mandrel (displacing the grout), is equivalent to or greater than the hydrostatic water head outside of the mandrel. Attachment B provides guidelines for the minimum required volume of initial grout based on inside diameter of the mandrel and the hydrostatic head on the outside of the mandrel at the maximum penetration depth.

D. The mandrel and hopper shall be filled with aggregate.

E. The impact hammer shall begin operation and remain in operation during the raising of the mandrel. The impact hammer may remain in operation during the lowering of the mandrel depending on the specific installation procedures established at the site.

F. The pier shall be constructed by raising the mandrel 3 feet and then driving the mandrel 2 feet using vertical impact energy and crowd pressure to construct an approximate 1-foot thick compacted lift. The mandrel shall be raised at a rate determined from the demonstration pier testing or no faster than 1 foot in 5 seconds. The crowd pressure shall be recorded to provide a measure of the vertical densification force as the mandrel is drive on its compaction stroke. Additional impact ramming and/or alternative lift heights and lowering depths, may be used as appropriate for the project site upon approval by the Designer.

G. Subsequent lifts shall be constructed following the same procedure described above until the pier is constructed to the top of pier elevation.

H. At RAP element locations, water or compressed air shall be used if necessary, as determined from the flow test, to enhance free flow of aggregate through the mandrel as determined during the performance of a flow test. Water or air flow shall be discontinued when the mandrel reaches the 3-foot raise height.

I. At GAP element locations, Grout shall be pumped continuously at a rate of about 20 gallon per minute during construction of the Grouted Impact RAP until the total required volume of grout has been pumped into the mandrel. The required volume of grout may be verified during the demonstration pier installations by performing test pits or drilling out the top of the demonstration piers where the constructed grouted shaft length of the pier will be located below existing grade. Adjustment may include, but are not limited to, increasing the rate of pumping, decreasing the speed of construction, increasing the total volume of grout, or decreasing the total volume of grout. Revisions to the installation procedures based on the demonstration pier installations shall be documented and discussed with the Designer and QA representative, and shall be provided in writing to the Designer.

J. At the completion of the pier installation, the hammer shall be turned off and the mandrel pushed downward applying full crowd pressure on the top of the pier to provide preloading.

K. At completion of the pier installation, the remaining stone in the mandrel may be emptied outside the pier location to allow for a measure of the remaining volume of aggregate.

3.3 DENSIFICATION

A. Special high-energy impact densification apparatus shall be employed to densify the Impact Rammed Aggregate Pier elements during installation. The apparatus shall apply direct vertical impact energy to each constructed lift of aggregate.

C. Densification shall be performed using a beveled tamper. The beveled tamper foot is required to adequately increase the lateral earth pressure in the matrix soil during installation.

C. Downward crowd pressure shall be constantly applied to the tamper shaft during tamping.

3.4 PLAN LOCATION AND ELEVATION OF IMPACT RAMMED AGGREGATE PIER ELEMENTS

A. The center of each pier shall be within six inches of the locations indicated on the plans. Piers installed outside of the above tolerances and deemed not acceptable shall be rebuilt at no additional expense to the Owner.

3.5 REJECTED IMPACT RAMMED AGGREGATE PIER ELEMENTS

A. Impact Rammed Aggregate Pier elements improperly located or installed beyond the maximum allowable tolerances shall be abandoned or reinstalled with new piers, unless the Designer approves other remedial measures. All material and labor required to replace rejected piers shall be provided at no additional cost to the Owner, unless the cause of the rejection is due to an obstruction.

SECTION 02300 – STRUCTURE EARTHWORK

PART 1 - GENERAL

1.1 GENERAL

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

C. Coordinate work with that of all other trades affecting or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.2 DESCRIPTION OF WORK

A. This section includes all excavating, filling backfilling and removal of materials.

1.3 RELATED SECTIONS

A. Section 02145: Dewatering

B. Section 02401: Lateral Support of Excavation

C. Section 02450: Rammed Aggregate Piers

1.4 PROTECTION

A. Paved surfaces: Do not operate equipment on paved surfaces which will damage these surfaces.

B. Maintain excavations with approved barricades, lights and signs to protect life and property until excavation is filled and graded to a condition acceptable to the Owner.

C. Protect structures, utilities, sidewalks, pavements and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations

D. Locate and clearly flag trees and vegetation to remain or to be relocated. Obtain approval from Architect before clearing operations begin

E. Tree Protection:

1. Erect and maintain temporary fencing around tree protection zones before starting site clearing. Remove fence when construction is complete.
2. Do not store construction materials, debris, or excavated material within protection area.
3. Do not permit vehicles, equipment, or foot traffic within protection area.
4. Maintain protection area free of weeds and trash.
5. Where excavation for new construction is required within tree protection zones, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.
    a. Cover exposed roots with burlap and water regularly.
    b. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
    c. Coat cut faces of roots more than 1-1/2inches (38 mm) in diameter with an emulsified asphalt or other approved coating formulated for use on damaged plant tissues.
    d. Backfill with soil as soon as possible.

1.5 JOB CONDITIONS

A. Prior to submitting a bid, the Contractor shall review and understand the information contained in the following report. This report is made available to the Contractor for information only and shall not be interpreted as a warranty of subsurface and/or environmental conditions whether interpreted from written text, boring logs, laboratory chemical test data or other data. "Report on Subsurface and Foundation Investigation, Proposed Village at Ocean Gate, Portland, Maine," prepared by Sebago Technics, Inc., dated October 3, 2007.

B. Available soil samples recovered from borings may be examined at the office of Sebago Technics, Inc., One Chabot Street, P.O. Box 1339, Westbrook, Maine 04098-1339. The boring information is considered to represent the conditions at the locations of test borings at the time the test borings were made. The Contractor should anticipate variations from the conditions disclosed by the borings in planning and estimating the work.

C. Prior to excavation, verify the underground utilities, pipes, structures, and facilities. Maine Dig-Safe law requires 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. Do not assume someone else will make the call.

3. 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.
4. 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.
5. Re-notify Dig Safe and the non-member utilities if the digging does not occur within 30 calendar days, or if the marks are lost due to weather conditions, site work activity or any other reason.
6. 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.
7. Dig Safe requirements are in addition to town, city and/or state DOT street opening permit requirements.
8. For complete Dig Safe requirements, call the PUC or visit their website.
9. 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.
10. 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.

1.6 QUALITY ASSURANCE

A. Standards:

b. "Standard Specification for Highways and Bridges" revision of April 1995, Maine Department of Transportation (abbreviated as MDOT "Standard Specification").

c. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM E 548.

d. Pre-excavation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.7 SUBMITTALS

A. Test Reports: Submit the following:
Reports on material gradations and compaction testing.

B. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that

might be misconstrued as damage caused by earthwork operations. Submit before earthwork begins.

PART 2 - MATERIALS

2.1 GENERAL

A. Suitable materials: As shown on the Drawings or as specified.

B. Unsuitable materials: Material containing excessive plastic clay, vegetation, organic matter, debris, pavement, stones or boulders over 6 inches in greatest dimension, and frozen material. Material which, in the opinion of the Geotechnical Engineer or Architect, will not provide a suitable foundation or subgrade.

C. On-Site Material: Any suitable material from on-site excavation.

D. Material for embankments and general fills may contain pieces of excavated ledge having a greatest dimension of up to 8 inches if approved by the Geotechnical Engineer.

E. Testing: The owner may inspect off-site sources of materials and order tests of these materials to verify compliance with these specifications. Provide a gradation analysis on any imported material or material processed on site.

2.2 Base and Subbase:

A. Aggregate Subbase Material: sand or gravel meeting the requirements of Maine Department of Transportation Standard Specifications Section 703.06(b), Type D.

Sieve Size	% Passing by Weight
4"	100
¼"	25-70
No. 40	0-30
No. 200	0-7

B. Aggregate Base Materials: Screened or crushed gravel meeting the requirements of MDOT Standard Specifications Section 703.06(a), Type A.

Sieve Size	x % Passing by Weight
2"	100
½"	45-70
¼"	30-55
No. 40	0-20
No. 200	0-5

C. Sand: Sieve analysis by weight:

Sieve Size	x % Passing by Weight
3/8"	100
No. 4	95 – 100
No. 16	50 - 85
No. 100	2 - 10

D. Crushed Stone: Durable, clean angular rock fragments obtained by breaking and crushing rock material. Crushed stone for underdrain shall be durable, washed angular rock fragments. Sieve analysis by weight.

Sieve Size	x % Passing by Weight
2"	100
1½"	95 - 100
3/4"	35 - 70
3/8"	10 - 30
No. 4	0 - 5

E. 3/4" Crushed Stone: Durable, clean angular rock fragments obtained by breaking and crushing rock material. 3/4" Crushed stone for underdrain shall be durable, washed angular rock fragments. Sieve analysis by weight.

Sieve Size	x % Passing by Weight
1"	100
3/4"	95-100
1/2"	35-70
3/8"	0-25

F. Refill Material: Crushed stone for refilling excavation below grade or unless otherwise directed by the Geotechnical Engineer.

G. Common Borrow: Inorganic mineral soil suitable for embankment construction free from frozen material, perishable rubble, peat and other unsuitable material.

H. Select fill: Use aggregate material for fill operations. Sieve analysis by weight.

Sieve Size	ax % Passing by Weight
4"	100
3"	90 - 100
¼"	25 - 90
No. 40	0 - 30
No. 200	0 - 5

I. Granular Fill: Well-graded material for fill operations. Sieve analysis by weight.

Sieve Size	ax % Passing by Weight
6"	100
3"	80 - 100
No. 200	0 - 40

J. Structural Fill: Hard, durable sandy gravel to gravelly sand containing only particles passing the 3" sieve. Sieve analysis by weight.

Sieve Size	ax % Passing by Weight
6"	100
No. 4	30 - 90
No. 40	10 - 50
No. 200	0 - 8

K. Filter Fabric below Crushed Stone: Shall consist of a non-woven fabric having a minimum weight of 6 ounces per square yard similar to Mirafi 160N or equivalent.

PART 3 - EXECUTION

3.1 EXCAVATION

A. General: Remove all materials encountered to the limits shown on the drawings, or designated in the Specifications.
   1. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.
      a. All previous construction, including foundations, walls, floor slabs and abandoned utilities, shall be removed from within the limits of the building.

B. Earth Excavation: Removal and disposal of pavements and other obstructions visible on ground surface, underground structures and utilities

indicated to be demolished and removed, and other materials encountered that are not classified as unauthorized excavation.

1. Conform to elevations and dimensions shown within a tolerance of plus or minus 1-inch, and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection.
2. Excavations for Footings and Foundations: Bearing surfaces for footings shall be protected by 3-inch thick lean concrete mud mats or non-woven geotextile fabric and a minimum of 6 inches of ¾-inch crushed stone. Do not disturb bottom of excavation. Excavate by hand or using equipment with smooth edged buckets to 3 inches below bottom of foundation if using concrete mud mats or 6 inches below bottom of foundation if using geotextile filter fabric and ¾-inch crushed stone before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work. Loose, softened or disturbed material due to construction traffic or replacement of reinforcement shall be removed prior to placement of concrete.
3. 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.
4. Excavation beyond the design limits, made without authorization from the Owner or Architect, will be refilled with structural fill material compacted to 95% maximum dry density at the Contractor's expense.
5. Bearing surfaces for slabs shall be protected by non-woven geotextile fabric and a minimum of 12 inches of ¾-inch crushed stone. Excavate the area within the building lines to 12 inches below the underside of the concrete floor slab and replace with filter fabric and crushed stone as noted above.
6. The subgrade soil is susceptible to disturbance from construction traffic. Equipment and personnel should not be permitted to travel across exposed footing bearing surfaces or exposed slab subgrades. Any subgrade areas that are disturbed shall be excavated and replaced with non-woven filter fabric and ¾-inch crushed stone. Final excavation to subgrade should be performed using equipment with smooth edge buckets.
7. If bearing is not suitable at levels shown on the Drawings, within the design limits, the Architect shall be notified so that adjustments in level or changes may be made immediately. The Architect will determine the extent of excavation of unsuitable material. Payment for excavation of unsuitable material, beyond the design limits, and replacement with crushed stone will be made under the unit price listed in the Bid Form, when the excavation has received prior approval from the Owner or Architect.

8. All previous construction, including foundations, walls, floor slabs and abandoned utilities which extend below subgrade, shall be removed from within the limits of the building and be replaced with filter fabric and ¾-inch crushed stone.
9. Prevent freezing of the subgrade soils inside the building lines. Freezing of these soils beneath footings and slabs may result in frost heaving or post-construction settlement. If frost penetration occurs, the native soil and overlying fill affected should be removed and replaced, as directed by the Geotechnical Engineer.

C. Excavation of Unsuitable Materials:
1. When excavation has reached required subgrade elevations, notify Architect who will make an inspection of conditions. If unsuitable bearing materials are encountered at required subgrade elevations, carry excavations deeper as directed by Geotechnical Engineer and replace excavated material with fabric and ¾-inch crushed stone.
2. Removal of unsuitable material and its replacement as directed will be paid for as detailed in the Contract,

3.2 SUBGRADE INSPECTION

A. Notify Architect when excavations have reached required subgrade

B. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
7. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

C. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.

3.3 STABILITY OF EXCAVATIONS

A. Slope sides of excavations or provide temporary excavation support to comply with OSHA regulations and local codes. Shore and brace where sloping is not possible because of space restrictions or stability to material excavated as specified in Section 02401 – Lateral Support of Excavation.

3.4 DEWATERING

A. Perform all work in the dry. Prevent surface water and subsurface or groundwater from flowing into excavations and from flooding project site and surrounding area.

B. Do not allow water to accumulate in excavations. Control water levels to at least one foot below subgrade elevation. Provide and maintain pumps, dewatering system components necessary to convey water away from excavations as specified in Section 02145 – Dewatering.

3.5 BACKFILL AND FILL

A. General:
   1. Place acceptable soil material in layers to required subgrade elevations as shown on the Drawings and as listed below such that required density is achieved throughout each lift.
   2. Place and compact fill material in layers to required elevations as follows:
      a. Under walks and pavements, use base and subbase material.
      b. Adjacent to exterior walls, use structural fill.
      c. Under footings, use lean concrete mud mats or fabric and ¾-inch crushed stone.
      d. Under building slabs, use fabric and ¾-inch crushed stone.

B. Fill, backfill and compact to produce minimum subsequent settlement of the material and provide adequate support for the surface treatment or structure to be placed on the material. Place material in approximately horizontal layers beginning at lowest area to be filled. Do not impair drainage:

C. Backfill, General: Backfill excavations as promptly as work permits, but not until completion of the following:
   1. Acceptance of construction below finish grade including, installation of perimeter foundation drain, dampproofing, waterproofing, and perimeter insulation.
   2. Installation, inspection and recording locations of underground utilities.
   3. Removal of concrete formwork.
   4. Removal of shoring and bracing, and backfilling of voids with satisfactory materials. Cut off temporary sheet piling driven below bottom of structures and remove in manner to prevent settlement of the structure or utilities, or leave in place if required.
   5. Removal of trash and debris.
   6. Permanent or temporary horizontal bracing is in place on horizontally supported walls.
   7. Backfill cast-in-place concrete structures when the concrete has developed adequate strength as determined by the Architect.
   8. Use care in backfilling to avoid damage or displacement of underground structures and pipe.

D. Placement:

1. Place backfill and fill materials in layers not more than 8" in loose depth for material compacted by heavy compaction equipment and not more than 6" in loose depth for material compacted by hand-operated tampers.
2. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice. Place backfill and fill materials evenly adjacent to structures to required elevations.
3. Take care to prevent wedging action of backfill against structures by carrying material uniformly around structure to approximately same elevation in each lift.
4. Do not allow heavy machinery within 5 feet of structure during backfilling and compacting.

E. Backfill of Structures:

1. Exterior foundation walls shall be backfilled with compacted structural fill. Compacted structural fill shall extend laterally a minimum of 2 feet from the wall. Backfill beyond this limit on the exterior of the building may consist of common fill.
2. The top 12 inches of fill on the exterior of the building shall consist of low permeability material or pavement to minimize water infiltration next to the building. Grading shall provide for runoff away from the building.
3. Compacted structural fill should be placed in layers not exceeding eight (8") inches in loose measure and compacted by self propelled vibratory equipment at the approximate optimum moisture. In confined areas, the maximum particle size shall be reduced to three (3) inches and the loose layer thickness should be reduced to six (6) inches and compaction performed by hand-guided vibratory equipment.
4. A filter fabric and a minimum of twelve (12) inches of ¾-inch crushed stone fill are placed below the on-grade floor slabs.
5. A minimum 3-inch thick lean concrete mud mat or filter fabric and a minimum six (6) inches of ¾-inch crushed stone shall be placed below footings.
6. The existing soils are not suitable for reuse as sub-slab or foundation wall backfill.

3.6 COMPACTION:

A. Methods:

1. Use methods which produce the required degree of compaction throughout the entire depth of material placed without damage to new or existing facilities and which are approved by the Architect.

2. Moisture Control: Uniformly moisten or aerate each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content. Remove and replace, or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight. Adjust moisture content of soil as required to achieve specified compaction. Remove and replace material which is too wet to compact to required density.

B. Degree of Compaction

1. Compact each layer of fill and slopes as work progresses. Compact to the following minimum densities:

FILL AND BACKFILL LOCATION	DENSITY
Crushed stone fill	100%
Beside structure foundation walls	95%
Pipe Bedding	92%

2. Maximum density: ASTM D1557, modified.
3. Field density tests: ASTM D1556 (sand cone), ASTM D2167 (rubber balloon), or ASTM D2922 (nuclear methods). ASTM C-29 (dry rodded unit weight) for crushed stone fill.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.

C. Allow testing agency access to off-site sources of materials for compliance verification. 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.

D. 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.

E, 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.

F. 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.

G. The Contractor shall bear cost of retesting when initial test results indicate non-compliance with specifications, or when alternate sources are submitted.

H. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. ASTM C-29 (dry rodded unit weight) for crushed stone fill.

I. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.8 DISPOSAL OF EXCESS MATERIALS:

A. Removal from Owner's Property:
1. Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.
2. Keep roads free of rocks, soil, trash, and debris. Use suitable watertight vehicles for hauling wet materials over roads and streets. Clean up materials dropped from or spread by vehicles promptly or when directed by the Architect.

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 Architect immediately. The State Bureau of Oil and Hazardous Waste Control shall 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, and will be paid for by appropriate change order.

END OF SECTION