City of Nashua, New Hampshire
Division of Public Works

# CSO-004 Infrastructure Improvements Burke Street Phase 2

## Contract Documents – Bid Set

## VOLUME 1 OF 1

THE STATE OF NEW HAMPSHIRE
BRUCE W. PIERSTORFF
No. 5204
LICENSED
PROFESSIONAL ENGINEER
02/26/15


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Prepared For:
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Division of Public Works
9 Riverside Street
Nashua, NH 03062

**March 2015**

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# for
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# in
# New Hampshire

**These documents apply to construction contracts funded by:**

***NH Department of Environmental Services State Aid Grant (SAG) Program***

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# A. BIDDING REQUIREMENTS

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# ADVERTISEMENT FOR BIDS

City of Nashua, New Hampshire
Owner

229 Main Street, City Hall, Nashua, NH 03060
Address

Separate sealed BIDS for the construction of

Lining and replacement of existing service and storm drain lateral connections on Burke Street, replacement of existing catch basins, modification of existing catch basins and road surface improvements, as outlined in the contract drawings.

will be received by Central Purchasing, 229 Main Street, City Hall, Nashua, NH 03060
at the office of Purchasing Department
until 3pm, (Standard Time-Daylight Savings Time) April 3, , 2015 and then at said office publicly opened and read aloud.

1. Completion time for the project will be calculated as calendar days from the date specified in the "Notice to Proceed" as follows:

   180 calendar days for substantial completion.
   200 calendar days for final completion.

   Liquidated damages will be in the amount of $ 500 for each calendar day of delay from the date established for substantial completion, and $ 1,000 for each calendar day of delay from the date established for final completion.

2. Each General Bid shall be accompanied by a Bid Security in the amount of 5% of the Total Bid Price.

3. The successful Bidder must furnish 100% Performance and Payment Bonds, and will be required to execute the Contract Agreement within 10 days following notification of the acceptance of his Bid.

4. Any contract or contracts awarded under this Advertisement for Bids are expected to be funded in whole or in part by:

   [ ] a loan from the NH State Water Pollution Control Revolving Loan Fund (CWSRF)
   [ ] a loan from the NH State Drinking Water Revolving Loan Fund (DWSRF)
   [ x ] a grant from the NH Department of Environmental Services (SAG)
   [ ] a loan or grant from USDA Rural Development
   [ ] a grant from the NH Office of Energy and Planning (CDBG)

5. No Bidder may withdraw a Bid within 60 days after the actual date of opening thereof.

The Contract Documents may be examined at the following locations:

| |
|---|
| -Hazen and Sawyer, P.C. 24 Federal Street, 5th Floor, Boston MA 02110 (between 9:00 am |
| and 4:00 pm Monday through Friday, except legal holidays, by appointment only) |
| -Construction Summary of NH, ME and VT Manchester NH Plan Room 734 Chestnut |
| Street, Manchester, NH 03104-3001 |

| | |
|---|---|
| Electronic copies of the Contract Documents may be viewed at | www.nashua.gov – Citizen Favorites-Current Bid Opportunities-Document IFB0196-040315 |

**INFORMATION FOR BIDDERS**

{For contracts utilizing State Aid Grant funding assistance only

BIDS will be received by City of Nashua, New Hampshire

(herein called the "OWNER"), at Central Purchasing, Lower Level, 229 Main Street, City Hall, Nashua, NH 03060 at the office of the Purchasing Manager

until March 31, 2015, 3 pm, (Eastern Standard Time-Daylight Savings Time) and then at said office publicly opened and read aloud.

Each BID must be submitted in a sealed envelope, addressed to:

City of Nashua New Hampshire, Attention Purchasing at Lower Level,229 Main Street, City Hall, Nashua, NH 03060

Each sealed envelope containing a BID must be plainly marked on the outside as BID

for Infrastructure Improvements at CSO 004 – Burke Street Phase 2 and the envelope should bear on the outside the BIDDER's name, address, and license number if applicable and the name of the project for which the BID is submitted. If forwarded by mail, the sealed envelope containing the BID must be enclosed in another envelope addressed to the OWNER at

Lower Level, 229 Main Street, City Hall, Nashua, NH 03060 Attention: Purchasing Manager

All BIDS must be made on the required BID form. All blank spaces for BID prices must be filled in, in ink or typewritten, and the BID form must be fully completed and executed when submitted. Only one copy of the BID form is required.

The OWNER may waive any informalities or minor defects or reject any and all BIDS. Any BID may be withdrawn prior to the above scheduled time for the opening of BIDS or authorized postponement thereof. Any BID received after the time and date specified shall not be considered. No BIDDER may withdraw a BID within 60 days after the actual date of the opening thereof. Should there be reasons why the contract cannot be awarded within the specified period, the time may be extended by mutual agreement between the OWNER and the BIDDER.

BIDDERS must satisfy themselves of the accuracy of the estimated quantities in the BID SCHEDULE by examination of the site and a review of the drawings and specifications including ADDENDA. After BIDS have been submitted, the BIDDER shall not assert that there was a misunderstanding concerning the quantities of WORK or of the nature of the WORK to be done.

The OWNER shall provide to BIDDERS prior to BIDDING, all information which is pertinent to, and delineates and describes, the land owned and rights-of-way acquired or to be acquired.

The CONTRACT DOCUMENTS contain the provisions required for the construction of the PROJECT. Information obtained from an officer, agent, or employee of the OWNER or any other person shall not affect the risks or obligations assumed by the CONTRACTOR or relieve him from fulfilling any of the conditions of the contract.

Each BID must be accompanied by a BID BOND payable to the OWNER in the amount of five percent (5%) of the total amount of the BID. As soon as the BID prices have been compared, the OWNER will return the BONDS of all except the three lowest responsible BIDDERS. When the AGREEMENT is executed, the BONDS of the two remaining unsuccessful BIDDERS will be returned. The BID BOND of the successful BIDDER will be retained until the PAYMENT BOND and PERFORMANCE BOND have been executed and approved, after which it will be returned. A certified check may be used in lieu of a BID BOND.

A PERFORMANCE BOND and a PAYMENT BOND, each in the amount of 100 percent of the CONTRACT PRICE, with a corporate surety approved by the OWNER, will be required for the faithful performance of the contract.

Attorneys-in-fact who sign BID BONDS or PAYMENT BONDS and PERFORMANCE BONDS must file with each BOND a certified and effective dated copy of their power of attorney.

The party to whom the contract is awarded will be required to execute the AGREEMENT and obtain the PAYMENT BOND and PERFORMANCE BOND within ten (10) calendar days from the date when NOTICE OF AWARD is delivered to the BIDDER. The NOTICE OF AWARD shall be accompanied by the necessary AGREEMENT and BOND forms. In case of failure of the BIDDER to execute the AGREEMENT, the OWNER may at his option consider the BIDDER in default, in which case the BID BOND accompanying the proposal shall become the property of the OWNER.

The OWNER within ten (10) days of receipt of acceptable PAYMENT BOND, PEERFORMANCE BOND and AGREEMENT signed by the party to whom the AGREEMENT was awarded shall sign the AGREEMENT and return to such party an executed duplicate of the AGREEMENT. Should the OWNER not execute the AGREEMENT within such period, the

BIDDER may by WRITTEN NOTICE withdraw his signed AGREEMENT. Such notice of withdrawal shall be effective upon receipt of the notice by the OWNER.

The NOTICE TO PROCEED shall be issued within ten (10) days of the execution of the Agreement by the OWNER. Should there be reasons why the NOTICE TO PROCEED cannot be issued within such period, the time may be extended by mutual agreement between the OWNER and CONTRACTOR. If the NOTICE TO PROCEED has not been issued within the ten (10) day period or within the period mutually agreed upon, the CONTRACTOR may terminate the AGREEMENT without further liability on the part of either party.

The OWNER may make such investigations as he deems necessary to determine the ability of the BIDDER to perform the WORK, and the BIDDER shall furnish to the OWNER all such information and data for this purpose as the OWNER may request. The OWNER reserves the right to reject any BID if the evidence submitted by, or investigation of, such BIDDER fails to satisfy the OWNER that such BIDDER is properly qualified to carry out the obligations of the AGREEMENT and to complete the WORK contemplated therein.

A conditional or qualified BID will <u>not</u> be accepted.

Award will be made to the lowest responsive and responsible BIDDER.

All applicable laws, ordinances, and the rules and regulations of all authorities having jurisdiction over construction of the PROJECT shall apply to the contract throughout.

Each BIDDER is responsible for inspecting the site and for reading and being thoroughly familiar with the CONTRACT DOCUMENTS. The failure or omission of any BIDDER to complete any of the foregoing shall in no way relieve any BIDDER from any obligation in respect to his BID.

Further, the BIDDER agrees to abide by the requirements under Executive Order No. 11246, as amended, including specifically the provisions of the equal opportunity clause set forth in the GENERAL CONDITIONS.

The low BIDDER shall supply the names and addresses of major material SUPPLIERS and SUBCONTRACTORS when requested to do so by the OWNER.

MANUFACTURERS EXPERIENCE

Wherever it may be written that an equipment manufacturer must have a specified period of experience with his product, equipment which does not meet the specified experience period can be considered if the equipment supplier or manufacturer is willing to provide a bond or cash deposit for the duration of the specified time period which will guarantee replacement of that equipment in the event of failure.

S.A.G. PROJECT SIGN

The Contractor shall construct a sign in accordance with the Standard Detail included in these specifications. The sign shall be erected in a location selected by the Engineer. The Contractor shall maintain the sign throughout the duration of the contract.

SAFETY AND HEALTH REGULATIONS

This project is subject to all of the Safety and Health Regulations (CFR 29 Part 1926 and all subsequent amendments) as promulgated by the U.S. Department of Labor on June 24, 1974. Contractors are urged to become familiar with the requirements of these regulations.

NON-DISCRIMINATION IN EMPLOYMENT

Contracts for work under this proposal will obligate the contractors and sub-contractors not to discriminate in employment practices.

STATE INSPECTION

Work performed on this project shall be subject to inspection by representatives of the NH Department of Environmental Services. Such inspection shall in no sense make the State Government a party to this contract, unless said Government is also the Owner, and will in no way interfere with the rights of either party hereunder.

Representatives of the State of New Hampshire Department of Environmental Services shall be given Right of Access to all portions of the proposed work, including but not limited to actual work site, storage yards, offsite manufacturing and fabricating location and job records.

COPIES OF THE CONTRACT

There shall be at least five (5) executed copies of the Contract to be distributed as follows:

a) One (1) copy each to the Owner, Engineer, and Contractor.
b) Two (2) copies to the New Hampshire Department of Environmental Services.
c) Additional copies as required for other federal or state agencies contributing to or participating in project costs.

NON-RESIDENT CONTRACTORS

The successful bidder, if a corporation established under laws other than the State of New Hampshire, shall file, at the time of the execution of the contract, with the Owner, notice of the name of its resident attorney, appointed as required by the laws of the State of New Hampshire.

The successful bidder, if not a resident of New Hampshire, and not a corporation, shall file, at the time of execution of the contract, with the Owner a written appointment of a resident of the state of New Hampshire, having an office or place of business therein, to be his true and lawful attorney upon whom all lawful processes in any actions or proceedings against him may be served; and in such writing, which shall set forth said attorney's place of residence, shall agree that any lawful process against him which is served on said attorney shall be of the same legal force and validity as if served on him and that the authority shall continue in force so long as any liability remains outstanding against him in New Hampshire. The power of attorney shall be filed in the office of the Secretary of State if required, and copies certified by the Secretary shall be sufficient evidence thereof. Such appointment shall continue in force until revoked by an instrument in writing, designating in a like manner some other person upon whom such processes may be served, which instrument shall be filed in the manner provided herein for the original appointment.

A Non-resident Contractor shall be deemed to be:

a) A person who is not a resident of the State of New Hampshire.
b) Any partnership that has no member thereof resident of the State of New Hampshire.
c) Any corporation established under laws other than those of the State of New Hampshire.

BIDDERS QUALIFICATIONS

No award will be made to any Bidder who cannot meet all of the following requirements:

A. He shall not have defaulted nor turned the work over to the bonding company on any contract within three years prior to the bid date.

B. He shall maintain a permanent place of business.

C. He shall have adequate personnel and equipment to perform the work expeditiously.

D. He shall have suitable financial status to meet obligations incidental to the work.

E. He shall have appropriate technical experience satisfactory to the Engineer and the Division in the class of work involved.

F. He shall be registered with the Secretary of State to do business in New Hampshire.

G. He shall have performed to the satisfaction of the Engineer and the Division on previous contracts of a similar nature.

H. He shall not have failed to complete previous contracts on time, including approved time extensions.

WITHDRAWAL OF BIDS

Prior to Bid Opening, bids may be withdrawn upon written or telegraphic request of the Bidder provided confirmation of any telegraphic withdrawal over the signature of the Bidder is placed in the mail and postmarked prior to the time set for Bid Opening. Bid documents and security of any Bidder withdrawing his bid in accordance with the foregoing conditions will be returned.

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A-3.1

**BID**

Proposal of _____ (hereinafter called "BIDDER"), organized and existing under the laws of the State of _____ doing business as _____
(Corporation, Partnership, Individual)

To the City of Nashua, New Hampshire (hereinafter called "OWNER").

In compliance with your Advertisement for Bids, BIDDER hereby proposes to perform all WORK For the construction of CSO-004 Infrastructure Improvements – Burke Street Phase 2 in strict accordance with the CONTRACT DOCUMENTS, within the time set forth therein, and at the prices stated below.

By submission of this BID, each BIDDER certifies, and in the case of a joint BID each party thereto certifies as to his own organization, that this BID has been arrived at independently, without consultation, communication, or agreement as to any matter relating to the BID with any other BIDDER or with any competitor.

BIDDER hereby agrees to commence WORK under this contract on or before a date to be specified in the NOTICE TO PROCEED and to complete the PROJECT within:

180 consecutive calendar days for substantial completion.

200 consecutive calendar days for final completion.

Liquidated damages will be in the amount of $ 500 for each calendar day of delay from the date established for substantial completion and $ 1,000 for each calendar day of delay from the date established for final completion, as provided in Section 18 of the General Conditions.

BIDDER acknowledges receipt of the following ADDENDUM:

_____

_____

_____

The Bidder shall state below what works of a similar character to that of the proposed contract he has performed, and provide such references as will enable the Owner to judge his experience, skill, and business standing.

All questions must be answered and the data given must be clear and comprehensive. This statement must be notarized. If necessary, add separate sheets.

1. Name of Bidder.

2. Permanent Main Office address.

3. When organized?

4. Where incorporated?

5. Is bidder registered with the Secretary of the State to do business in New Hampshire?

6. For how many years has your firm engaged in the contracting business under its present name? Also state names and dates of previous firm names, if any.

7. Contracts on hand. (Schedule these, showing gross amount of each contract and the approximate anticipated dates of completion.)

8. General character of work performed by your company.

9. Have you ever failed to complete any work awarded you in the scheduled contract time, including approved time extensions? ___(Yes) __(No).
   If so, where and why?

10. Have you ever defaulted on a contract? ___(Yes) __(No).
    If so, where and why?

11. Have you ever had liquidated damages assessed on a contract? _____(Yes) ____(No).
    If so, where and why?

12. List the more important contracts recently executed by your company, stating approximate cost for each, and the month and year completed.

13. List your major equipment <u>available for this contract</u>.

14. List your key personnel such as Project Superintendent and foreman available for this contract.

15. List any subcontractors whom you would expect to use for the following (unless this work is to be done by your own organization):

    a. Civil Engineering
    b. Utility Installation
    c. Other work

16. With what banks do you conduct business?

Do you grant the Engineer permission to contact this (these) institutions? ___(Yes) ___(No)

NOTE: Bidders may be required to furnish their latest financial statement as part of the award process.

Respectfully submitted:

_____ Signature

_____ Address

_____ Title

_____ Date

_____ Being duly sworn, deposes and says that he is

_____ of _____ (Name of Organization)

and that the answers to the foregoing questions and all statements contained therein are true and correct.

Sworn to before me this _____ day of _____ , 20 _____

_____ Notary Public

My commission expires _____

(Seal - If BID is by Corporation)

ATTEST: _____

BIDDER agrees to perform all the work described in the CONTRACT DOCUMENTS for the following unit prices or lump sum:

NOTE: BIDS shall include sales tax and all other applicable taxes and fees.

**BID SCHEDULE**

| Item No. | Estimated Quantity | Units | Brief Description: (unit or lump sum price bid in both words and figures) | Total Figure: |
|---|---|---|---|---|
| 1* | 1 | Lump Sum | MOBILIZATION (not to exceed 5% of Contract)<br>_____Dollars<br>($_____)Per Lump Sum | $_____ |
| 2* | 1 | Lump Sum | ALL WORK EXCEPT THE WORK OF BID ITEM NO. 1 AND BID ITEMS NOS. 3 THROUGH 50<br>_____Dollars<br>($_____)Per Lump Sum | $_____ |
| 3* | 1 | Lump Sum | SOILS AND WASTE MANAGEMENT<br>_____Dollars<br>($_____)Per Lump Sum | $_____ |
| 4* | 1 | Allowance | DISPOSAL OF SOIL/FILL AS NON-HAZARDOUS SOLID WASTE<br>TEN THOUSAND_____Dollars<br>($_10,000_____)Per Allowance | $____10,000___ |
| 5* | 1 | Allowance | REUSE SOIL/FILL AS DAILY COVER (LINED LANDFILL)<br>ONE HUNDRED THOUSAND_____Dollars<br>($__100,000_____)Per Allowance | $____100,000___ |
| 6* | 1 | Allowance | REUSE SOIL/FILL AS DAILY COVER (UNLINED LANDFILL)<br>FIVE THOUSAND_____Dollars<br>($_5,000_____)Per Allowance | $____5,000____ |
| 7* | 1 | Allowance | DISPOSAL AS RCRA HAZARDOUS WASTE<br>FOUR THOUSAND_____Dollars<br>($_4,000_____)Per Allowance | $____4,000_____ |

| | | | | |
|---|---|---|---|---|
| 8* | 1 | Allowance | DISPOSAL AS ASBESTOS CONTAINING WASTE<br><br>__FIVE THOUSAND_____Dollars<br><br>($_5,000_____)Per Allowance | $____5,000____ |
| 9* | 2 | Cubic Yards | ROCK EXCAVATION<br><br>_____Dollars<br><br>($_____)Per Cubic Yard | $_____ |
| 10* | 10 | Each | CIPP LINE EXISTING LATERAL UP TO 6 FEET FROM INTERCEPTOR<br><br>_____Dollars<br><br>($_____)Per each | $_____ |
| 11* | 100 | Linear Feet | CIPP LINE ADDITIONAL LENGTH WITHIN EXISTING LATERAL<br><br>_____Dollars<br><br>($_____)Per Linear Foot | $_____ |
| 12* | 5 | Each | STRUCTURAL GROUT EXISTING LATERAL<br><br>_____Dollars<br><br>($_____)Per Each | $_____ |
| 13* | 200 | Linear Feet | REMOVE AND REPLACE EXISTING LATERAL<br><br>_____Dollars<br><br>($_____)Per Linear Foot | $_____ |
| 14* | 10 | Each | INSTALL NEW CLEANOUT ON EXISTING LATERAL<br><br>_____Dollars<br><br>($_____)Each | $_____ |
| 15* | 3 | Each | INSTALL NEW CATCH BASIN AND LATERAL<br><br>_____Dollars<br><br>($_____)Each | $_____ |

| | | | | |
|---|---|---|---|---|
| 16* | 50 | Cubic Yards | TEST PITS<br>_____Dollars<br>($_____)Per Cubic Yard | $_____ |
| 17* | 50 | Square Yards | ASPHALT PAVEMENT<br>_____Dollars<br>($_____)Per Square Yard | $_____ |
| 18* | 1 | Allowance | FLAGGERS/POLICE DETAILS<br>_Seventy Five Thousand_____Dollars<br>($__75,000_____)Per Allowance | $___75,000_____ |
| 19 | 14,500 | Square Yards | REMOVAL OF EXISTING PAVEMENT<br>_____Dollars<br>($_____)Per Square Yard | $_____ |
| 20 | 15,000 | Square Yards | GRADING AND EARTHWORK<br>_____Dollars<br>($_____)Per Square Yard | $_____ |
| 21 | 1,500 | TON | CRUSHED GRAVEL or CRUSHED STONE (FINE)<br>_____Dollars<br>($_____)Per Ton | $_____ |
| 22 | 2,500 | Linear Foot | SAWED BITUMINOUS PAVEMENT<br>_____Dollars<br>($_____)Per Linear Foot | $_____ |
| 23 | 1,500 | Square Yards | COLD PLANING OF BITUMINOUS SURFACE<br>_____Dollars<br>($_____)Per Square Yard | $_____ |

| | | | | |
|---|---|---|---|---|
| 24 | 13 | Each | ADJUST EXISTING MANHOLE/CATCH BASIN CASTING TO GRADE<br>_____Dollars<br>($_____)Each | $_____ |
| 25 | 14 | Each | REPLACE EXISTING CASTING WITH NEW MANHOLE/CATCH BASIN CASTING AND ADJUST CASTING TO GRADE<br>_____Dollars<br>($_____)Each | $_____ |
| 26 | 3,200 | TON | HOT BITUMINOUS PAVEMENT, MACHINE METHOD<br>_____Dollars<br>($_____)Per Ton | $_____ |
| 27 | 500 | TON | HOT BITUMINOUS PAVEMENT, HAND METHOD<br>_____Dollars<br>($_____)Per Ton | $_____ |
| 28 | 600 | Linear Foot | STRAIGHT GRANITE CURB<br>_____Dollars<br>($_____)Per Linear Foot | $_____ |
| 29 | 500 | Linear Foot | CURVED GRANITE CURB<br>_____Dollars<br>($_____)Per Linear Foot | $_____ |
| 30 | 1,600 | Linear Foot | REMOVE AND RESET EXISTING VERTICAL GRANITE CURBING<br>_____Dollars<br>($_____)Per Linear Foot | $_____ |
| 31 | 10 | Square Yards | REMOVE AND RECONSTRUCT EXISTING CONCRETE SIDEWALK<br>_____Dollars<br>($_____)Per Square yards | $_____ |

| | | | | |
|---|---|---|---|---|
| 32 | 2,000 | Square Yards | REMOVE AND RECONSTRUCT EXISTING BITUMINOUS SIDEWALK<br>_____Dollars<br>($_____)Per Square Yard | $_____ |
| 33 | 125 | Square Yards | NEW 2-1/2" BITUMINOUS SIDEWALK<br>_____Dollars<br>($_____)Per Square Yard | $_____ |
| 34 | 250 | Square Yards | NEW SPECIAL BITUMINOUS SIDEWALK<br>_____Dollars<br>($_____)Per Square Yard | $_____ |
| 35 | 16 | Each | FURNISH AND INSTALL 2'X4' ADA DETECTABLE WARNING PANEL WITH CONCRETE BASE FOR PEDESTRIAN CROSSINGS.<br>_____Dollars<br>($_____)Each | $_____ |
| 36 | 9 | Each | FURNISH AND INSTALL 2'X5' ADA DETECTABLE WARNING PANEL WITH CONCRETE BASE FOR PEDESTRIAN CROSSINGS<br>_____Dollars<br>($_____)Each | $_____ |
| 37 | 20 | Each | FURNISH AND INSTALL MUTCD W11-2 & W16-7P SIGN<br>_____Dollars<br>($_____)Each | $_____ |
| 38 | 3 | Each | FURNISH AND INSTALL MUTCD W11-2 & W16-9P SIGN<br>_____Dollars<br>($_____)Each | $_____ |
| 39 | 5 | Each | FURNISH AND INSTALL MUTCD R1-1 SIGN<br>_____Dollars<br>($_____)Each | $_____ |

| | | | | |
|---|---|---|---|---|
| 40 | 50 | Linear Foot | RESET EXISTING GUARDRAIL<br>_____Dollars<br>($_____) Linear Foot | $_____ |
| 42 | 1 | Lump Sum | FURNISH AND INSTALL SIGNAL DETECTOR LOOP<br>_____Dollars<br>($_____)Per Lump Sum | $_____ |
| 42 | 15,000 | Linear Foot | 4” RETROFLECTIVE PAINT PAVEMENT MARKING<br>_____Dollars<br>($_____)Per Linear Foot | $_____ |
| 43 | 1,250 | Linear Foot | 12” RETROFLECTIVE PAINT PAVEMENT MARKING<br>_____Dollars<br>($_____)Per Linear Foot | $_____ |
| 44 | 2,800 | Linear Foot | THERMOPLASTIC PAVEMENT MARKING (12” LINE)<br>_____Dollars<br>($_____)Per Linear Foot | $_____ |
| 45 | 2,000 | Square Yards | 6” LOAM AND SEED<br>_____Dollars<br>($_____)Per Square Yard | $_____ |
| 46 | 34 | Each | ORNAMENTAL TREE INCLUDING CONCRETE PLANTER<br>_____Dollars<br>($_____)Each | $_____ |
| 47 | 300 | Linear Foot | RESET EXISTING CHAIN LINK FENCE<br>_____Dollars<br>($_____)Per Linear Foot | $_____ |

| | | | | |
|---|---|---|---|---|
| 48 | 5,000 | Pound | CALCIUM CHLORIDE<br><br>_____Dollars<br><br>($_____)Per Pound | $_____ |
| 49* | 1 | Lump Sum | TEMPORARY TRAFFIC CONTROL PLAN, TRAFFIC CONTROL AND MAINTENANCE<br><br>_____Dollars<br><br>($_____)Per Lump Sum | $_____ |
| 50* | 5 | Each | DYE TESTING OF RESIDENTIAL SEWER SERVICE CONNECTIONS<br><br>_____Dollars<br><br>($_____)Each | $_____ |

*Items marked with an asterisk are eligible for funding via State Aid Grant.

Total amount of Bid based on Engineer's estimate of quantities for Items 1 through 50, inclusive (Basis of Award)

TOTAL OF BID ITEMS (figures):

_____

TOTAL OF BID ITEMS (words):

_____

Contractor: _____

Authorized Signature: _____

Address:_____

_____

Phone: _____Facsimile:_____

Email Address:_____

As provided in the INFORMATION TO BIDDERS, BIDS will be compared on the basis of the prices bid and contract will be awarded to the lowest responsive and responsible BIDDER selected by the OWNER.

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A-4.1

**BID BOND**

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned, _____

_____ as Principal, and

_____ as Surety, are hereby

held and firmly bound unto City of Nashua, NH as OWNER

in the penal sum of _____

for the payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, successors and assigns.

Signed, this _____ day of _____

The Condition of the above obligation is such that whereas the Principal has submitted to

_____

a certain BID, attached hereto and hereby made a part hereof to enter into a contract in writing, for

the CSO-004 Infrastructure Improvements – Burke Street Phase 2

_____

_____

NOW, THEREFORE,

(a) If said BID shall be rejected, or

(b) If said BID shall be accepted and the Principal shall execute and deliver a contract in the Form of Contract attached hereto (Properly completed in accordance with said BID) and shall furnish a BOND for faithful performance of said contract, and for the payment of all persons performing labor or furnishing materials in connection therewith, and shall in all other respects perform the agreement created by the acceptance of said BID, then this obligation shall be void, otherwise, the same shall remain in force and effect; it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the penal amount of this obligation as herein stated.

The Surety , for value received, hereby stipulates and agrees that the obligations of said Surety and its BOND shall be in no way impaired or affected by any extension of the time within which the OWNER may accept such BID; and said Surety does hereby waive notice of any such extension.

IN WITNESS WHEREOF, the Principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, the day and year first set forth above.

_____
Principal

By: _____

_____
Surety

By: _____

**IMPORTANT**-Surety companies executing BONDS must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the state of New Hampshire.

# B. CONTRACT

NO TEXT ON THIS PAGE

B-1.1

**NOTICE OF AWARD**

Dated _____ , 20 ____

TO: _____
(BIDDER)

ADDRESS: _____

OWNER'S PROJECT NO: _____

PROJECT: CSO-004 Infrastructure Improvements – Burke Street Phase 2

OWNER'S CONTRACT NO: _____

CONTRACT FOR: CSO-004 Infrastructure Improvements – Burke Street Phase 2

_____
(Insert name of contract as it appears in the Bid Documents)

---

You are notified that your Bid dated _____ for the above Contract has been considered. You are the apparent successful bidder and have been awarded a contract for:

CSO-004 Infrastructure Improvements – Burke Street Phase 2

_____

_____

_____
(Indicate total Work, alternates or sections of Work awarded)

The Contract Price of your contract is _____

_____ Dollars ($ _____ ).

_____ copies of each of the proposed Contract Documents (except Drawings) accompany this Notice of Award. The same number of sets of the Drawings will be delivered separately or otherwise made available to you immediately.

You must comply with the following conditions precedent within ten days of receiving this Notice of Award.

1. You must deliver to the OWNER all of the fully executed counterparts of the Agreement including all the Contract Documents. This includes the sets of Drawings. Each of the Contract Documents must bear your signature on the cover page.

2. You must deliver with the executed Agreement the Contract Security Bonds as specified in the Information for Bidders and General Conditions.

3. (List other conditions precedent).

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Failure to comply with these conditions within the time specified will entitle **OWNER** to consider your bid abandoned, to annul this Notice of Award and to declare your Bid Security forfeited.

Within ten days after receipt of acceptable performance BOND, payment BOND and agreement signed by the party to whom the Agreement was awarded, the **OWNER** will return to you one fully signed counterpart of the Agreement with the Contract Documents attached.

City of Nashua, New Hampshire
(OWNER)

**By** _____
(AUTHORIZED SIGNATURE)

_____
(TITLE)

ACCEPTANCE OF NOTICE

Receipt of the above NOTICE OF AWARD is hereby acknowledged

By _____

The _____ day of _____ , 20 _____

By _____

Title _____

Copy to ENGINEER
(Use Certified Mail, Return Receipt Requested)

B-2.1

**AGREEMENT**

**THIS AGREEMENT**, made this _____ day of _____ ,20 _____ by and between City of Nashua, New Hampshire _____ , hereinafter called **"OWNER"**
(Name of Owner)
and _____ doing business as (an individual,) or (a partnership,) or (a corporation) hereinafter called **"CONTRACTOR" .**

**WITNESSETH**: That for and in consideration of the payments and agreements hereinafter mentioned:

1. The **CONTRACTOR** will commence and complete the construction of

CSO-004 Infrastructure Improvements – Burke Street Phase 2
(Project)

2. The **CONTRACTOR** will furnish all of the material, supplies, tools, equipment, labor and other services necessary for the construction and completion of the **PROJECT** described herein.

3. The **CONTRACTOR** will commence the work required by the **CONTRACT DOCUMENTS** within 7 calendar days after the date of the **NOTICE TO PROCEED** unless the period for completion is extended otherwise by the **CONTRACT DOCUMENTS.** Completion time for the project will be calculated as calendar days from the date specified in the **NOTICE TO PROCEED** as follows:

180 calendar days for substantial completion.
200 calendar days for final completion.

Liquidated damages will be in the amount of $ 500 for each calendar day of delay from the date established for substantial completion and $ 1,000 for each calendar day of delay from the date established for final completion

4. The **CONTRACTOR** agrees to perform all of the **WORK** described in the **CONTRACT DOCUMENTS** and comply with the terms therein for the sum of $ _____ or as shown in the **BID** schedule.

5. The term "**CONTRACT DOCUMENTS**" means and includes the following:

(A) ADVERTISEMENT FOR BIDS

(B) INFORMATION FOR BIDDERS

(C) BID

(D) BID BOND

(E) NOTICE OF AWARD

(F) AGREEMENT

(G) PAYMENT BOND

(H) PERFORMANCE BOND

(I) NOTICE TO PROCEED

(J) CHANGE ORDER(S)

(K) CERTIFICATON OF SUBSTANTIAL COMPLETION

(L) CERTIFICATION OF FINAL COMPLETION

(M) CONTRACTOR'S AFFIDAVIT

(N) CONTRACTOR'S RELEASE

(O) GENERAL CONDITIONS

(P) SUPPLEMENTAL GENERAL CONDITIONS

(Q) SPECIAL CONDITIONS

(R) DRAWINGS prepared by:
Hazen and Sawyer, P.C.
numbered _____ through _____ , and dated _____ , 20 _____

(S) SPECIFICATIONS prepared or issued by:
Hazen and Sawyer, P.C.
_____ , and dated _____ , 20 _____

(T) ADDENDA:

No. _____ , dated _____ , 20 _____

No. _____ , dated _____ , 20 _____

No. _____ , dated _____ , 20 _____

No. _____ , dated _____ , 20 _____

No. _____ , dated _____ , 20 _____

6. The **OWNER** will pay to the **CONTRACTOR** in the manner and at such times as set forth in the General Conditions such amounts as required by the **CONTRACT DOCUMENTS.**

7. This Agreement shall be binding upon all parties hereto and their respective heirs, executors, administrators, successors, and assigns.

**IN WITNESS WHEREOF**, the parties hereto have executed, or caused to be executed by their duly authorized officials, this Agreement in _____ copies, each of which shall be deemed an original on the date first above written.

**OWNER**: City of Nashua, NH

By: _____

Name: Donnalee Lozeau, Mayor
(Please type)

(SEAL)

ATTEST: _____

Name: _____

Title: _____

**CONTRACTOR:** _____

By: _____

Name: _____

Address: _____

_____

(SEAL)

ATTEST: _____

Name: _____

Title: _____

NO TEXT ON THIS PAGE

B-3.1

**PAYMENT BOND**

**KNOW ALL MEN BY THESE PRESENTS**: that

_____
(Name of Contractor)

_____
(Address of Contractor)

a _____ , hereinafter called Principal,
(Corporation, Partnership or Individual)

and _____
(Name of Surety)

_____
(Address of Surety)

hereinafter called Surety, are held and firmly bound unto

City of Nashua, New Hampshire
(Name of Owner)

229 Main Street, City Hall, Nashua, NH 03060
(Address of Owner)

hereinafter called **OWNER** and unto all persons, firms, and corporations who or which may furnish labor, or who furnish materials to perform as described under the contract and to their successors and assigns, in the total aggregate penal sum of _____ Dollars, ($ _____ ) in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

**THE CONDITION OF THIS OBLIGATION** is such that whereas, the Principal entered into a certain contract with the **OWNER**, dated the _____ day of _____ 20 _____ , a copy of which is hereto attached and made a part hereof for the construction of:

CSO-004 Infrastructure Improvements – Burke Street Phase 2

**NOW, THEREFORE**, if the Principal shall promptly make payment to all persons, firms, and corporations furnishing materials for or performing labor in the prosecution of the **WORK** provided for in such contract, and any authorized extension or modification thereof, including all amounts due for materials, lubricants, oil, gasoline, coal and coke, repairs on machinery, equipment and tools, consumed or used in connection with the construction of such **WORK**, and for all labor cost incurred in such WORK including that be a subcontractor, and to any mechanic or material man lienholder whether it acquires its lien by operation of State or Federal Law; then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED, that beneficiaries or claimants hereunder shall be limited to the subcontractors, and persons, firms, and corporations having a direct contract with the PRINCIPAL or its SUBCONTRACTORS.

**PROVIDED FURTHER,** that the said Surety for value received hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the contract or to the **WORK** to be performed thereunder or the **SPECIFICATIONS** accompanying the same shall in any way affect its obligation on this **BOND**, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the contract or to the **WORK** or to the **SPECIFICATIONS**.

**PROVIDED, FURTHER** that no suit or action shall be commenced hereunder by any claimant: (a) Unless claimant, other than one having a direct contract with the PRINCIPAL shall have given written notice to any two of the following: The PRINCIPAL, the OWNER, or the SURETY above named within ninety (90) days after such claimant did or performed the last of the work or labor, or furnished the last of the materials for which said claim is made, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were furnished, or for whom the work or labor was done or performed. Such notice shall be served by mailing the same by registered mail or certified mail, postage prepaid, in an envelope addressed to the PRINCIPAL, OWNER, or SURETY, at any place where an office is regularly maintained for the transaction business, or served in any manner in which legal process may be served in the state in which the aforesaid project is located, save that such service need not be made by a public officer. (b) After the expiration of one (1) year following the date on which PRINCIPAL ceased work on said CONTRACT, it being understood, however, that if any limitation embodied in the BOND is prohibited by any law controlling the construction hereof, such limitation shall be deemed to be amended so as to be equal to the minimum period of limitation permitted by such law.

**PROVIDED, FURTHER**, that it is expressly agreed that this BOND shall be deemed amended automatically and immediately, without formal and separate amendments hereto, upon amendment to the Contract not increasing the contract price more than 20 percent, so as to bind the PRINCIPAL and the SURETY to the full and faithful performance of the Contract as so amended. The term "Amendment", wherever used in this BOND and whether referring to this BOND, the contract or the loan Documents shall include any alteration, addition, extension or modification of any character whatsoever.

**PROVIDED FURTHER**, that no final settlement between the **OWNER** and the **CONTRACTOR** shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

**IN WITNESS WHEREOF**, this instrument is executed in _____ counterparts, each one of
(number)

which shall be deemed an original, this _____ day of _____ , 20 ____ .

**ATTEST:**

_____
Principal

By: _____
(Principal) Secretary

**(SEAL)** **BY** _____

_____
(Address)

_____

By: _____
Witness as to Principal

_____
(Address)

_____
(Surety)

**ATTEST**: **BY** _____
Attorney - in - Fact

By _____
Witness as to Surety

_____
(Address)

_____

_____

_____
(Address)

_____

**NOTE**: Date of **BOND** must not be prior to date of Contract.
If **CONTRACTOR** is partnership, all partners should execute BOND.

**IMPORTANT**: Surety companies executing **BONDS** must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the State of New Hampshire.

NO TEXT ON THIS PAGE

B-4.1

**PERFORMANCE BOND**

**KNOW ALL MEN BY THESE PRESENTS**: that

_____
(Name of Contractor)

_____
(Address of Contractor)

a _____ , hereinafter called Principal,
(Corporation, Partnership or Individual)

and _____
(Name of Surety)

_____
(Address of Surety)

hereinafter called Surety, are held and firmly bound unto

City of Nashua, NH
(Name of Owner)

229 Main Street, City Hall, Nashua, NH 03060
(Address of Owner)

hereinafter called **OWNER**, in the total aggregate penal sum of _____

_____ Dollars, $ ( _____ )

in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators successors, and assigns, jointly and severally, firmly by these presents.

**THE CONDITION OF THIS OBLIGATION** is such that whereas, the Principal entered into a certain contract with the **OWNER**, dated the _____ day of _____ 20 ___ , a copy of which is hereto attached and made a part hereof for the construction of:

_____

_____

_____

**NOW, THEREFORE**, if the Principal shall well, truly and faithfully perform its duties, all the undertakings, covenants, terms, conditions, and agreements of said contract during the original term thereof, and any extension thereof which may be granted by the **OWNER**, with or without notice to the Surety and during the one year guaranty period, and if the **PRINCIPAL** shall satisfy all claims and demands incurred under such contract, and shall fully indemnify and save harmless the **OWNER** from all costs and damages which it may suffer by reason of failure to do so, and shall reimburse and repay the **OWNER** all outlay and expense which the **OWNER** may incur in making good any default, then this obligation shall be void: otherwise to remain in full force and effect.

**PROVIDED, FURTHER**, that the said surety, for value received hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the contract or to **WORK** to be performed thereunder or the specifications accompanying same shall in any way affect its obligation on this **BOND**, and it does hereby waive notice of any such change, extension of time alteration or addition to the terms of the contract or to the **WORK** or to the specifications.

**PROVIDED, FURTHER**, that it is expressly agreed that this **BOND** shall be deemed amended automatically and immediately, without formal and separate amendments hereto, upon amendment to the Contract not increasing the contract price more than 20 percent, so as to bind the **PRINCIPAL** and the **SURETY** to the full and faithful performance of the Contract as so amended. The term "Amendment", wherever used in this **BOND** and whether referring to this **BOND**, the contract or the loan Documents shall include any alteration, addition, extension or modification of any character whatsoever.

**PROVIDED, FURTHER**, that no final settlement between the **OWNER** and the **CONTRACTOR** shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

**IN WITNESS WHEREOF**, this instrument is executed in _____ counterparts, each one of
(number)

which shall be deemed an original, this _____ day of _____ , 20 ____ .

**ATTEST:**

_____
Principal

By: _____
(Principal) Secretary

**(SEAL)** **BY** _____

_____
(Address)

_____

By: _____
Witness as to Principal

_____
(Address)

_____

_____
(Surety)

**ATTEST**: **BY** _____
Attorney - in - Fact

By _____
Witness as to Surety

_____
(Address)

_____

_____

_____
(Address)

_____

NOTE: Date of **BOND** must not be prior to date of Contract.
If **CONTRACTOR** is Partnership, all partners should execute BOND.
**IMPORTANT**: Surety companies executing BONDS must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the State of New Hampshire

B-5.1

**NOTICE TO PROCEED**

Dated _____ , 20 _____

TO: _____
(Insert Name of Contractor as it appears in the Bid Documents)

ADDRESS: _____

_____

OWNER'S PROJECT NO. _____

PROJECT: CSO-004 Infrastructure Improvements – Burke Street Phase 2

OWNER'S CONTRACT NO. _____

CONTRACT FOR: _____

_____

---

You are notified that the Contract Time under the above contract will commence to run on _____ , 20 _____ . By that date, you are to start performing your obligations under the Contract Documents. In accordance with paragraph 3 of the Agreement, the dates of Substantial Completion and Final Completion are _____ , 20 _____ and _____ , 20 _____ , respectively.

Before you may start any Work at the site, paragraph 27 of the General Conditions provides that you and Owner must each deliver to the other (with copies to ENGINEER) certificates of insurance which each is required to purchase and maintain in accordance with the Contract Documents. Also before you may start any Work at the site, you must:

_____

_____
(add other requirements)

Copy to ENGINEER
(Use certified Mail, return Receipt Requested)

_____
(owner)

By _____
(Authorized Representative)

_____
(Title)

---

ACCEPTANCE OF NOTICE

Receipt of the above NOTICE TO PROCEED is hereby acknowledged by:

_____
(Contractor)

this the _____ , 20 _____

Employer Identification Number: _____

By: _____

_____

_____

NO TEXT ON THIS PAGE

B-6.1

# CHANGE ORDER

No. _____

PROJECT: CSO-004 Inf. Improvements – Burke St Phase 2 DATE OF ISSUANCE: _____

OWNER: City of Nashua, NH

229 Main St, City Hall
Nashua, NH 03060
(Address)

CONTRACTOR: _____ OWNER's Project No. _____

CONTRACT FOR: _____ ENGINEER Hazen and Sawyer, P.C.

ENGINEER's Project No. 90006-020

You are directed to make the following changes in the Contract Documents.
Description:
Purpose of Change Order:
Justification:
Attachments: (List documents supporting change)

| CHANGE IN CONTRACT PRICE | CHANGE IN CONTRACT TIME |
|---|---|
| Original Contract Price<br>$ _____ | Original Contract Time<br>_____<br>(days or date) |
| Previous Change Orders<br>$ _____ | Net change from previous Change Orders<br>_____<br>(days) |
| Contract Price prior to this Change Order<br>$ _____ | Contract Time prior to this Change Order<br>_____<br>(days or date) |
| Net Increase (Decrease) of this Change Order<br>$ _____ | Net Increase (decrease) this Change Order<br>_____<br>(days) |
| Contract Price with all approved Change Orders<br>$ _____ | Contract Time with all Change Orders<br>_____<br>(days or date) |

This document will become a supplement to the CONTRACT and all provisions will apply hereto. The attached Contractor's Revised Project Schedule reflects increases or decreases in Contract Time as authorized by this Change Order.
Stipulated price and time adjustment includes all costs and time associated with the above described change. Contractor waives all rights for additional time extension for said change. Contractor and Owner agree that the price(s) and time adjustment(s) stated above are equitable and acceptable to both parties.

| RECOMMENDED: | APPROVED: | APPROVED: | APPROVED: |
|---|---|---|---|
| By: _____ | By: _____ | By: _____ | By: _____ |
| Engineer | Owner | Contractor | NHDES |
| _____ | _____ | _____ | _____ |
| Date | Date | Date | Date |

NO TEXT ON THIS PAGE

B-7.1

# CERTIFICATE OF SUBSTANTIAL COMPLETION

OWNER's Project No.: _____ ENGINEER's Project No.: 90006-020

Project: CSO-004 Infrastructure Improvements–Burke Street Phase 2

CONTRACTOR: _____

Contract For: _____ Contract Date: _____

This Certificate of Substantial Completion applies to all Work under the Contract Documents or to the following specified parts thereof:

_____

To: City of Nashua, New Hampshire
(Owner)

And To: _____
(Contractor)

The Work to which this Certificate applies has been inspected by authorized representatives of OWNER, CONTRACTOR and ENGINEER, and that Work is hereby declared to be substantially complete in accordance with the Contract Documents on

_____
(Date of Substantial Completion)

A tentative list of items to be completed or corrected is attached hereto. This list may not be all-inclusive, and the failure to include an item in it does not alter the responsibility of CONTRACTOR to complete all the Work in accordance with the Contract Documents. The items in the tentative list shall be completed or corrected by CONTRACTOR within _____ calendar days of the above date of Substantial Completion.

The responsibilities between OWNER and CONTRACTOR for security, operation, safety, maintenance, heat, utilities, insurance and warranties shall be as follows:

RESPONSIBILITIES:

OWNER: _____

_____

CONTRACTOR: _____

_____

---

The following documents are attached to and made a part of this Certificate:

_____

_____

_____

_____

---

This certificate does not constitute an acceptance of Work not in accordance with the Contract Documents nor is it a release of CONTRACTOR's obligation to complete the Work in accordance with the Contract Documents.

---

Executed by ENGINEER on _____ , 20 _____

_____
(Engineer)

By: _____

CONTRACTOR accepts this Certificate of Substantial Completion on _____ , 20 _____

_____
(Contractor)

By: _____

OWNER accepts this Certificate of Substantial Completion on _____ , 20 _____

_____
(Owner)

By: _____

B-8.1

**CERTIFICATE OF FINAL COMPLETION**

Owner's Project No. _____ Engineer's Project No. 90006-020

Project CSO-004 Infrastructure Improvements – Burke Street Phase 2

Owner: City of Nashua, New Hampshire

Contractor: _____

Engineer: Hazen and Sawyer, P.C.

Agreement Date: _____

Notice to Proceed Date: _____

Contractual Substantial Completion Date as modified by Change Orders: _____

Actual Substantial Completion Date: _____

Contractual Final Completion Date as modified by Change Orders: _____

The Work to which this Certificate applies has been inspected by authorized representatives of Owner, Contractor, Engineer and NHDES, the punch list has been completed and the Work of the Contract is hereby declared to be Finally Complete in accordance with the Contract Documents on:

_____
Date of Final Completion

This Certificate does not constitute an acceptance of any Work not in accordance with the Contract Documents nor is it a release of Contractor's obligation to complete the Work in accordance with the Contract Documents. The Warranty for all Work completed subsequent to the date of Substantial Completion expires one year from the date of this Final Acceptance.

Executed by Engineer on: _____, 20____

By:_____

Contractor Accepts this Certificate of Final Completion on: _____, 20____

By:_____

Owner Accepts this Certificate of Final Completion on: _____, 20____

By:_____

NHDES Accepts this Certificate of Final Completion on: _____, 20____

By:_____

NO TEXT ON THIS PAGE

B-9.1

**CONTRACTOR'S AFFIDAVIT**

STATE OF: _____

COUNTY OF: _____

Before me, the undersigned, a _____
(Notary Public, Justice of Peace, Alderman)
in and for said County and State personally appeared, _____
(Individual, Partner or duly
_____ who being duly sworn according to law
authorized representative of corporate contractor)
deposes and says that the cost of all the Work, and outstanding claims and indebtedness of whatever
nature arising out of the performance of the contract between
_____
(Owner)
And _____ of _____
(Contractor) (Address)
dated _____ for the construction of the _____
(Project Name)
and necessary appurtenant installations have been paid in full.

_____
(Individual, Partner, or duly authorized representative of corporate contractor)

_____
(Title)

Sworn to and subscribed before me
this _____ day of _____ , 20 ___

_____

_____
Notary Public

NO TEXT ON THIS PAGE

B-10.1

**CONTRACTOR'S FINAL RELEASE AND WAIVER OF LIEN**

| Project/Owner | Contractor |
|---|---|
| Project: CSO-004 Infrastructure Improvements Burke Street Phase 2 | Name_____ |
| Address: 9 Riverside Street | Address:_____ |
| Nashua_____NH____03062<br>City State Zip | _____<br>City State Zip |
| Owner: City of Nashua, New Hampshire | Contractor License:_____ |
| _____ | Contract Date:_____ |

**TO ALL WHOM IT MAY CONCERN**:

For good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, the undersigned Contractor hereby waives, discharges, and releases any and all liens, claims, and rights to liens against the above-mentioned project, and any and all other property owned by or the title to which is in the name of the above-referenced Owner and against any and all funds of the Owner appropriated and available for the construction of said project, and any and all warrants drawn upon or issued against any such funds or monies, which the undersigned Contractor may have or may hereafter acquire or process as a result of the furnishing of labor, materials, and/or equipment, and the performance of Work by the Contractor on or in connection with said project, whether under and pursuant to the above-mentioned contract between the Contractor and the Owner pertaining to said project or otherwise, and which said liens, claims or rights of lien may arise and exist.

The undersigned further hereby acknowledges that the sum of

_____

Dollars ($_____) constitutes the entire ***unpaid*** balance due the undersigned in Connection with said project whether under said contract or otherwise and that the payment of said sum to the Contractor will constitute payment in full and will fully satisfy any and all liens, claims, and demands which the Contractor may have or assert against the Owner in connection with said contract or project.

Dated this ___ day of _____20__

_____
Contractor

Witness to Signature

By_____ By_____

Title_____ Title_____

NO TEXT ON THIS PAGE

# C. GENERAL CONDITIONS

NO TEXT ON THIS PAGE

# GENERAL CONDITIONS

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56. Maintenance During construction
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58. Work Performed at Night, and on Sundays and Holidays
59. Laws to be Observed
60. Permits
61. Control of Pollution
62. Use of Explosives
63. Arbitration by Mutual Agreement
64. Taxes
65. Separate Contracts

## GENERAL CONDITIONS

1. Contract and Contract Documents. The plans, information for bidders, bids, advertisement for bids, bid payment and performance bonds, Agreements, change orders, notice to proceed, specifications and addenda, hereinafter enumerated in the Agreement, shall form part of this Contract and the provisions thereof shall be as binding upon the parties hereto as if they were herein fully set forth. The table of contents, titles, headings, running headlines and marginal notes contained herein and in said documents are solely to facilitate reference to various provisions of the Contract Documents and in no way affect, limit or cast light on the interpretation of the provisions to which they refer.

2. Definitions.

2.1 "Addenda" means written or graphic instruments issued prior to the execution of the Agreement which modify or interpret the Contract Documents, drawings and specifications, by additions, deletions, clarifications or corrections. Such written or graphic instruments will be issued no less than five days before the bid opening.

2.2 "Bid" means the offer or proposal of the bidder submitted on the prescribed form setting forth the prices for the work to be performed.

2.3 "Bidder" means any person, firm or corporation submitting a bid for the work.

2.4 "Bonds" means bid, performance, and payment bonds and other instruments of security, furnished by the Contractor and his surety in accordance with the Contract Documents.

2.5 "Change Order" means a written order to the Contractor authorizing an addition, deletion or revision in the work within the general scope of the Contract Documents, or authorizing an adjustment in the Contract Price or Contract Time.

2.6 "Contract Documents" means the Contract, including any advertisement for bids, information for bidders, bid, bid bond, Agreement, payment bond, performance bond, notice of award, notice to proceed, change orders, drawings, specifications and addenda.

2.7 "Contract Price" means the total monies payable to the Contractor under the terms and conditions of the Contract Documents.

2.8 "Contract Time" means the number of calendar days stated in the Contract Documents for the completion of the Work.

2.9 "Contractor" means the person, firm or corporation with whom the Owner has executed the Agreement.

2.10 "Division" means the state of New Hampshire Department of Environmental Services, Water Division.

2.11 “Drawings” mean the part of the Contract Documents which show the characteristics and scope of the work to be performed and which have been prepared or approved by the Engineer.

2.12 “Engineer” means the person, firm or corporation named as such in the contract documents.

2.13 “Field order” means a written order effecting a change in the work not relating to an adjustment in the contract price or an extension of the contract time and issued by the Engineer to the Contractor during construction.

2.14 “Notice of Award” means the written notice of the acceptance of the Bid from the Owner to the successful Bidder.

2.15 “Notice to Proceed” means the written communication issued by the Owner to the Contractor authorizing him to proceed with the Work and establishing the date of commencement of the Work.

2.16 “Owner” means a public or quasi-public body or authority, corporation, association, partnership, or individual for whom the work is to be performed.

2.17 “Plans” means the contract drawings or exact reproductions thereof which show the scope, character, dimensions and details of the work and which have been prepared or approved by the Engineer.

2.18 “Project” means the undertaking to be performed as provided in the Contract Documents.

2.19 “Resident Project Representative” means the authorized representative of the Owner who is assigned to the Project site or any part thereof.

2.20 “Shop Drawings” means all drawings, diagrams, illustrations, brochures, schedules and other data which are prepared by the Contractor, a Subcontractor, manufacturer, supplier or distributor, which illustrates how specific portions of the Work shall be fabricated or installed.

2.21 “Special conditions” means revisions or additions to these general conditions, Supplemental General Conditions or specifications applicable to an individual project.

2.22 “Specifications” means a part of the contract documents consisting of written descriptions of a technical nature of materials, equipment, construction systems, standards and workmanship.

2.23 “Subcontractor” means an individual, firm or corporation having a direct contract with the Contractor or with any other Subcontractor for the performance of a part of the Work at the site.

2.24 “Substantial Completion” means that date as certified by the Engineer when the construction of the Project or a specified part thereof is sufficiently completed, in

accordance with the Contract Documents, so that the Project or specified part can be utilized for the purposes for which it is intended.

2.25 “Supplemental General Conditions” means modifications to these general conditions required by a Federal agency for participation in the PROJECT and approved by the agency in writing prior to inclusion in the CONTRACT DOCUMENTS, or such documents that may be imposed by applicable State laws.

2.26 “Supplier” means any person or organization who supplies materials or equipment for the Work, including that fabricated to a special design, but who does not perform labor at the site.

2.27 “Work” means all labor necessary to produce the construction required by the contract documents, and all materials and equipment incorporated or to be incorporated in the project.

2.28 “Written Notice” means any notice to any party of the Agreement relative to any part of this Agreement in writing and considered delivered and the service thereof completed, when posted by certified or registered mail to the said party at his last given address, or delivered in person to said party or his authorized representative on the Work.

3. Additional Instructions and Detail Drawings. The Contractor may be furnished additional instructions and detail drawings as necessary to carry out the work included in the contract. The additional drawings and instructions thus supplied to the Contractor will coordinate with the contract documents and will be so prepared that they can be reasonably interpreted as part thereof.

4. Shop or Setting Drawings. Shop or setting drawings shall be in accordance with the following:

4.1 The Contractor shall furnish 6 copies of the manufacturer's shop drawings, specific design data as required in the detailed specifications, and technical literature covering all equipment and fabricated materials which he proposes to furnish under this contract in sufficient detail to indicate full compliance with the specifications. Shop drawings shall indicate the method of installing, the exact layout dimensions of the equipment or materials, including the location, size and details of valves, pipe connections, etc.

4.2 No equipment or materials shall be shipped until the manufacturer's shop drawings and specifications or other identifying data, assuring compliance with these specifications, are approved by the Engineer.

4.3 The Contractor shall check and verify all field measurements and shall be responsible for the prompt submission of all shop and working drawings so that there shall be no delay in the work.

4.4 Regardless of corrections made in or approval given to such drawings by the Engineer, the Contractor will nevertheless be responsible for the accuracy of such

drawings and for their conformity to the plans and specifications. The Contractor shall notify the Engineer in writing of any deviations at the time he furnishes such drawings. He shall remain responsible for the accuracy of the drawings showing the deviations but not for the acceptance of the deviations from the original design shown in the plans and specification. Approval by the Engineer and the Owner of any deviation in material, workmanship or equipment proposed subsequent to approval of the shop drawings or design data, shall be requested in writing by the Contractor.

4.5 When submitted for the Engineer's review, Shop Drawings shall bear the Contractor's certification that he has reviewed, checked and approved the Shop Drawings and that they are in conformance with the requirements of the Contract Documents.

5. Materials, Services, Facilities and Workmanship shall be furnished as follows:

5.1 Except as otherwise specifically stated in the contract documents, the Contractor shall provide and pay for all materials, labor, tools, equipment, water, light, power, transportation, superintendence, temporary construction of every nature, and all other services and facilities of every nature whatsoever necessary to execute, complete, and deliver the work within the specified time.

5.2 Unless otherwise specifically provided for in the specifications, all workmanship, equipment, materials and articles incorporated in the work shall be new and the best grade of the respective kinds for the purpose.

5.3 The Contractor shall furnish to the Engineer for approval the manufacturer's detailed specifications for all machinery, mechanical and other special equipment, which he contemplates installing together with full information as to type, performance characteristics, and all other pertinent information as required.

5.4 Materials which are specified by reference to the number or symbol of a specific standard, such as an ASTM standard, a federal specification or other similar standard, shall comply with requirements in the latest revision thereof and any amendment or supplement thereto in effect on the date of the advertisement for bids, except as limited to type, class or grade, or modified in such reference. The standards referred to shall have full force and effect as though printed therein.

5.5 For equipment or for materials, when requested by the Engineer, the Contractor shall submit certificates of compliance from the manufacturer, certifying that the equipment or the materials comply with the requirements of the specifications or the standards.

5.6 Manufactured articles, materials, and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned as directed by the manufacturer.

5.7 Materials, supplies, and equipment shall be in accordance with samples submitted by the Contractor and approved by the Engineer.

6. Contractor's Title To Materials. No material, supplies, or equipment to be installed or furnished under this contract shall be purchased subject to any chattel mortgage or under a conditional sale, lease purchase or other agreement by which an interest therein or in any part thereof is retained by the seller or supplier. The Contractor shall warrant good title to all materials, supplies, and equipment installed or incorporated in the work and upon completion of all work, shall deliver the same together with all improvements and appurtenances constructed or placed thereon by him to the Owner free from any claims, liens, or charges. Neither the Contractor nor any person, firm or corporation furnishing any material or labor for any work covered by this contract shall have any right to a lien upon any improvement or appurtenance thereon. Nothing contained in this paragraph, however, shall defeat or impair the right of persons furnishing materials or labor to recover under any bond given by the Contractor for their protection or any rights under any law permitting such persons to look to funds due the Contractor in the hands of the Owner. The provisions of this paragraph shall be inserted in all subcontracts and material contracts and notice of its provisions shall be given to all persons furnishing materials for the work when formal contract is entered into for such materials.

7. Inspection and Testing of Materials shall be as follows:

7.1 All materials and equipment used in the construction of the project shall be subject to inspection and testing by the Engineer in accordance with accepted standards at any and all times during manufacture or during the project construction and at any or all places where such manufacture is carried on.

7.2 The Contractor shall furnish promptly upon request by the Engineer, all materials required to be tested. All tests made by the Engineer shall be performed in such manner and ahead of scheduled installation, as not to delay the work of the Contractor. When required, testing of concrete, masonry, soils, pipe and pipe materials will be made in accordance with provisions in the specifications.

7.3 Material required to be tested which is delivered to the job site shall not be incorporated into the work until the tests have been completed and approval or acceptance given in writing by the Engineer.

7.4 Each sample submitted by the Contractor for testing shall carry an identification label containing such information as is requested by the Engineer. It shall also include a statement that the samples are representative of the remaining materials to be used on the project.

7.5 Approval of any materials shall be general only and shall not constitute a waiver of the Owner's right to demand full compliance with the contract requirements.

7.6 The Engineer may, at his own discretion, undertake the inspection of materials at the source. In the event plant inspection is undertaken, the following conditions shall be met:

a. The Engineer shall have the cooperation and assistance of the Contractor and the producer with whom he has contracted for materials.

b. The Engineer shall have full entry at all reasonable times to such areas as may concern the manufacture or production of the materials being furnished.

c. If required, the Contractor shall arrange for a building for the use of the inspector; such building to be located near the plant, independent of any building used by the material producer, in which to house and use the equipment necessary to carry on the required tests. Cost for such arrangement shall be paid by the Owner as a stated allowance in the bid.

d. Adequate safety measures shall be provided and maintained at all times.

7.7 Except as otherwise specifically stated in the contract, the costs of sampling and testing will be divided as follows:

a. The Contractor shall furnish the Engineer, without extra cost, all samples required for testing purposes. All sampling and testing including the number and selection of samples shall be determined by the Engineer for his own information and use.

b. When testing of materials is specified in the appropriate section of the specifications, the cost of the same shall be charged to the Owner or Contractor, as detailed in the specifications. However, costs of equipment performance tests shall be borne by the Contractor, as detailed in the appropriate section of the specifications.

c. When the Contractor proposes a material, article or component as equal to the ones specified, reasonable tests may, or may not, be required by the Engineer. If the Engineer requires tests of a proposed equal item, the Contractor will be required to assume all costs of such testing.

d. Any material, article or component which fails to pass tests required by the Engineer or by the specifications, will be rejected and shall be removed from the project site. However, if, upon request of the Contractor, retesting or further tests are permitted by the Engineer, the Contractor shall assume all costs related to such retesting or further tests.

e. Neither the Owner nor the Engineer will in any way be charged for the manufacturer's costs in supplying certificates of compliance.

7.8 If the Contract Documents, laws, ordinances, rules, regulations or orders of any public authority having jurisdiction require any Work to specifically be inspected, tested or approved by someone other than the Contractor, the Contractor will give the Engineer

timely notice of readiness. The Contractor will then furnish the Engineer with the required certificates of inspection, testing or approval.

7.9 Inspections, tests, or approvals by the engineer or others shall not relieve the Contractor from obligations to perform the Work in accordance with the requirements of the Contract Documents.

8. "Or Equal" Clause, Substitutions and Contractor Options.

8.1 Whenever a material, article, or piece of equipment is identified on the plans or in the specifications by reference to manufacturer's or vendor's names, trade names, catalogue numbers, etc., it is intended merely to establish a standard of quality and performance. Any material, article, or equipment of other manufacturers and vendors, which will perform satisfactorily the duties imposed by the general design, shall be considered equally acceptable provided the material, article, or equipment so proposed is, in the opinion of the Engineer, of equal quality and function. The Engineer shall determine equality based on such information, tests, or other supporting data that may be required of the Contractor.

8.2 Upon acceptance and approval by the Engineer of an equal product, it shall remain the responsibility of the Contractor to coordinate installation of the item with all other items to be furnished to assure proper fitting together of all items. Similar responsibility applies to items which are left to the Contractor's option. Any additional cost of equal items and any additional cost incidental to the coordination and/or fitting together of such items shall be borne by the Contractor at no extra cost to the Owner.

8.3 If a specified or equal item is not available to meet the construction schedule, the Contractor may propose a substitute item of less than equal performance and quality. If this substitute is acceptable to the Engineer, any difference in purchase cost or costs incidental to the installation of such item will be negotiated between the parties to the contract.

8.4 Neither equal nor substitute items shall be installed without written approval of the Engineer.

8.5 The Contractor shall warrant that if substitutes are approved, no major changes in the function or general design of the Project will result.

9. Patents. Patent information is as follows:

9.1 The Contractor shall hold and save the Owner and its officers, agents, servants, and employees harmless from liability of any nature or kind, including cost and expenses for, or on account of, any patented or unpatented invention, process, article, or appliance manufactured or used in the performance of the contract, including its use by the Owner, unless otherwise specifically stipulated in the contract documents.

9.2 License and/or royalty fees for the use of a process used in wastewater plant design which is authorized by the Owner for the project, must be reasonable, and paid to the holder of the patent, or his authorized licensee.

9.3 If the Contractor uses any design, device or materials in the construction methods for the project covered by patents or copyrights, he shall provide for such use by suitable agreement with the owner of such patented or copyrighted design, device or material. It is mutually agreed and understood, that, without exception, the contract prices shall include all royalties or costs arising from the use of such design, device or materials, in any way involved in the work. The Contractor and/or his sureties shall indemnify and save harmless the Owner of the project from any and all claims for infringement by reason of the use of such patented or copyrighted design, device or materials or any trademark or copyright in connection with work agreed to be performed under this contract, and shall indemnify the Owner for any cost, expense or damage which it may be obliged to pay by reason of such infringement at any time during the construction of the work or after completion of the work.

10. Surveys. Surveys of land, property and construction shall be as follows:

10.1 The Owner will provide all land surveys and will establish and locate all property lines relating to the project.

10.2 For structures, the Engineer will establish and stake out one or more base lines as needed and will establish bench marks in and around the project site for the use of the Contractor and for the Engineer's own reference in checking the work in progress. For structures such as pipelines, the Engineer will establish the location of the pipe, manholes and other appurtenances, and will establish bench marks along the route of the pipeline at intervals for the using of the Contractor and for his own reference in checking the pipe and manhole inverts and other elevations throughout the project. The Contractor shall utilize the lines and bench marks established by the Engineer to set up whatever specific detail controls he may need for establishing location, elevation lines and grades of all structures. All this work is subject to checking, approval, and continuous surveillance by the Engineer to avoid error. The Contractor shall provide the Engineer with a qualified man or men to assist in this checking as needed and on request of the Engineer.

10.3 For construction other than pipelines and appurtenances in roadways and cross country, the Contractor shall be responsible for the location and setting lines and grades. The Contractor shall establish the location for pump station and wastewater treatment facility structures, associated yard piping including electrical conduits, internal piping and all equipment. Base lines and benchmarks for setting of the lines and grades for the above shall be provided by the Engineer.

10.4 Protection of stakes. The Contractor shall protect and preserve all of the established baseline stakes, bench marks, or other controls placed by the Engineer. Any of these items destroyed or lost through fault of the Contractor will be replaced by the Engineer at the Contractor's expense.

11. Contractor's Obligations are as follows: The Contractor shall and in good workmanlike manner, do and perform all work and furnish and pay for all supplies and materials, machinery, equipment, facilities and means, except as herein otherwise expressly specified, necessary or proper to perform and complete all the work required by this contract, within the time stated in the proposal in accordance with the plans and drawings covered by this contract, and any and all supplemental plans and drawings, in accordance with the directions of the Engineer as given from time to time during the progress of the work, whether or not he considers the direction in accordance with the terms of the contract. He shall furnish, erect, maintain and remove such construction plant and such temporary works as may be required. The Contractor shall observe, comply with, and be subject to all terms, conditions, requirements, and limitations of the contract documents, and shall do, carry on and complete the entire work to the satisfaction of the Engineer and Owner.

    Contractor shall carry on the work and adhere to the progress schedule during all disputes, disagreements or unresolved claims with the Owner. No work shall be delayed or postponed pending the resolution of any disputes, disagreements, or claims except as the Owner and Contractor may otherwise agree in writing.

12. Weather Conditions. In the event of temporary suspension of work, or during inclement weather, or whenever the Engineer shall direct, the Contractor and his Subcontractors shall protect their work and materials against damage or injury from the weather. If, in the opinion of the Engineer, any work or material shall have been damaged or injured by reason of failure on the part of the Contractor or any of his Subcontractors to so protect his work, such materials shall be removed and replaced at the expense of the Contractor.

13. Protection of Work and Property shall be provided as follows:

    13.1 The Contractor shall at all times safely guard the Owner's property from injury or loss in connection with this contract. He shall at all times safely guard and protect his own work, and that of adjacent property, from damage. The Contractor shall replace or make good any such damage, loss or injury unless caused directly by errors contained in the contract, or by the Owner, or his authorized representatives. The Contractor will notify owners of adjacent utilities when prosecution of the Work may affect them.

    13.2 The Contractor shall take all necessary precautions for the safety of employees on the work site, and shall comply with all applicable provisions of federal, state and municipal safety laws and building codes to prevent accidents or injury to persons on, about or adjacent to the premises where the work is being performed. He shall erect and properly maintain at all times, as required by the conditions and progress of the work, all necessary safeguards for the protection of the workmen and the public and shall post danger signs warning against the hazards created by such features of construction as protruding nails, hoists, well holes, elevator hatchways, scaffolding, window openings, stairways, trenches and other excavations, and falling materials, and he shall designate a responsible member of his organization on the work, whose duty shall be the prevention of accidents. The name and position of any person so designated shall be reported to the

Engineer by the Contractor. The person so designated shall be available by phone during nonworking hours.

13.3 In case of emergency which threatens loss or injury of property, and/or safety of life, the Contractor is allowed to act, without previous instructions from the Engineer. He shall notify the Engineer immediately thereafter. Any claim for compensation by the Contractor due to such extra work shall be promptly submitted in writing to the Engineer for approval.

13.4 When the Contractor has not taken action but has notified the Engineer of an emergency threatening injury to persons or damage to the work or any adjoining property, he shall act as instructed or authorized by the Engineer.

13.5 The intention is not to relieve the Contractor from acting, but to provide for consultations between Engineer and Contractor in an emergency which permits time for such consultations.

13.6 The amount of reimbursement claimed by the Contractor on account of any emergency action shall be determined in the manner provided in Article 17 (extra work and change orders) of the general conditions.

14. Inspection of work for conformance with plans and specifications.

14.1 For purposes of inspection and for any other purpose, the Owner, the Engineer, and agents and employees of the Division or of any funding agency may enter upon the work and the premises used by the Contractor, and the Contractor shall provide safe and proper facilities therefore. The Engineer shall be furnished with every facility for ascertaining that the work is in accordance with the requirements and intention of this contract, even to the extent of uncovering or taking down portions of finished work.

14.2 During construction and on its completion, all work shall conform to the location, lines, levels and grades indicated on the drawings or established on the site by the Engineer and shall be built in a workmanlike manner, in accordance with the drawings and specifications and the supplementary directions given from time to time by the Engineer. In no case shall any work which exceeds the requirements of the drawings and specifications be paid for as extra work unless ordered in writing by the Engineer.

14.3 Unauthorized work and work not conforming to plans and specifications shall be handled as follows:

a. Work considered by the Engineer to be outside of or different from the plans and specifications and done without instruction by the Engineer, or in wrong location, or done without proper lines or levels, may be ordered by the Engineer to be uncovered or dismantled.

b. Work done in the absence of the Engineer or his agent may be ordered by the Engineer to be uncovered or dismantled.

c. Should the work thus exposed or examined prove satisfactory, the uncovering or dismantling and the replacement of material and rebuilding of the work shall be considered as “Extra Work” to be processed in accordance with article 17.

d. Should the work thus exposed or examined prove to be unsatisfactory the uncovering or dismantling and the replacement of material and rebuilding of the work shall be at the expense of the Contractor.

15. Reports, Records and Data shall be furnished as follows: The Contractor shall submit to the Owner such schedule of quantities and costs, progress schedules, payrolls, reports, estimates, records and other data as are required by the Contract Documents or as the Owner, Division or any funding agency may request concerning work performed or to be performed under this contract.

16. Superintendence by Contractor shall be furnished as follows: At the site of the work, the Contractor shall employ a competent construction superintendent or foreman who shall have full authority to act for the Contractor. The superintendent or foreman shall have been designated in writing by the Contractor as the Contractor's representative at the site. It is understood that such representative shall be acceptable to the Engineer and shall be the one who can be continued in that capacity for the particular job involved unless he ceases to be on the Contractor's payroll. Such representative shall be present on the site at all times as required to perform adequate supervision and coordination of the Work.

17. Extra Work and Change Orders shall be processed as follows:

17.1 The Engineer may at any time by written order and without notice to the sureties require the performance of such extra work or changes in the work as may be found necessary. The amount of compensation to be paid to the Contractor for any extra work so ordered shall be made in accordance with one or more of the following methods in the order of precedence listed below:

a. A price based on unit prices previously approved; or

b. A lump sum price agreed upon between the parties and stipulated in the order for the extra work;

c. A price determined by adding 15 percent to the “reasonable cost” of the extra work performed, such “reasonable cost” to be determined by the Engineer in accordance with the following paragraph.

17.2 The Engineer shall include the reasonable cost to the Contractor of all materials used, of all labor, both common and skilled, of foreman, trucks, and the fair-market rental rate for all machinery and equipment for the period employed directly on the work. The reasonable cost for extra work shall include the cost to the Contractor of any additional

insurance that may be required covering public liability for injury to persons and property, the cost of workmen's compensation insurance, federal social security, and any other costs based on payrolls, and required by law. The cost of extra work shall not include any cost or rental of small tools, buildings, or any portion of the time of the Contractor, his project supervisor or his superintendent, as assessed upon the amount of extra work, these items being considered covered by the 15 percent added to the reasonable cost. The reasonable cost for extra work shall also include the premium cost, if any, for additional bonds and insurance required because of the changes in the work.

17.3 In the case of extra work which is done by Subcontractors under the specific contract, or otherwise if so approved by the Engineer, the 15 percent added to the reasonable cost of the work will be allowed only to the Subcontractor. On such work an additional percentage of the reasonable cost (before addition of the 15 percent) will be paid to the Contractor for his work in directing the operations of the Subcontractor, for administrative supervision, and for any overhead costs. Such percentage shall be in accordance with the following schedule: reasonable cost up to and including $50,000—10 percent; next $50,000 to and including $100,000—7½ percent; greater than $100,000—5 percent.

17.4 The Engineer may authorize minor changes or alterations in the work not involving extra cost and not inconsistent with the overall intent of the contract documents. These shall be accomplished by a written field order. However, if the Contractor believes that any minor change or alteration authorized by the Engineer entitles him to an increase in the contract price, he may make a claim therefore as provided in article 21.

18. Time For Completion and Liquidated Damages. The following paragraphs address time for completion and liquidated damages:

18.1 It is hereby understood and mutually agreed, by and between the Contractor and the Owner, that the date of beginning and the time for completion as specified in the contract of the work to be done hereunder are Essential Conditions of this contract; and it is further mutually understood and agreed that the work embraced in this contract shall be commenced on a date to be specified in the “Notice to Proceed.”

18.2 The Contractor agrees that said work shall be pursued regularly, diligently and continuously at such rate of progress as will insure full completion thereof within the time specified. It is expressly understood and agreed, by and between the Contractor and the Owner, that the time for the completion of the work described herein is a reasonable time, taking into consideration the average climatic range and usual industrial conditions prevailing in this locality.

18.3 If the Contractor shall neglect, fail or refuse to complete the work within the time herein specified, or any proper extension thereof granted by the Owner, then the Contractor does hereby agree, as a part consideration for the awarding of this contract, to pay to the Owner the amount specified in the contract, not as a penalty but as liquidated damages for such breach of contract as hereinafter set forth, for each and every calendar day that the Contractor shall be in default after the time stipulated in the contract for completing the work.

18.4 The liquidated damages amount is fixed and agreed upon by and between the Contractor and the Owner because of the impracticability and extreme difficulty of fixing

and ascertaining the actual damages the Owner would in such event sustain. Said amount is agreed to be the amount of damages which the Owner would sustain and said amount shall be deducted from time to time by the owner from current periodical payments.

18.5 It is further agreed that "time is of the essence" of each and every portion of this contract and of the specifications wherein a definite and certain length of time is fixed for the performance of any act whatsoever; and where under the contract an additional time is allowed for the completion of any work, the new time limit fixed by such extension shall "be of the essence". Provided, that the Contractor shall not be charged with liquidated damages or any excess cost when the Owner determines that the Contractor is without fault and the Contractor's reasons for the time extension are acceptable to the Owner; provided, further, that the Contractor shall not be charged with liquidated damages or any excess cost when the delay in the completion of the work is due to:

a. A preference, priority or allocation order duly issued by the government;

b. An unforeseeable cause beyond the control and without the fault or negligence of the Contractor, including, but not restricted to, acts of God, or of the public enemy, acts of the Owner, acts of another Contractor in the performance of a contract with the Owner, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, and severe weather;

c. Any delays of Subcontractors or suppliers occasioned by any of the causes specified in subsections (a) and (b) of this article:

18.6 The Contractor shall promptly notify the Owner in writing of the causes of the delay. The Owner shall ascertain the facts and extent of the delay and notify the Contractor within a reasonable time of his decision in the matter.

19. Defective Work. Defective work shall be processed as follows:

19.1 The Contractor shall promptly remove from the premises all materials and work condemned by the Engineer as failing to meet contract requirements, whether incorporated in the work or not, and the Contractor shall promptly replace and re-execute his own work in accordance with the contract and without expense to the Owner and shall bear the expense of making good all work of other Contractors which was destroyed or damaged by such removal or replacement.

19.2 All removal and replacement work shall be done at the Contractor's expense. If the Contractor does not take action to remove such condemned work and materials within 10 days after receipt of written notice, the Owner may remove them and store the material at the expense of the Contractor. If the Contractor does not pay the expense of such removal and storage within 10 days time thereafter, the Owner may, upon 10 days written notice, sell such materials at auction or at private sale and shall pay to the Contractor any net proceeds thereof, after deducting all the costs and expenses that should have been borne by the Contractor.

20. Differing Site Conditions. Claims for differing site conditions shall be processed as follows:

20.1 The Contractor shall promptly and before such conditions are disturbed, notify the Engineer in writing of:

a. Subsurface or latent physical conditions at the site differing materially from those indicated in this contract; or,

b. Unknown physical conditions at the site, differing materially from those ordinarily encountered and generally recognized as inherent in the type of work provided for in this contract.

20.2 The Engineer shall promptly investigate the conditions. If he finds that conditions differ materially and will cause an increase or decrease in the Contractor's cost or the time required to perform any part of the work under this contract whether or not changed as a result of such conditions, the Engineer shall make an equitable adjustment and modify the contract in writing.

20.3 No claim of the Contractor under this clause shall be allowed unless the Contractor has given proper notice as required in paragraph 20.1 of this clause.

20.4 No claim by the Contractor for an equitable adjustment shall be allowed if asserted after final payment under this contract.

21. Claims For Extra Cost. Claims for extra cost shall be processed as follows:

21.1 No claim for extra work or cost shall be allowed unless the same was done pursuant to a written order by the Engineer, approved by the Owner and the claim presented for payment with the first estimate after the changed or extra work is done. When work is performed under the terms of article 17, the Contractor shall furnish satisfactory bills, payrolls and vouchers covering all items of cost when requested by the Owner and shall allow the Owner access to accounts relating thereto.

21.2 If the Contractor claims that any instructions by drawings or similar documents issued after the date of the contract involve extra cost under the contract, he shall give the Engineer written notice after the receipt of such instruction and before proceeding to execute the work, except in an emergency which threatens life or property, then the procedure shall be as provided for under article 17, “Extra Work & Change Orders.” No claim shall be valid unless so made.

22. Right of Owner to Terminate Contract:

22.1 In the event that any of the provisions of this contract are violated by the Contractor, or by any of his Subcontractors, the Owner may serve written notice upon the Contractor and the surety of its intention to terminate the contract, and unless within 10 days after the serving of such notice upon the Contractor, such violation or delay shall cease and satisfactory arrangement for correction be made, the contract shall, upon the expiration of said 10 days cease and terminate. In the event of any such termination, the Owner shall immediately serve notice thereof upon the surety and the Contractor and the surety shall have the right to take over and perform the contract; provided, however, that if the surety does not commence performance thereof within 10 days from the date of the mailing to such surety of notice of termination, the Owner may take over the work and prosecute the same to completion by contract or by force account for the account and at the expense of the Contractor and the Contractor and his surety shall be liable to the Owner for any excess cost occasioned the Owner thereby, and in such event the Owner

may take possession of and utilize in completing the work, such materials, appliances, and plant as may be on the site of the work and necessary therefore.

22.2 If the Contractor should be adjudged bankrupt, or if he should make a general assignment for the benefit of his creditors, or if a receiver should be appointed on account of his insolvency, or if he should refuse or should fail, except in cases for which extensions of time are provided, to supply enough skilled workmen or materials, or if he should fail to make payments to Subcontractors or for material or labor, so as to affect the progress of the work, or be guilty of a violation of the contract, then the Owner, upon the written notice of the Engineer that sufficient cause exists to justify such action may, without prejudice to any other right or remedy and after giving the Contractor and his surety 7 days' written notice, terminate the employment of the Contractor and take possession of the premises and of all materials, tools, equipment and other facilities installed on the work and paid for by the Owner, and finish the work by whatever method he may deem expedient. In the case of termination of this contract before completion from any cause whatever, the Contractor, if notified to do so by the Owner, shall promptly remove any part or all of his equipment and supplies at the expense of the Contractor. If such expense exceeds such unpaid balance, the Contractor shall pay the difference to the Owner. The expense incurred by the Owner as herein provided, and the damage incurred through the Contractor's default, shall be approved by the Engineer.

22.3 Where the contract has been terminated by the Owner, said termination shall not affect or terminate any of the rights of the Owner as against the Contractor or his surety then existing or which may thereafter accrue because of such default. Any retention or payment of monies by the Owner due the Contractor under the terms of the contract, shall not release the Contractor or his surety from liability for his default.

22.4 After ten (10) days from delivery of a Written Notice to the Contractor and the Engineer, the Owner may, without cause and without prejudice to any other remedy, elect to abandon the Project and terminate the Contract. In such case the Contractor shall be paid for all Work executed and any expense sustained plus reasonable profit.

22.5 If through no act or fault of the Contractor, the Work is suspended for a period of more than ninety (90) days by the Owner or under an order of court or other public authority, or the Engineer fails to act on any request for payment within thirty (30) days after it is submitted, or the Owner fails to pay the Contractor substantially the sum approved by the Engineer or awarded by arbitrators within thirty (30) days of its approval and presentation, then the Contractor may, after ten (10) days from delivery of a Written Notice to the Owner and the Engineer terminate the Contract and recover from the Owner payment for all Work executed and all expenses sustained. In addition and in lieu of terminating the Contract, if the Engineer has failed to act on a request for payment or if the Owner has failed to make any payment as aforesaid, the Contractor may upon ten (10) days written notice to the Owner and the Engineer stop the Work until paid all amounts then due, in which event and upon resumption of the Work Change Orders shall be issued for adjusting the Contract Price or Extending the Contract Time or both to compensate for the costs and delays attributable to the stoppage of the Work.

22.6 If the performance of all or any portion of the Work is suspended, delayed, or interrupted as a result of failure of the Owner or Engineer to act within the time specified in the Contract Documents, or if no time is specified, within a reasonable time, an adjustment in the Contract Price or an extension of the Contract Time, or both, shall be

made by Change Order to compensate the Contractor for the costs and delays necessarily caused by the failure of the Owner or Engineer.

23. Construction Schedule and Periodic Estimates shall provide for the following:

23.1 Before starting the work or upon request by the Engineer during its progress, the Contractor shall submit to the Engineer a work plan showing construction methods and the various steps he intends to take in completing the work.

23.2 Before the first partial payment is made, the Contractor shall prepare and submit to the Engineer:

a. A written schedule fixing the dates for submission of drawings; and

b. A written schedule fixing the respective dates for the start and completion of segments of the work. Each such schedule shall be subject to review and change during the progress of the work.

c. Respective dates for submission of Shop Drawings and for the beginning of manufacture, the testing, and the installation of materials, supplies, and equipment.

d. A schedule of payments that the Contractor anticipates will be earned during the course of the Work.

24. Payments to Contractor. Payments to the Contractor shall be made as follows:

24.1 Progress payments. The Owner will once each month make a progress payment to the Contractor on the basis of an estimate of the total amount of work done to the time of the estimate and its value as prepared by the Contractor and approved by the Engineer.

24.2 Retainage by Owner. The Owner will retain a portion of the progress payment, each month, in accordance with the following procedures:

a. The Owner will establish an escrow account in the bank of the Owner's choosing. The account will be established such that interest on the principal will be paid to the Contractor. The principal will be the accumulated retainage paid into the account by the Owner. The principal will be held by the bank, available only to the Owner, until termination of the contract.

b Until the work is 50% complete, as determined by the Engineer, retainage shall be 10% of the monthly payments claimed. The computed amount of retainage will be deposited in the escrow account established above.

c. After the work is 50% complete, and provided the Contractor has satisfied the Engineer in quality and timeliness of the work, and provided further that there is no specific cause for withholding additional retainage no further amount will be withheld. The escrow account will remain at the same balance throughout the remainder of the project, unless drawn upon by the Owner in accordance with articles 19, 22, and 58.

d. Upon substantial or final completion (as defined in article 25), the amount of retainage will be reduced to 2% of the total Contract Price plus an additional retainage based on the Engineer's estimate of the fair value of the punch list items and the cost of completing and/or correcting such items of work, with specified amounts for each incomplete or defective item of work. As these items are completed or corrected, they shall be paid for out of the retainage until the entire project is declared completed (See article 25). The final 2% retainage shall be held during the one-year warranty period and released only after the Owner has accepted the project.

24.3 In reviewing monthly estimates for payments of the value of work done, the Engineer may accept in the estimate, prior to subtracting the retainage, the delivered cost of certain equipment and nonperishable material which have been delivered to the site or off-site location and which are properly stored and protected from damage. With the estimate, the Contractor shall submit to the Engineer invoices as evidence that the material has been delivered to the site. Prior to submitting the next monthly estimate, the Contractor shall provide the Engineer with paid invoices or other evidence that the materials have been paid for. If the Contractor fails to submit such evidence, the Engineer may then subtract the value of such materials or equipment for which the Owner has previously paid, from the next monthly estimate. The type of equipment and material eligible for payment prior to being incorporated in the work will be at the Engineer's discretion. Material and equipment made specifically for the subject job will be eligible for payment.

24.4 All material and work for which partial payments have been made shall thereupon become the sole property of the Owner. This provision shall not be construed as relieving the Contractor from the sole responsibility for the care and protection of materials and work upon which payments have been made or for the restoration of any damaged work, or as a waiver of the right of the Owner to require compliance with all of the terms of the contract.

24.5 Owner's right to withhold payments and make application. The Contractor agrees that he will indemnify and save the Owner or the Owner's agents harmless from all claims growing out of the lawful demands of Subcontractors, laborers, workmen, mechanics, material men, and furnishers of machinery and parts, equipment, power, tools and all supplies, including commissary, incurred in the furtherance of the performance of this contract. The Contractor shall, at the Owner's request, furnish satisfactory evidence that all claims of the nature hereinabove designated have been paid, discharged, or waived. If the Contractor fails to do so, then the Owner may, upon written notice to the Contractor either pay unpaid bills of which the Owner has written notice directly, or withhold from the Contractor's unpaid compensation a sum of money to pay any and all such lawful claims until satisfactory evidence is furnished that all liabilities have been fully discharged. Payment to the Contractor shall then be resumed in accordance with the terms of this contract but in no event shall the above provisions be construed to impose any obligations upon the Owner to either the Contractor or his surety or any third party. In paying any unpaid bills of the Contractor, the Owner shall be deemed the agent of the Contractor, and any payment so made by the Owner shall be considered as payment made under contract by the Owner to the Contractor and the Owner shall not be liable to the Contractor for any such payments made in good faith.

24.6 If the Owner fails to make payment forty-five (45) days after approval by the Engineer, in addition to other remedies available to the Contractor, there shall be added to

each such payment interest at an annual rate of 10% commencing on the first day after said payment is due and continuing until the payment is received by the Contractor.

25. Acceptance and Final Payment provisions shall be as follows:

25.1 Substantial completion and payment.

a. Substantial completion shall be that point, as certified by the Engineer, at which the contract has been completed to the extent that the Owner may occupy and/or make use of the work performed for the purposes for which it was intended. Upon substantial completion there may be minor items, such as seeding, landscaping, etc., yet to be completed or items of work to be corrected.

b. Upon receipt of written notice from the Contractor that the work is substantially complete, the Engineer shall promptly make an inspection, and when he finds the work complies with the terms of the contract and the contract is substantially completed, he will issue a signed and dated certificate, and a list of all items to be completed or corrected, stating that the work required by this contract has been substantially completed and is accepted by him.

c. Upon substantial completion, the entire balance due and payable to the Contractor less 2 percent of the Contract Price, and less a retention based on the Engineer's estimate of the fair value for the cost of completing or correcting listed items of work with specified amounts for each incomplete or defective item of work shall be made.

d. The general guarantee period for the work shall begin on the date certified by the Engineer that the work is substantially completed.

25.2 Final completion shall be that point at which all work has been completed and all defective work has been corrected. Unless the Engineer has issued a certificate of substantial completion, the general guarantee period shall begin upon certification by the Engineer of final completion.

25.3 At the end of the general guarantee period for the entire contract which has been certified finally completed or substantially completed, the Owner, through the Engineer, shall make a guarantee inspection of all or portions of the work. When it is found that the work is satisfactory and that no work has become defective under the terms of the contract, the Owner will accept the entire project and make final payment, including the reimbursement of monies retained pursuant to the guarantee period.

25.4 If the guarantee inspection discloses any work as being unsatisfactory, the Engineer will give the Contractor the necessary instructions for correction of such work, and the Contractor shall immediately execute such instructions. Upon correction of the work, another inspection will be made which shall constitute the guarantee inspection, provided the work has been satisfactorily completed.

25.5 Before issuance of final payment, the Contractor shall certify in writing to the Engineer that all payrolls, material bills, and other indebtedness connected with the work have been paid or otherwise satisfied; except that in case of disputed indebtedness or liens, if the contract does not include a payment bond, the Contractor may submit in lieu of certification of payment a surety bond in the amount of the disputed indebtedness or

liens, guaranteeing payment of all such disputed amounts, including all related costs and interest in connection with said disputed indebtedness or liens which the Owner may be compelled to pay upon adjudication.

25.6 If upon substantial completion, full completion is delayed through no fault of the Contractor, and the Engineer so certifies, the Owner may, upon certificate of the Engineer, and without termination of the contract, make payment of the balance due for that portion of the work fully completed and accepted. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

25.7 The acceptance by the Contractor of final payment shall release the Owner from all claims and all liability to the Contractor for all things relating to this work and for every act and neglect of the Owner and others relating to or arising out of this work. No payment, however, final or otherwise, shall operate to release the Contractor or his sureties from any obligations of the performance and payment bond under this contract.

26. Payments by Contractor. The Contractor shall pay the costs:

26.1 For all transportation and utility services not later than the 20th day of the calendar month following that in which services are rendered;

26.2 For all materials, tools, and other expendable equipment to the extent of 90 percent of the cost thereof, not later than the 20th day of the calendar month following that in which such materials, tools and equipment are delivered at the site of the work and the balance of the cost thereof not later than the 30th day following the completion of that part of the work in or on which such materials, tools and equipment are incorporated or used; and

26.3 To each of his Subcontractors, not later than the 5th day following each payment to the Contractor, the respective amounts allowed the Contractor on account of the work performed by his Subcontractors to the extent of each Subcontractor's interest therein.

27. Insurance. The Contractor and any Subcontractor shall obtain all the insurance required under this article and such insurance shall be approved by the Owner.

27.1 The Contractor and all Subcontractors shall procure and shall maintain during the life of this contract workmen's compensation insurance as required by applicable state law. The Contractor shall provide and shall cause each Subcontractor to provide adequate employer's liability insurance.

Limits of Liability: $100,000 each accident;
$500,000 disease - policy limit;
$100,000 disease - each employee.

27.2 The Contractor shall procure and shall maintain during the life of this contract Commercial General liability insurance to include contractual liability, explosion, collapse and underground coverages.

Limits of liability: $1,000,000 each occurrence bodily injury and property damage;
$2,000,000 general aggregate - include per project aggregate endorsement;
$2,000,000 products/completed operations aggregate.

If blasting or demolition or both is required by the contract, the Contractor or Subcontractor shall obtain the respective coverage and shall furnish the Engineer a certificate of insurance evidencing the required coverages prior to commencement of any operations involving blasting or demolition or both.

27.3 The Contractor shall procure and shall maintain during the life of this contract comprehensive automobile liability insurance to include all motor vehicles including owned, hired, borrowed and non-owned vehicles.

Limits of liability: $1,000,000 combined single limit for bodily injury and property damage.

27.4 The Contractor shall either:

a. Require each of his Subcontractors to procure and to maintain during the life of his subcontract commercial general liability insurance and comprehensive automobile liability insurance of the type and in the amounts specified in articles 27.2 and 27.3; or

b. Insure the activities of his Subcontractors in his policy.

27.5 The required insurance shall provide adequate protection for the Contractor and his Subcontractors, respectively, against damage claims which may arise from work under this contract, whether such work be by the insured or by anyone employed by him and also against any of the special hazards which may be encountered in the performance of this contract.

27.6 The Contractor shall furnish the Owner with certificates showing the type, amount, class of operations covered, effective dates and dates of expiration of policies. Such insurance shall not be canceled or materially altered, except after 10 days written notice has been received by the Owner.

27.7 For builder's risk insurance (fire and extended coverage) and until the work is completed and accepted by the Owner, the Contractor is required to maintain builder's risk type insurance on a 100 percent completed value basis on the insurable portion of the work for the benefit of the Owner, the Contractor, and Subcontractors as their interests may appear.

27.8 The Contractor shall take out and furnish to the Owner and maintain during the life of this contract, complete Owner's protective liability insurance.

Limits of Liability: $1,000,000 each occurrence;
$2,000,000 aggregate.

28. Contract Security. The Contractor shall within ten (10) days after the receipt of the Notice of Award furnish the Owner with a performance bond and a payment bond in penal sums equal to the amount of the contract price conditioned upon the performance by the Contractor of all undertakings, covenants, terms, conditions and agreements of the Contract Documents, and upon the prompt payment by the Contractor to all persons supplying labor and materials in the prosecution of the Work provided by the contract Documents. Such Bonds shall be executed by the Contractor and a corporate bonding company licensed to transact business in the state in which the Work is to be performed

and named on the current list of "Surety Companies Acceptable on Federal Bonds" as published in the Treasury Department Circular Number 570. The expense of these Bonds shall be borne by the Contractor.

29. Additional or Substitute Bond. If at any time a surety on any such Bond is declared as bankrupt or loses its right to do business in the state in which the Work is to be performed, or is removed from the list of Surety Companies accepted on Federal Bonds, the Contractor shall within ten (10) days after notice from the Owner to do so, substitute an acceptable bond (or bonds) in such form and sum and signed by such other surety or sureties as may be satisfactory to the Owner. The premiums on such bond shall be paid by the Contractor. No further payments shall be deemed due nor shall be made until the new surety or sureties shall have furnished such an acceptable bond to the Owner.

30. Assignments. The Contractor shall not assign the whole or any part of this contract or any monies due or to become due hereunder without written consent of the Owner. In case the Contractor assigns all or any part of any monies due or to become due under this contract, the instrument of assignment shall contain a clause substantially to the effect that it is agreed that the right of the assignee in and to any monies due or to become due to the Contractor shall be subject to prior claims of all persons, firms and corporations for services rendered or materials supplied for the performance of the work called for in this contract.

31. Mutual Responsibility of Contractors. If, through acts of neglect on the part of the Contractor, any other Contractor or any Subcontractor shall suffer loss or damage on the work site, the Contractor agrees to settle with such other Contractor or Subcontractor by agreement or arbitration if such other Contractor or Subcontractors will so settle. If such other Contractor or Subcontractors shall assert any claim against the Owner on account of any damage alleged to have been sustained, the Owner shall notify the Contractor, who shall indemnify and save harmless the Owner against any such claim.

32. Subcontracting. When subcontracting, the Contractor:

32.1 May utilize the services of specialty Subcontractors on those parts of the work which, under usual contracting practices, are performed by specialty Subcontractors.

32.2 Shall be as fully responsible to the Owner for the acts and omissions of his Subcontractors, and of persons either directly or indirectly employed by them, as he is for the acts and omissions of persons directly employed by him.

32.3 Shall cause appropriate provisions to be inserted in all subcontracts relative to the work to bind Subcontractors to the Contractor by the terms of the contract documents insofar as applicable to the work of Subcontractors and to give the Contractor the same power as regards terminating any subcontract that the Owner may exercise over the Contractor under any provision of the contract documents.

32.4 Shall not create any contractual relation between any Subcontractor and the Owner.

32.5 Shall not award Work to Subcontractor(s), in excess of fifty percent (50%) of the Contract Price, without prior written approval of the Owner.

33. Authority of the Engineer. In performing his duties, the Engineer or his representative shall:

33.1 Have the authority to suspend the work in whole or in part for such periods as he may deem necessary due to the failure of the Contractor to carry out provisions of the Contract or for failure of the Contractor to suspend work in weather conditions considered by the Engineer to be unsuitable for the prosecution of the work. The Engineer shall give all orders and directions under this contract, relative to the execution of the work. The Engineer shall determine the amount, quality, acceptability, and fitness of the several kinds of work and materials which are to be paid for under this contract and shall decide all questions which may arise in relation to the work. The Engineer's estimates and decisions shall be final and conclusive, except as otherwise provided. In case any question shall arise between the parties hereto relative to said contract or specifications, the determination or decision of the Engineer shall be a condition precedent to the right of the Contractor to receive any money or payment for work under this contract affected to any extent by such question. The Engineer shall decide the meaning and intent of any portion of the specifications and of any plans or drawings where the same may be found unclear. Any differences or conflicts in regard to their work which may arise between the Contractor under this contract and other Contractors performing work for the Owner shall be adjusted and determined by the Engineer.

a. The purpose of the above article is not in any way to relieve the Contractor of his responsibilities for the safety of workmen or general public in the execution of the work. Attention is drawn to Article 13 of these Conditions which refers to the safety obligations of the Contractor.

b. The Engineer, acting on behalf of the Owner, has the authority to enforce corrective action for work not in accordance with the specifications.

c. In addition, the Engineer, acting on behalf of the Owner, is to ensure that the work is in accordance with the Contract documents. He is not held responsible, however, for the methods of construction, sequences, schedules and procedures in the execution of the work. The Engineer does have the opportunity under 33.1 to reject the method of construction, work plan schedule, procedures, as he thinks appropriate.

33.2 Appoint assistants and representatives as he desires, and they shall be granted full access to the work under the contract. They have the authority to give directions pertaining to the work, to approve or reject materials, to suspend any work that is being improperly performed, to make measurements of quantities, to keep records of costs, and otherwise represent the Engineer in all matters except as provided below. The Contractor may, however, appeal from their decision to the Engineer himself, but any work done pending its resolution is at the Contractor's own risk. Except as permitted and instructed by the Engineer, the assistants and representatives are not authorized to revoke, alter, enlarge, relax, or release any requirements of these specifications, nor to issue instructions contrary to the plans and specifications. They are not authorized to act as superintendents or foremen for the Contractor, or to interfere with the management of the work by the Contractor. Any advice which the assistants or representatives of the Engineer may give the Contractor shall not be construed as binding the Engineer or the Owner in any way, nor as releasing the Contractor from the fulfillment of the terms of the contract. All transactions between the Contractor and the representatives of the Engineer which are liable to protest or where payments are involved shall be made in writing.

34. Stated Allowances. The Contractor shall include in his proposal for costs of materials not shown in his bid under "cash allowances" or "allowed materials," any cash allowances stated in the supplemental general conditions or other contract documents. The Contractor shall purchase the "allowed materials" as directed by the Owner on the basis of the lowest and best bid of at least 3 competitive bids. If the actual price for purchasing the "allowed materials" is more or less than the "cash allowance," the contract price shall be adjusted accordingly. The adjustment in contract price shall be made on the basis of the purchase price without additional charges for overhead, profit, insurance or any other incidental expenses. The cost of installation of the "allowed materials" shall be included in the applicable sections of the contract specifications covering this work.

35. Use of Premises, Removal of Debris, Sanitary Conditions. In the use of premises or removal of debris, the Contractor expressly undertakes at his own expense: to take every precaution against injuries to persons or damage to property; to maintain sanitary conditions; to store his apparatus, materials, supplies and equipment in such orderly fashion at the site of the work as will not interfere with the progress of his work or the work of any other Contractors; to place upon the work or any part thereof only such loads as are consistent with the safety of that portion of the work; to clean up frequently all refuse, rubbish, scrap materials and debris caused by his operations, to the end that at all times the site of the work shall present an orderly and workmanlike appearance; before final payment to remove all surplus material falsework, temporary structures, including foundations thereof, plant of any description and debris of every nature resulting from his operations, and to put the site in an orderly condition; to effect all cutting, fitting or patching of his work required to make the same conform to the plans and specifications and, except with the consent of the Engineer, not to cut or otherwise alter the work of any other Contractor; to provide and maintain in a sanitary condition such toilet accommodations for the use of his employees as may be necessary to comply with the requirements of the state and local boards of health, or of other bodies or authorities having jurisdiction.

36. Quantities of Estimate. Wherever the estimated quantities of work to be done and materials to be furnished under this contract are shown in any of the documents including the proposal, they are given for use in comparing bids and the right is specifically reserved except as herein otherwise specifically limited, to increase or decrease them as may be deemed reasonably necessary by the Owner to complete the work contemplated by this contract, and such increase or decrease shall in no way invalidate this contract, nor shall any such increase or decrease give cause for claims or liability for damages. Such increases or decreases shall not exceed 25 percent of the estimated quantities of work. An increase or decrease in quantities for subsurface materials (e.g. ledge, unsuitable backfill), which overrun or underrun by 25% or more of the bid quantity may be the basis for a contract price adjustment, at the rate of a negotiated adjusted unit rate. Negotiated unit price rates shall be equitable and shall take into account, but not be limited to the following factors; bid unit rate, distribution of rates and bid balance, and the scope of work as affected by the changed quantities. Claims for extra work resulting from changed quantities shall be processed under article 21.

37. Lands and Rights-of-Way. Acquisition and usage of lands and rights-of-way shall be as follows:

37.1 Prior to issuing the Notice to Proceed, the Owner shall legally obtain all lands and rights-of-way necessary for carrying out and completing the work to be performed under this contract.

37.2 The Contractor shall not (except after written consent from the Owner) enter or occupy with men, tools, materials, or equipment, any land outside the rights-of-way or property of the Owner. A copy of the written consent shall be given to the Engineer.

37.3 The Owner shall provide to the Contractor information which delineates and describes the lands owned and the rights-of-way acquired.

37.4 The Contractor shall provide at its own expense and without liability to the Owner any additional land and access thereto that the Contractor may desire for temporary construction facilities, or for storage of materials.

38. General Guarantee. With reference to warranties, neither the final certificate of payment nor any provision in the contract documents, nor partial or entire occupancy of the premises by the Owner, shall constitute an acceptance of work not done in accordance with the contract documents or relieve the Contractor of liability in respect to any express warranties or responsibility for faulty materials or workmanship. The Contractor shall remedy any defects in the work and pay for any damage to other work resulting therefrom, which appear within the warranty period one year or longer if required by the contract, from the certified date of completion or substantial completion of the work. The Owner will give notice of observed defects within two working days of their discovery.

39. Errors and Inconsistencies. With reference to errors and inconsistency in contract documents, any provisions in any of the contract documents which may be in conflict with the paragraphs in these general conditions shall be subject to the following order of precedence for interpretation:

39.1 Drawings will govern technical specifications.

39.2 General conditions will govern drawings and technical specifications.

39.3 Supplemental general conditions will govern general conditions, drawings and technical specifications.

39.4 Special conditions will govern supplemental general conditions, general conditions, drawings and technical specifications.

39.5 The Contractor shall take no advantage of any apparent error or omission in the plans or specifications. In the event the Contractor discovers such an error or omission, he shall notify the Engineer. The Engineer will then make such corrections and interpretations as may be deemed necessary for fulfilling the intent of the plans and specifications.

39.6 Figure dimensions on Drawings shall govern over general drawings.

40. Notice and Service Thereof. Any notice to the Contractor from the Owner relative to any part of this contract will be in writing and will be considered delivered and the service completed, when said notice is mailed, by certified registered mail, to the Contractor at

his last given address, or delivered in person to the Contractor or his authorized representative on the work.

41. Required Provisions Deemed Inserted. Each and every provision of law and clause required by law to be inserted in this contract shall be deemed to be inserted herein and the contract shall be read and enforced as though it were included herein, and if through mistake or otherwise any such provision is not inserted or is not correctly inserted (example; miswording, etc.), then upon the application of either party the contract shall forthwith be physically amended to make such insertion or correction.

42. Protection of Lives and Health. The work under this contract is subject to the safety and health regulations (CRF 29, part 1926, and all subsequent amendments) as promulgated by the U.S. Department of Labor on June 24, 1974. Contractors are urged to become familiar with the requirements of these regulations.

43. OSHA Construction Safety Program.

43.1 Pursuant to NHRSA 277:5-a, the Contractor shall provide an Occupational Health and Safety Administration (OSHA) 10-hour construction safety program for its on-site employees. All employees are required to complete the program prior to beginning work. The training program shall utilize an OSHA-approved curriculum. Graduates shall receive a card from OSHA certifying the successful completion of the training program.

43.2 Any employee required to complete the OSHA 10-hour construction safety program, and who can not within 15 days provide documentation of completion of such program, shall be subject to removal from the job site.

43.3 The following individuals are exempt from the requirements of the 10-hour construction safety program: law enforcement officers involved with traffic control or jobsite security; flagging personnel who have completed the training required by the Department of Transportation; all relevant federal, state and municipal government employees and inspectors; and all individuals who are not considered to be on the site of work under the federal Davis-Bacon Act, including, but not limited to, construction and non-construction delivery personnel and non-trade personnel.

44. Equal Employment Opportunity. Under equal employment opportunity requirements and during the performance of this contract the Contractor agrees to the following:

44.1 The Contractor will not discriminate against any employee or applicant for employment because of race, creed, color, national origin, or sex. The Contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, creed, color, national origin, or sex. Such action shall include, but not be limited to, the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this nondiscrimination clause.

44.2 The Contractor will in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment, without regard to race, creed, color, national origin, or sex.

44.3 The Contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided advising the labor union or worker's representative of the Contractor's commitment under section 202 of executive order no. 11246 of September 24, 1965, and 11375 of October, 13, 1967, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

44.4 The Contractor will comply with all provisions of executive orders no. 11246 and 11375.

44.5 The Contractor will furnish all information and reports required by executive orders no. 11246 and 11375.

44.6 In the event of the Contractor's noncompliance with the nondiscrimination clauses of this contract or with any of such rules, regulations, or orders, this contract may be canceled, terminated, or suspended in whole or in part by the Owner or the Department of Labor and the Contractor may be declared ineligible for further government contracts or federally-assisted construction, however, that in the event the Contractor becomes involved in, or is threatened with, litigation with a Subcontractor or vendor as a result of such direction by the Department of Labor, the Contractor may request the United States to enter into such litigation to protect the interests of the United States.

44.7 A breach of this article may be grounds for termination of this contract and for debarment as provided in 29 CFR 5.6.

45. Interest of Federal, State or Local Officials. No federal, state or local official shall be admitted to any share or part of this contract or to any benefit that may arise therefrom, but this provision shall not be construed to extend to this contract if made with a corporation for its general benefit.

46. Other Prohibited Interests. No official of the Owner who is authorized in such capacity and on behalf of the Owner to negotiate, make, accept or approve, or to take part in negotiating, making, accepting, or approving any architectural, Engineering, inspection, construction or material supply contract or any subcontract in connection with the construction of the project, shall become directly or indirectly interested personally in this contract or in any part hereof. No officer, employee, architect, attorney, Engineer or inspector of or for the Owner who is authorized in such capacity and on behalf of the Owner to exercise any legislative, executive, supervisory or other similar functions in connection with the construction of the project, shall become directly or indirectly interested personally in this contract or in any part thereof, any material supply contract, subcontract, insurance contract, or any other contract pertaining to the project.

47. Use and Occupancy Prior to Acceptance. Use and occupancy of a portion or unit of the project, upon completion of that portion or unit, and before substantial completion of the project, shall be a condition of this contract with the following provisions:

47.1 The Owner will make his request for use or occupancy to the Contractor in writing.

47.2 There must be no significant interference with the Contractor's work or performance of duties under the contract.

47.3 The Engineer, upon request of the Owner and agreement by the Contractor, will make an inspection of the complete part of the work to confirm its status of completion.

47.4 Consent of the surety and endorsement of the insurance carrier must be obtained prior to use and/or occupancy by the Owner. Also, prior to occupancy, the Owner will secure the required insurance coverage on the building.

47.5 The Owner will have the right to exclude the Contractor from the subject portion of the project after the date of occupancy but will allow the Contractor reasonable access to complete or correct items.

47.6 The warranty period shall begin upon substantial completion.

48. Suspension of Work. The Owner may, at any time and without cause, suspend the work or any portion thereof for a period of not more than 90 days by notice in writing to the Contractor and the Engineer. The Owner shall fix the date on which work shall be resumed. The Contractor will be allowed an increase in the contract price or an extension of the contract time, or both, directly attributable to any suspension if he makes a claim therefore as provided in articles 17 and 21.

49. [Reserved]

50. [Reserved]

51. [Reserved]

52. Project Sign. Furnish and erect a sign at the project site to identify the project and to indicate that the State Government is participating in the development of the project. Place the sign in a prominent location as directed by the Engineer. Do not place or allow the placement of other advertising signboards at the project site or along rights-of-way furnished for the project work. See Exhibit 1 for details of construction.

53. [Reserved]

54. Public Convenience and Traffic Control requirements:

54.1 The Contractor shall at all times so conduct his work as to assure minimal obstruction to traffic. The safety and convenience of the general public and the residents along the work site route and the protection of property shall be provided for by the Contractor. The Contractor shall be responsible for timely notification to local residents before causing any interruptions of their access.

54.2 Fire hydrants and water holes for fire protection on or adjacent to the work site shall be kept accessible to fire apparatus at all times, and no obstructions shall be placed within 10 feet of any such facility. No footways, gutters, drain inlets, or portions of highways adjoining the work site shall be obstructed. In the event that all or part of a roadway is officially closed to traffic during construction, the Contractor shall provide and maintain safe and adequate traffic accessibility, satisfactory to the Engineer, for residences and businesses along and adjacent to the roadway so closed.

54.3 When the maintenance of traffic is considered by the Engineer to be minimal, the contract may not show this work as a pay item. In such cases, the Contractor shall bear all expense of maintaining traffic over the sections of road undergoing improvement and of constructing and maintaining such approaches, crossings, intersections, and other features as may be necessary, without direct reimbursement.

55. Pre-Construction Conference. The Contractor shall not commence work until a pre-construction conference has been held at which representatives of the Contractor, Engineer, Division and Owner are present. The pre-construction conference shall be scheduled by the Engineer.

56. Maintenance During Construction.

56.1 The Contractor shall maintain the work during construction and until it is accepted by the Owner. This maintenance shall be continuous and effective work prosecuted day by day, with adequate equipment and forces, to the end that roads or structures are kept in satisfactory condition at all times.

56.2 All cost of maintenance during construction and before the work is accepted by the Owner shall be included in the unit prices bid on the various pay items and the Contractor shall not be paid an additional amount for such maintenance.

56.3 If the Contractor, at any time, fails to comply with the provisions above, the Engineer may direct the Contractor to do so. If the Contractor fails to remedy unsatisfactory maintenance within the time specified by the Engineer, the Engineer may immediately cause the project to be maintained and the entire cost of this maintenance will be deducted from money to become due the Contractor on this contract.

57. Cooperation with Utilities.

57.1 The Owner will notify all utility companies, all pipe line owners, or other parties affected, and have all necessary adjustments of the public or private utility fixtures, pipe lines, and other appurtenances within or adjacent to the limits of construction made as soon as practicable.

57.2 Water lines, gas lines, wire lines, service connections, water and gas meter boxes, water and gas valve boxes, light standards, cableways, signals, and all other utility appurtenances within the limits of the proposed construction which are to be relocated or adjusted are to be moved by the owners of such utilities at their expense, except as may otherwise be provided for in the special conditions or as noted on the plans.

57.3 It is understood and agreed that the Contractor has considered in his bid all of the permanent and temporary utility appurtenances in their present or relocated positions as shown on the plans and as evident on the site, and that no additional compensation will be allowed for any delays, inconvenience, damage sustained by him due to any interference from such utility appurtenances or the operation of moving them.

57.4 The Contractor shall cooperate with the Owners of any underground or overhead utility lines in their removal and rearrangement operations in order that these operations may progress in a reasonable manner, that duplication of rearrangements may be reduced to a minimum, and that services rendered by those parties will be minimal.

57.5 In the event of interruption to a water or utility service as a result of accidental breakage or as a result of being exposed or unsupported, the Contractor shall promptly notify the proper authority and shall cooperate with said authority in the restoration of services. If water service is interrupted, repair work shall be continuous until the service is restored. No work shall be undertaken around fire hydrants until provisions for continued service have been approved by the local fire authority. If any utility service is interrupted for more than 4 hours, the Contractor shall make provisions for temporary service at his own expense until service is resumed.

58. Work Performed at Night and on Sundays and Holidays shall comply with the following:

58.1 No work will be permitted at night or on Sundays or holidays except as approved in writing by the Engineer, and provided such work is not in violation of a local ordinance. When working at night, the Contractor shall provide flood lighting sufficient to insure the same quality of workmanship and the same conditions regarding safety as would be achieved in daylight.

58.2 Whenever Memorial Day or Fourth-of-July is observed on a Friday or a Monday and during the weekend of Labor Day, the Contractor may be required to suspend work for the 3 calendar days. Prior to the close of work, the work site shall be placed in a condition acceptable to the Engineer for the comfort and safety of the traveling public. An arrangement shall be made for responsible personnel acceptable to the Engineer to maintain the project in the above conditions.

59. Laws to be Observed. With reference to laws that shall be observed:

59.1 The Contractor shall keep fully informed of all federal and state laws, all local laws, ordinances, and regulations, and all orders and decrees of tribunals having any jurisdiction or authority, which in any manner affect those engaged or employed on the work. He shall at all times observe and comply with all such laws, ordinances, regulations, orders, and decrees; and shall protect and indemnify the state and its representatives against any claim or liability arising from or based on the violation of any such law, ordinance, regulation, order, or decree, whether by himself or his employees.

59.2 Indemnification

The Contractor will indemnify and hold harmless the Owner and the Engineer and their agents and employees from and against all claims, damages, losses, and expenses including attorney's fees arising out of or resulting from the performance of the Work, provided that any such claims, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property including the loss of use resulting therefrom; and is caused in whole or in part by any negligent or willful act or omission of the Contractor, and Subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable.

In any and all claims against the Owner or the Engineer, or any of their agents of employees, by any employees of the Contractor, and Subcontractor, anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable, the indemnification obligation shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by disability benefit or other employee benefit acts.

The obligation of the Contractor under this paragraph shall not extend to the liability of the Engineer, his agents or employees arising out of the preparation or approval of maps, Drawings, opinions, reports, surveys, Change Orders, designs or Specifications.

60. Permits. Permits to be obtained by the Contractor shall be in accordance with the following:

60.1 Permits and licenses of a temporary nature necessary for the prosecution of the work shall be obtained and paid for by the Contractor. Permits, licenses and easements for permanent structures or permanent changes in existing facilities will be secured and paid for by the Owner. Permits may include:

a. New Hampshire Department of Transportation Highway Trench Permits.

b. RSA 485-A:17 and 483-A N.H. DES Wetlands Bureau Dredge and Fill Permit.

c. RSA 485-A:17 - N.H. DES Site Specific Permit (Water Quality)

d. RSA 149-M:10 N.H. DES Solid Waste Management Bureau - disposal of construction debris and/or demolition waste.

e. N.H. Department of Environmental Services Air Resources Division (burning permits).

f. Other permits, as required by State and Local laws and ordinances.

g. Notice of intent for coverage under EPA's General NPDES Permit for construction dewatering activities.

61. Control of Pollution due to construction shall comply with the following:

61.1 During construction, the Contractor shall take precautions sufficient to avoid the leaching or runoff of polluting substances such as silt, clay, fuels, oils, bitumens, calcium chloride and any other polluting materials which are unsightly or which may be harmful to humans, fish, or other life, into groundwaters and surface waters of the State.

61.2 In waters used for public water supply or used for trout, salmon, or other game or forage fish spawning or nursery, control measures must be adequate to assure that turbidity in the receiving water will be increased not more than 10 standard turbidity units (s.t.u.) in the absence of other more restrictive locally-established limitations, unless otherwise permitted by the Division. In no case shall the classification for the surface water be violated.

61.3 In water used for other purposes, the turbidity must not exceed 25 s.t.u. unless otherwise permitted by the Division.

62. Use of Explosives.

62.1 When the use of explosives is necessary for the prosecution of the Work, exercise the utmost care not to endanger life or property. The Contractor shall be responsible for any and all damage resulting from the use of explosives.

62.2 Store all explosives in a secure manner, in compliance with all State and local laws and ordinances, and legally mark all such storage places. Storage shall be limited to such quantity as may be needed for the work underway.

62.3 Designate as a “Blasting Area” all sites where electric blasting caps are located and where explosive charges are being placed. Mark all blasting areas with signs as required by law. Place signs as required by law from each end of the blasting area and leave in place while the above conditions prevail. Immediately remove signs after blasting operations or the storage of caps is over.

62.4 Notify each property Owner and public utility company having structures in proximity to the site of the work sufficiently in advance to enable the companies to take such steps as they may deem necessary to protect their property. Such notice shall not relieve the Contractor of any of his responsibility for damage resulting from his blasting operation. Warn all persons within the danger zone of blasting operations and do not perform blasting work until the area is cleared. Provide sufficient flagmen outside the danger zone to stop all approaching traffic and pedestrians. Provide watchmen during the loading period and until charges have been exploded. Place adequate protective covering over all charges before being exploded.

63. Arbitration by Mutual Agreement.

63.1 All claims, disputes, and other matters in question arising out of, or relating to, the Contract Documents or the breach thereof, except for claims which have been waived by making an acceptance of final payment as provided in Section 25, may be decided by arbitration if the parties mutually agree. Any agreement to arbitrate shall be specifically enforceable under the prevailing arbitration law. The award rendered by the arbitrators shall be final, and judgment may be entered upon it in any court having jurisdiction thereof.

63.2 Notice of the request for arbitration shall be filed in writing with the other party to the Contract Documents and a copy shall be filed with the Engineer. Request for arbitration shall in no event be made on any claim, dispute, or other matter in question which would be barred by the applicable statute of limitations.

63.3 The Contractor will carry on the Work and maintain the progress schedule during any arbitration proceedings, unless other wise mutually agreed in writing.

64. Taxes. The Contractor shall pay all sales, consumer, use, and other similar taxes required by the laws of the place where the Work is performed.

65 Separate Contracts.

65.1 The Owner reserves the right to let other contracts in connection with this Project. The Contractor shall afford other Contractors reasonable opportunity for the introduction and storage of their materials and the execution of their Work, and shall properly connect and coordinate the Work with theirs. If the proper execution or results of any part of the Contractor's Work depends upon the Work of any other Contractor, the Contractor shall inspect and promptly report to the Engineer any defects in such Work that render it unsuitable for such proper execution and results.

65.2 The Owner may perform additional Work related to the Project or the Owner may let other contracts containing provisions similar to these. The Contractor will afford the other Contractors who are parties to such Contracts (or the Owner, if the Owner is performing the additional Work) reasonable opportunity for the introduction and storage of materials and equipment and the execution of the Work, and shall properly connect and coordinate the Work with theirs.

65.3 If the performance of the additional Work by other Contractors or the Owner is not noted in the Contract Documents prior to the execution of the Contract, written notice shall thereof be given to the Contractor prior to starting such additional Work. If the Contractor believes that the performance of such additional Work by the Owner or others involves it in additional expense or entitles it to an extension of the Contract Time, the Contractor may make a claim thereof as provided in Sections 17 and 18.

**Supplemental General Conditions**
**City of Nashua, New Hampshire**

The following clauses modify, change, delete, or add to the "General Conditions." Where any part of the "General Conditions" is modified or voided by these sections, the unaltered provisions of that part shall remain in effect.

## GENERAL CONDITION 27 – INSURANCE

- 27.1 In the first sentence, **DELETE "**workmen's compensation insurance" **REPLACE** with "workers' compensation insurance"

- 27.2 **ADD** the following sentence to the end of this subparagraph

  **"The City of Nashua shall be named as an additional insured."**

- 27.3 **ADD** the following sentence to the end of this subparagraph

  "Coverage must include all owned and non owned vehicles."

- 27.4 Paragraph A. **REPLACE** entire paragraph with the following:

  "Require each of the Subcontractors to procure and to maintain, during the life of the subcontract, commercial general liability insurance, workers' compensation insurance, and comprehensive automobile liability insurance of the type and in amounts specified in articles 27.1, 27.2, and 27.3; or"

- 27.7 **INSERT** the following after the last sentence:

  "**The City of Nashua shall be named as an additional insured**. A certificate of insurance must be submitted to the Owner reflecting coverage for builder's risk."

- 27.8 **INSERT** the following after the last sentence:

  "**The City of Nashua shall be named as an additional insured**.

- **INSERT** the following Paragraphs immediately after Paragraph 27.8 of the General Conditions:

  27.9 All bidders and subcontractors at every tier under the bidder will fully comply with NH RSA 281-A, "Workers' Compensation". It is the responsibility of the CONTRACTOR to submit to the OWNER certificates of insurance for all other subcontractors prior to the start of the project. It is the responsibility of the CONTRACTOR to provide the OWNER with updated certificates of insurance for the CONTRACTOR and all subcontractors 10 days prior to the expiration of coverage. The OWNER may, at any time, order the CONTRACTOR to stop work, suspend the contract or terminate the contract for non-compliance. All subcontractors are subject to the same insurance requirements as the CONTRACTOR.

**GENERAL CONDITION 42 - HEALTH AND SAFETY**

**INSERT** the following Paragraphs immediately after Paragraph 42 of the General Conditions:

42.1 "Attention is directed to the fact that confined spaces and other hazardous conditions exist within the work area, and as such, the Contractor shall submit a site-specific Health and Safety Plan in accordance with the requirements of Section 02210."

**GENERAL CONDITION 44- EQUAL EMPLOYMENT OPPORTUNITY**

For each instance that the following occurs:

**REPLACE "**race, creed, color, national origin, or sex" **with** "race, color, religion, sex, sexual orientation, or national origin"

For each instance that the following occurs:

**REPLACE "**executive order no. 11246 "with "executive order no. 11246, as amended"

**GENERAL CONDITION 55 – PRE-CONSTRUCTION CONFERENCE**

**ADD** the following sentences:

"The Contractor shall attend a weekly construction meeting and be prepared to outline the anticipated work schedule for the next week. A specific time and place will be established for the meeting, and representatives from the City, Engineer, and utility companies will also be in attendance as needed."

**GENERAL CONDITION 59- INDEMIFICATION**

59.3 **ADD** the following subparagraph:

"59.3 The application, implementation, and interpretation of the contract shall be governed exclusively by the laws of the State of New Hampshire, and any litigation shall be brought in a court located in the State of New Hampshire.

**GENERAL CONDITION 66 – INFORMATION NOT GUARANTEED**

ADD the following NEW paragraph as a City of Nashua – Supplemental General Conditions (Corresponds to General Condition 66):

66. INFORMATION NOT GUARANTEED

66.1 All information given on the Drawings or in the other Contract Documents relating to subsurface and other conditions, natural phenomena, existing pipes, and other structures is from the best sources at present available to the Owner. All such information is furnished only for information and convenience of the Contractor and is not guaranteed. It is agreed and understood that the Owner does not warrant or guarantee that the subsurface or other conditions, natural phenomena, existing

pipes or other structures encountered during construction will be the same as those indicated on the Drawings or in the other Contract Documents. It is agreed further and understood that the Contractor shall not use or be entitled to use any of the information made available to him or obtained in any examination made by him in any manner as a basis of or ground for any claim or demand against the Owner or the Engineer, arising from or by reason of any variance which may exist between the information made available and the actual subsurface or other conditions, natural phenomena, existing pipes or other structures actually encountered during the construction work, except as may otherwise be expressly provided for in the Contract Documents."

**GENERAL CONDITION 67 – POTENTIAL FOR HAZARDOUS MATERIALS**

**ADD** the following **NEW** paragraph as a City of Nashua - Special Condition (Corresponds to General Condition 67):

67. POTENTIAL FOR HAZARDOUS MATERIALS

67.1 Although not anticipated, work may include excavation through, and removal of, materials potentially containing undocumented asbestos-containing or other hazardous materials. Should the Contractor, while performing work under this Contract, uncover hazardous materials, as defined in federal, state and local regulations, he shall immediately notify the Engineer. No further disturbance of the area shall occur without direction from the Engineer. The area shall be cordoned off and covered with 6-mil polyethylene sheeting and await further directions from the Engineer.

67.2 Disposal of Asbestos Containing Materials shall be made at the Nashua Landfill. The Contractor is responsible to make all arrangements for delivery with the Owner.

67.3 The contract includes allowances for costs that may be incurred should contaminated soils or asbestos-containing materials be encountered. Should costs exceed these allowances or if other hazardous materials are encountered, any claim for extra work shall be processed in accordance with General Conditions, Section 21.

**GENERAL CONDITION 68 – MISCELLANEOUS**

**ADD** the following **new** paragraph as a City of Nashua - Special Condition (Corresponds to General Condition 68):

68. MISCELLANEOUS

68.1 DISPOSAL OF EXCAVATED MATERIALS

All surplus material shall be the property of the Contractor. The Contractor shall dispose of surplus materials in a legal manner.

68.3 CITY OF NASHUA HOLIDAYS

For calendar year 2015, Construction on the following City of Nashua Holidays shall not be allowed unless approved by the City: New Year's Day, Martin Luther King Day, President's Day, Memorial Day,

Independence Day, Labor Day, Veteran's Day, Thanksgiving Day, the day after Thanksgiving, Christmas Eve and Christmas Day.

Choice of Law and Venue:

This agreement shall be governed exclusively by the laws of the State of New Hampshire, and any litigation shall be brought in a court located in the State of New Hampshire.

SECTION 01010

SUMMARY OF WORK

PART 1 - GENERAL

1.01 LOCATION OF WORK:

A. The work in this Contract is located in the City of Nashua, NH on Burke Street, as described under paragraph 1.02.

1.02 SCOPE OF WORK:

A. Furnish all labor, materials, equipment and incidentals necessary to construct the CSO-004 Infrastructure Improvements – Burke Street Phase 2 project complete and ready for operation as shown on the Drawings and specified herein.

B. The work includes, but is not limited to, the following major items:

1. Cleaning and lining of existing service and storm drain lateral connections to the existing interceptor, installation of cleanouts, rehabilitation of existing manholes and catch basins, replacement of existing manhole frames, removal and replacement of existing catch basins and installation of new catch basins.

2. Installation of new curb bump outs, landscaping and rain gardens.

3. Removal of existing paving and repaving of Burke Street, including the necessary resetting of any curbs, reconstruction of sidewalks and lining of the street, as outlined in the specifications and on the contract drawings.

1.03 GENERAL:

A. Where articles of the General Conditions are repeated in the sections of Division 1 - General Requirements, it is intended to elaborate or qualify such articles. It is not intended that other articles of the above documents shall be omitted or that additional requirements set forth in the above documents and noted herein shall be excluded from Contract requirements unless specifically noted as such hereinafter.

B. Throughout Divisions 1 through 17 of the specifications, the term "Contractor" shall mean the general Contractor or the trade subcontractor performing the work, unless noted otherwise.

C. Work and materials which are necessary in the construction but which are not specifically referred to in the Specification, or shown on the Drawings, but

implied by the Contract shall be furnished by the Contractor and included in the Contractor's Unit and Lump Sum Prices Bid. The work and materials shall be such as will correspond with the general character of the work as may be determined by the Engineer, whose decisions as to the necessity for and character of such work and materials shall be final and conclusive. It is the intent of these specifications to produce a complete, finished job whether shown in every detail or not.

D. For the purposes of this Contract, anywhere the term "Temporary" is used in the Specifications, in the Plans, in Contract Addenda, in any revisions made to the Contract Documents at any time prior to or during construction, verbally, in writing, in change orders or work change directives or at any other time whether listed here or not, it shall be taken to mean "Temporary" only as it relates to the duration of the Contract. All repairs, restoration, and construction shall be considered permanent.

1.04 SEQUENCE OF CONSTRUCTION OPERATIONS:

A. Sequence of construction operations describes the general limitations and requirements for construction operations throughout the duration of the project.

B. Within 30 days of signing of the Contract, the Contractor shall submit to the Engineer a schedule/sequence of construction for the Work under this Contract in accordance with the requirements of the Specification Section 01300 Submittals and the requirements contained herein. The schedule shall indicate the anticipated timing of construction of new facilities as well as the demolition and modifications of existing structures.

C. The detailed schedule/sequence shall also include a description of the temporary bypass pumping operation(s), to comply with the requirements specified herein including the type of equipment, controls and provisions for standby units in the event of a failure of the primary bypass pumping units.

D. The schedules as accepted shall be adhered to except as deviations there from are expressly permitted by the Engineer. Schedules shall be updated and resubmitted as specified and as requested by the Engineer.

E. The Owner and Engineer reserve the right to reschedule such work at any time if, in his sole judgment, weather conditions, flow conditions or other factors would adversely affect the operation of the collection system during the conduct of the work.

F. Maintenance of sewer, water, gas and other utilities to residences shall be maintained throughout the project. When any utility interruption is required in order to complete construction operations the Contractor shall notify the City and the resident whose services are to be interrupted a minimum of 48 hours prior to any loss of service.

G. Specific constraints which shall be placed on the Contractor's sequence of

construction operation are as follows:

1. Do not begin work until plans have been submitted and approved and until all erosion control and environmental control measures are in place.

2. Obtain all permits and/or approvals before commencing any work.

3. Refer to Division 1 – General Requirements for additional requirements.

4. The Contractor shall have an approved plan for traffic control and obtain a road opening permit from the City prior to beginning any work in Burke Street.

5. The Contractor shall provide a detailed plan of paving, excavation, restoration and lateral and structure installation, detailing proposed overnight and daytime traffic control, expected duration between removal of existing pavement and installation of new pavement and other items for review by the City and the Engineer prior to the beginning of any construction operations.

6. The Contractor shall minimize the requirement for overnight detouring of traffic.

7. The Contractor shall ensure that access to the Nashua school bus parking area at the end of Burke Street is not disrupted during the construction period.

8. The Contractor shall be responsible for acquiring a laydown and storage area in the proximity of the work area. Past contracts have entered agreements with the owners of the large parking areas at the end of Burke Street to lease space to store their materials and equipment.

9. The contractor shall maintain local traffic access to homes and properties during all construction activities. Overnight detouring of non-local traffic will not be permitted. All excavations shall be plated and safely covered at the end of each work day, and detours taken down.

10. The contractor shall have no more than 1200 linear feet of unpaved road on Burke Street at any one time.

1.05 <u>OTHER PROVISIONS:</u>

A. In general, the Contractor shall make whatever provisions are necessary to protect and maintain the continued operation of the existing utilities and facilities. Such provisions shall include, but not necessary limited to, such items

as:

1. Protection of the structural integrity of existing structures.

2. Installation of suitable temporary piping and pumping equipment to replace conduits that must be modified in part to construct the work.

3. Where temporary bulkheads are indicated or otherwise required, they shall be the complete responsibility of the Contractor and shall be subject to the acceptance of the Engineer. Upon completion of the work for which the bulkhead was constructed, the bulkheads shall be removed in their entirety, with no debris and material to be left in the flow stream.

4. Notification of residents, the Engineer and the Owner of interruption in service due to construction operations.

1.06 CONTRACTOR'S USE OF PREMISES:

A. Contract or shall limit work and activities to those areas indicated on the Contract Drawings.

B. Contractor shall limit the use of the premises for the performance of the work and storage of materials and equipment to allow for the Owner's use in operating and maintaining existing facilities.

C. Contractor shall coordinate with Owner as necessary for normal access and maintenance requirements.

D. Contractor shall assume full responsibility for security of his and his subcontractor's materials and equipment stored on the site.

E. Contractor shall locate equipment and materials such that the Owner and emergency vehicle access is maintained at all times.

F. If directed by the Owner, Contractor shall move any stored equipment, materials and/or items which interfere with operations with Owner at no additional cost.

G. Contractor shall maintain all required equipment, materials, vehicles and other items required to complete the work within the laydown areas noted on the plants.

H. If required, the Contractor shall be responsible for snow removal within the limits of construction. Plant personnel will provide assistance, as required.

1.07 CONTRACT DRAWINGS:

A. The work to be performed is shown in the Contract Documents, including the set of Contract Drawings entitled "City of Nashua, New Hampshire CSO-004 Infrastructure Improvements – Burke Street Phase 2"

B. Additional Drawings showing details in accordance with which the work is to be done may be furnished by the Engineer, if found necessary, and shall then become a part of the Drawings.

1.08 UNDERGROUND UTILITIES:

A. The underground utilities shown on the drawings have been located primarily from information furnished by others and are considered approximate both as to size and location. Should additional utilities be encountered that are not shown on the drawings, it shall be the Contractor's responsibility to locate all existing utilities and to protect same from damage or harm. All utilities interfered with or damaged shall be properly restored, at the expense of the Contractor, to the satisfaction of its owner. The Contractor shall notify Dig Safe prior to any excavation.

1.09 GENERAL ARRANGEMENT;

A. Contract Drawings indicate the extent and general arrangement of the work. If any departures from the Contract Drawings are deemed necessary by the Contractor to accommodate the material and equipment he proposes to furnish, details of such departures and reasons thereof shall be submitted as soon as practicable to Engineer for approval. No such departures shall be made without the prior written approval of Engineer. Approved changes shall be made without additional cost to Owner for this work or related work under other Contracts of the project.

1.10 RESTORATION OF SURFACES

A. All surfaces disturbed by Contractor in the installation of underground piping or for any other reason shall be restored by the Contractor. All restoration work shall be performed in accordance with the requirements of Division 2 - Site Work. Any temporary pavement patching shall be of sufficient quality to allow for full beneficial use of the Burke Street right of way and sidewalks.

1.11 ADDITIONAL ENGINEERING SERVICES:

A. In the event that Engineer is required to provide additional engineering services as a result of substitution of materials or equipment which are not "or equal" by Contractor, or changes by Contractor in dimension, weight, power requirements, etc., of the equipment and accessories furnished, or if Engineer is required to examine and evaluate any changes proposed by Contractor for the convenience of Contractor, then Engineer's charges in connection with such additional services shall be charged to Contractor by Owner.

B. In the event that Engineer is required to provide additional engineering services as a result of Contractor's errors, omissions or failure to conform to the requirements of the Contract Documents, or if Engineer is required to examine and evaluate any changes proposed by Contractor solely for the convenience of Contractor, then Engineer's charges in connection with such additional services shall be charged to

Contractor by Owner.

1.12 CLEANUP AND DISPOSAL OF EXCESS MATERIALS:

A. During the course of his work, the Contractor shall keep the site of his operations in as clean and as neat a condition as possible. He shall dispose of all residue resulting from the construction work and at the conclusion of the work, he shall remove and haul away any surplus excavation, broken pavement, lumber, equipment, temporary structures, and any other refuse remaining from the construction operations and shall leave the site(s) of the work in a neat and orderly condition.

B. In order to prevent environmental pollution arising from the construction activities related to the performance of this Contract, the Contractor and his subcontractors shall comply with all applicable Federal State and Local laws, and regulations concerning waste material disposal, as well as the specific requirements stated in this Section.

C. The Contractor is advised that the disposal of excess excavated or material in wetlands, stream corridors, and plains is strictly prohibited even if the permission of the property owner is obtained. Any violation of this restriction by the Contractor or any person employed by him will be brought to the immediate attention of the responsible regulatory agencies, with a request that appropriate action be taken against the offending parties. Therefore, the Contractor will be required to remove the fill or material at his own expense and restore the area impacted.

1.13 TIME OF WORK:

A. Unless otherwise especially permitted, work shall be done between the hours of 7:00 a.m. and 4:00 p.m., Monday thru Friday excluding Saturdays, Sundays and legal holidays The following legal holidays are observed by the City of Nashua, and therefore shall be observed by the Contractor:

New Years Day
Civil Rights Day
Presidents Day
Memorial Day
Independence Day
Labor Day
Election Day
Veterans Day
Thanksgiving Day
Day after Thanksgiving
Christmas Day

B. Work outside the above time periods will be permitted on a case by case basis and only with written approval from the City of Nashua, Director of Public Works and if approved, can be revoked at any time for failing to comply with any of the terms

and conditions contained herein..

C. Unless otherwise specifically permitted, all work that would be subject to damage shall be stopped during inclement, stormy or freezing weather. Only such work as will not suffer injury to workmanship or materials will be permitted. Contractor shall carefully protect his work against damage or injury from the weather, and when work is permitted during freezing weather, he shall provide and maintain approved facilities for heating the materials and for protecting the finished work.

D. Contractor must understand that the work may be subject to noise restrictions. If work outside the normal working hours is approved, the Contractor shall be responsible for controlling noise pollution in accordance with Section 01505, Noise Control.

E. The Contractor shall pay special attention to ensuring that the neighborhood surrounding the area is not disturbed during construction operations. All vehicles travelling to and from Burke Street shall maintain the speed limit. Vehicles leaving the construction site shall be sufficiently washed to avoid depositing soils, stones or other construction related debris on the surrounding roadways.

1.14 FIRE PROTECTION:

A. Contractor shall take all necessary precautions to prevent fires at or adjacent to the work and shall provide adequate facilities for extinguishing fires which do occur. No burning of trash or debris will be permitted.

1.15 CHEMICALS AND PETROLEUM PRODUCTS:

A. All chemicals and/or petroleum products used during project construction must show approval of the EPA, NSF or USDA. Herbicides and pesticides must be approved for use within watersheds for potable water supply. Use of all such chemicals and disposal of residues shall be in strict conformance with all applicable rules and regulations.

B. Maintain Material Safety Data Sheets (MSDS) on site for all chemicals and/or petroleum products stored or used on site.

C. The Contractor shall provide storage containers and containment facilities for all chemical and petroleum products.

1.16 OPEN EXCAVATIONS:

A. All open excavations shall be adequately safeguarded by providing temporary barricades, fencing, caution signs, lights and other means to prevent accidents to persons and damage to property. The length and size of excavation will be controlled by the particular surrounding conditions, but shall always be confined to the limits prescribed by the Engineer. If the excavation becomes a hazard, or if it excessively restricts traffic at any point, the Engineer may require special construction procedures such as limiting the length of open excavations

prohibiting stacking excavated material, and requiring that excavations shall not remain open overnight.

B. The Contractor shall take all necessary precautions to protect and prevent injury to all individuals that may enter the work site(s).

C. When backfilling trenches or excavations are not practical, beveled steel plates and supports shall be provided by the Contractor in order to maintain the flow of traffic and access to all areas of the plant as needed. Plates shall be capable of withstanding AASHTO HS-20 loading and consist of steel plates of adequate size, strength and suitably held in place to keep all traffic out of the excavation.

D. All excavations, excavated material, equipment or other obstacles which could be dangerous shall be secured, fenced off, and well lit at night when necessary.

1.17 INTERFERENCE WITH AND PROTECTION OF STREETS:

A. The Contractor shall not close or obstruct any portion of street, road or private way without obtaining permits therefore from the proper authorities. If any street, road or private way shall be rendered unsafe by the Contractor's operations, he shall make such repairs or provide such temporary ways or guards as shall be acceptable to the proper authorities.

B. Streets, roads, private ways and walks not closed shall be maintained passable and safe by the Contractor, who shall assume and have full responsibility for the adequacy and safety of provisions made therefore.

C. The Contractor shall, at least 24 hours in advance, notify the Police and Fire Departments in writing, with a copy to the Engineer, if the closure of a street or road is necessary. The Contract or shall cooperate with the police department in the establishment of alternate routes and shall provide adequate detour signs, plainly marked and well lighted in order to minimize confusion. Any single lane road closures or detours must be coordinated with the police and fire department prior to the traffic control devices and personnel being placed into operation.

1.18 TEST PITS:

A. Test pits may be undertaken by the Contractor at his discretion at no additional cost to the Owner.

B. The Owner or Engineer may instruct the Contractor to undertake test pits in order to verify existing subsurface conditions. Any test pits that are requested by the Owner or Engineer that are not implicitly called out in the contract documents will be paid for under the Test Pits bid item.

1.19 REJECTED MATERIALS AND DEFECTIVE WORK:

A. Materials furnished by the Contractor and condemned by the Engineer as unsuitable or not in conformity with the specifications shall forthwith be

removed from the work by the Contractor, and shall not be made use of elsewhere in the work. Any errors, defects or omissions in the execution of the work or in the materials furnished by the Contractor, even though they may have been passed or overlooked or have appeared after the completion of the work, discovered at any time before the final payment is made hereunder, shall be forthwith rectified and made good by and at the expense of the Contractor and in a manner satisfactory to the Owner and Engineer. The Contractor shall reimburse the Owner for any expenses, losses or damages incurred in consequence of any defect, error, omission or act of the Contractor or his employees, as determined by the Owner and Engineer, occurring previous to the final payment.

1.20 PRIVATE LAND:

A. The Contractor shall not enter or occupy private land outside of easements, except by permission of the Owner.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

NO TEXT ON THIS PAGE

# SECTION 01025

# MEASUREMENT AND PAYMENT

## PART 1 – GENERAL

### 1.01 DESCRIPTION:

A. Work completed under the contract shall be measured in accordance with this specification section and paid in accordance with this specification section for the work to be done under the items listed in the Form of BID and the requirements of the Contract Documents.

B. All work that is required by items on the Drawings and Contract Documents or is required for complete construction but is not listed in the Bid Schedule will not be measured for payment. These items are considered incidental to construction and all costs for construction are to be included in the items of the Bid Schedule.

C. Extra work, if any, shall be performed and paid for in accordance with the General Conditions.

D. The Contractor and Subcontractors shall not take advantage of any apparent error or omission on the Drawings or Specifications. They shall be permitted to make corrections and interpretations as may be deemed necessary for fulfillment of the intent of the Contract Documents at no additional cost to the Owner. Owner reserves the right to reject any and all bids.

E. Anywhere in these Contract Documents, the term furnish means manufacture, supply and deliver to the project site, including actual unloading, unpacking, assembly, erection, placing, installation, anchoring, applying, working to dimension, finishing, protecting, curing, cleaning, testing, startup and similar operations unless stated otherwise.

F. The following items are considered "Incidental" to the completion of the Work included in this Contract. These incidental work items shall be included in the Bid Schedule prices, and not included for separate payment elsewhere. The incidental work items include, but are not limited to:

1. Abandonment, removal and disposal of existing, abandoned or relocated private utilities not specified for payment elsewhere.
2. Establishing construction baseline.
3. Dust control.
4. Rodent control.
5. Attending all meetings
6. Furnish, install and maintain erosion and sedimentation control
7. Construction photographs
8. Compaction and compaction testing
9. Saw cutting concrete
10. Provide, maintain and install bypass pumping of sewers and drains

11. Furnish and placing backfill material by one of the approved methods listed below:
    a. Reuse of on-site excavated backfill material.
    b. Furnish and install imported suitable backfill material
    c. Transport the material to staging area, stage and protect material, load material, transport material to be used as backfill in the area of excavation or to another backfill area of equal or greater contamination where geotechnically suitable, and as approved by the Owner, Engineer and local regulatory authority.
12. Furnish, install, test, compact sub-base material by one of the approved methods listed below:
    d. Reuse of on-site excavated sub-base material.
    e. Furnish and install imported suitable sub-base material
    f. Transport the material to staging area, stage and protect material, load material, transport material to be used as sub-base in the area of excavation or to another sub-base area of equal or greater contamination where geotechnically suitable.
13. Concrete collars as required
14. Temporary excavation support; furnished and installed complete; left in place and cut off below grade as per contract specifications.
15. Construction dewatering
16. Filtration and/or treatment of construction dewatering water
17. Pre- and post- construction video
18. Providing certificates of design where required.
19. Submitting work plans, shop drawings CPM schedules and other submittals in accordance with Section 01300.
20. Concrete encasement of impacted utilities
21. Demolition and removal of pipe smaller than 15-inches diameter.
22. Permanent masonry plugs and bulkheads for pipe abandonment smaller than 15-inches diameter.
23. Street sweeping and snow removal from streets and sidewalks where work is on-going.
24. Obtain all permits including payment of fees not included for payment elsewhere.
25. Fulfilling all reporting requirements
26. Preparation and submission of monthly and final record drawing information
27. Tree pruning, protection and maintenance
28. Clearing and grubbing.
29. Cleanup and restoration of all surface features not included for payment elsewhere.
30. Demobilization from the site
31. Removal and reset of all signs, fences, posts, poles and all other surface features on public or private property which may need to be removed for construction.

1.02 <u>UNIT PRICE ITEMS:</u>

A. All Contract work shall be measured by the Engineer in accordance with the standards of weights and measures recognized by the U. S. Bureau of Standards.

B. Measurements will only be taken within designated limits as indicated on the drawings or as directed or computed to provide correct limits per intent of work and the project.

C. Items that are measured by the linear foot, such as pipe, shall be measured parallel to the base or foundation upon which such items are installed.

D. For measuring quantities where computation of area by geometric methods would be comparatively laborious, the planimeter shall be considered an instrument of precision adapted to area measurement.

E. In computing volumes of excavation, the average end area method, based on horizontal measurements, or other acceptable methods, will be used.

F. Materials measured or proportioned by weight shall be weighed on accurate approved scales by qualified personnel unless theoretical weights are permitted by the Engineer. Ton measure shall mean 2,000 pounds unless specified otherwise.

G. Net certified scale weights, based on certified volumes, shall be the basis of weight measure subject to correction for loss as determined by the Engineer.

H. Structures shall be measured according to neat lines indicated on the Contract drawings or as altered to fit field conditions. No payment shall be made for length, width, or depth, in excess of that indicated on the Contract Drawings or specified in the Contract Documents unless previously approved by the Engineer in writing.

I. When volume measure is specified, material shall be weighed when approved and converted to volume measure. Factors for conversion from weight measure to volume measure, unless provided in specifications, will be determined by the Engineer.

J. Any unit price which is unduly high or low may be rejected as unbalanced.

K. Unit prices shall be full compensation for all labor, materials and equipment required to furnish, install, construct, startup and test the work covered under that unit price item, whether listed in the related compensation subsection for each item or not. All supervision; overhead items including but not limited to bonds, insurance, and labor burden; and profit are also included.

L. Payment shall fully compensate the Contractor for any other work which is not specified or shown, but which is necessary to complete the work.

1.03 LUMP SUM ITEMS:

A. Each unit or lump-sum price stated in the Form of BID shall constitute full compensation for all labor materials and equipment required to furnish, install, construct, startup and test the work covered under that lump sum item including cleanup whether listed in the related compensation subsection for each item or not.

B. Payment for the lump sums shall include their pro-rata share of all costs for supervision, overhead, profit, bond, labor, materials, insurance and disposal required to perform the work item completely, as indicated or specified. Payment shall also fully compensate the

Contractor for any other work which is not specified or shown but which is necessary to complete the work.

C. Estimates of lump sum items shall be based on a schedule of values dividing each lump sum item into its appropriate component parts together with a quantity and a unit price for each part. The sum of the products of prices and quantities will equal the contract price for the lump sum item. The schedule of values shall be submitted by the Contractor and must have the approval of the Engineer (prior to the first payment requisition).

1.04 MEASUREMENT FOR PAYMENT:

A. Work completed to date measured as a percentage of the total Work, shall be submitted by the Contractor and substantiated as required by the Engineer and Owner.

B. The Engineer will review the submittal for completeness and verification. Failure to submit any of the below requirements will be grounds for a rejection of a submitted pay estimate until which time as the submittals are complete, accurate, up-to-date, and have been approved by the Engineer.

1. Include a checklist of completed items; only signed-off items will be considered for payment.
2. Include red-lined drawings indicating degree of completion.
3. Include a revised CPM schedule and narrative as required in the Specifications and show actual record information.
4. Include a copy of all required test results including but not limited to compaction test results, concrete strength test results, analytical test results, etc.

C. CONTAMINATED SOIL MANAGEMENT

Measurement and Payment for Contaminated Soil Management items shall be as listed below. Payment for lump sum items and allowances (Items 3 through 8) shall constitute full payment for all fees; labor, materials and equipment required to perform the work; furnishing, installing, constructing, starting-up and testing the work covered under that lump sum item; all supervision; all overhead items including but not limited to bonds, insurance, labor burden, profit, protections are also included. The Contractor shall be made aware that for soil management items, the actual quantities encountered may vary from the estimated quantities represented by the allowances presented in the Bid Schedule. The allowances presented have been established for bid comparison purposes only and do not represent a warranty of work.

Payment Items 3 through 8 are for managing soils and fill material encountered during the course of this contract that are subject to variable quantities. Management of excess soil/fill shall be in accordance with applicable regulations and technical specifications. The costs associated with managing, excavating and characterizing all soil and fill other than allowed for in the following payment items shall be incorporated into the contractor's bid price for Item 3 – Soil and Waste Management and completed in accordance with the technical specifications.

BID ITEM NO. 1: MOBILIZATION

A. Under the Lump Sum price bid for Mobilization, the Contractor shall move his equipment to the site and prepare to begin construction. Mobilization shall include all costs of initiating the Contract, exclusive of the cost of materials. Mobilization includes securing and constructing a staging area(s) for materials, furnishing office trailers fully equipped and supplied; traffic management; fabrication and installation of project sign; furnishing potable water, temporary sanitary facilities, utility and communication services for the office trailers; distributing contact numbers for Contractor's staff to Owner and Engineer; submission and approval of initial shop drawings; submission and approval of CPM schedule; submission and approval of initial work plans and sequencing plans; obtaining all necessary permits; installing temporary power, lighting and water for construction purposes; implementing security features; transporting all necessary trucks and construction equipment to the site necessary to begin construction; and all other work necessary to start Construction, including temporary water, power and telephone service.

B. Payment for Mobilization will be at lump sum price bid for this item in the proposal and shall be payable when the Contractor is operational on the site. Operational is defined as the substantial commencement of work on site as described in the preceding paragraph. The Lump Sum price bid for mobilization shall not exceed 5 percent of the Total Amount of Bid.

BID ITEM NO. 2: ALL WORK EXCEPT THE WORK OF BID ITEM NO. 1 AND BID ITEMS NOS. 3 THROUGH 50:

A. The Lump Sum price bid for this item shall constitute full compensation for all labor, equipment and materials required to furnish, install, construct, startup and test all work of the Contract covered under this Item, as indicated on the drawings and as specified within the specifications, which is not covered in Bid Item No. 1 and Bid Items Nos. 3 through 50 below.

B. Payment of this lump sum will be based on physical progress for each activity in accordance with the approved Schedule of Values.

BID ITEM NO. 3: SOIL AND WASTE MANAGEMENT

A. Under the Lump Sum price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for soil management. The work shall include, but not be limited to, the following:

1) Development and implementation of all plans specified in Section 02220, including, but not limited to: Health and Safety Plan; Equipment and Personnel Decontamination Plan; Waste Management Plan; Dust, Vapor, Liquid and Odor Plan; Air Quality Control Plan; Contingency Plan; and a Spill and Discharge Control Plan.

2) Submittal of certifications.

3) Soil staging area for stockpiling pending analytical testing, reuse or disposal and sufficient area to stockpile soil from suspected contaminated areas and soils of unknown quality without delaying construction activities as further specified in the Contract Documents.

The Contractor shall perform all work as shown on the Drawings and detailed in the Specifications regarding the management of all waste disposal, including project coordination with all parties affected and maintaining proper documentation necessary. The work shall also include disposal of wastes, such as construction-related waste and by-products, and Contractor-generated waste material, such as personal protective equipment, excess materials, debris removal, wash water, and any other waste materials not specially addressed in other payment items. Waste characterization sampling and analysis costs for the waste referenced above shall be considered incidental to disposal costs and shall be included in the lump sum price of this item. Soil characterization shall be undertaken as part of this lump sum item, and shall be completed in conformance with Division 2 of the specifications.

B. Measurement and payment for Soil and Waste Management shall be based on the percentage of project completion based on elapsed time compared to the contractual construction time limit as per the Contract established lump sum value in the Form of BID.

BID ITEM NO. 4: DISPOSAL OF SOIL/FILL AS NON-HAZARDOUS SOLID WASTE

A. Under the Allowance established for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to load, transport, and dispose at an appropriately permitted, solid waste facility, all soil/fill which is unsuitable for on-site reuse and defined as a non-hazardous solid waste unsuitable as daily cover at a New Hampshire Landfill. Upon City review and approval of the testing and analytical data conducted in accordance with the state regulations and facility specific requirements, soil meeting the criteria of this bid item may be delivered to the City of Nashua's Four Hills Landfill for use as daily cover or structural fill. However, the City reserves the option to reject any of this soil material it deems to be unsuitable regardless of the results of testing and analysis. Work for this bid item will be paid based on the cost to load, transport and dispose (including tipping fees) of the material, and will constitute full payment for the Work described. This cost shall include all fees, permits, and taxes. Soils sampling required by the City Landfill, or any other landfill chosen for disposal shall be considered included under the lump sum for Bid Item No 3. If the material is accepted at the City's landfill, tipping fees will be waived by the City. The Contractor will still be responsible for loading, handling and transporting the material. If the City does not accept the material at its landfill, the Contractor will still be responsible for all costs related to loading, transporting and disposing (including tipping fees) at another landfill.

B. Measurement and payment shall be on the basis of the cost of waste actually disposed, backed up by measurements at the disposal facility by certified scale, and documented on the return manifest or certified weight slip and accompanied by the appropriate Bill of Lading form. The quantity shall be verified by the Engineer by calculation of the in-place tonnage using the trench width pay limited defined in the Contract, a bulking factor

applicable to the soil type, and in place density tests supplied from a certified soil testing lab, by the Contractor. Should the quantity determined through the Engineer's calculations be less than the tonnage on the certified weight slips, the Contractor shall be compensated for the lesser tonnage. The Contractor shall receive no additional compensation for material removed outside of the approved pay limits. The Owner, and/or their representative, shall have the right to perform independent weighing of trucks. No payments will be made in cases of incomplete documentation of disposal. Payment will be made under the Allowance established in the Form of BID. If the total cost for such charges is greater or less than the Allowance amount stated under this item in the BID, a debit or credit of the difference in cost shall be made to the Owner.

BID ITEM NO. 5: REUSE SOIL/FILL AS DAILY COVER (LINED LAND FILL)

A. Under the Allowance established for this Item, the Contractor shall provide all necessary equipment, labor, and material to load, transport, and dispose at an appropriately permitted, solid waste facility, all soil/fill defined as a non-hazardous solid waste suitable for reuse as daily cover at a lined New Hampshire Landfill as defined by state regulations. Upon City review and approval of the testing and analytical data conducted in accordance with the state regulations and facility specific requirements, soil meeting the criteria of this bid item may be delivered to the City of Nashua's Four Hills Landfill for use as daily cover or structural fill. However, the City reserves the option to reject any of this soil material it deems to be unsuitable regardless of the results of testing and analysis. Work for this bid item will be paid based on the cost to load, transport and dispose (including tipping fees) of the material, and will constitute full payment for the Work described. This cost shall include all fees, permits, and taxes. Soils sampling required by the City Landfill, or any other landfill chosen for disposal shall be considered included under the lump sum for Bid Item No 3. If the material is accepted at the City's landfill, tipping fees will be waived by the City. The Contractor will still be responsible for loading, handling and transporting the material. If the City does not accept the material at its landfill, the Contractor will still be responsible for all costs related to loading, transporting and disposing (including tipping fees) at another landfill.

B. Measurement and payment shall be on the basis of the cost of waste actually disposed, backed up by measurements at the disposal facility by certified scale, and documented on the return manifest or certified weight slip and accompanied by the appropriate Bill of Lading form. The quantity shall be verified by the Engineer by calculation of the in-place tonnage using the trench width pay limited defined in the Contract Drawings, a bulking factor applicable to the soil type, and in place density tests supplied from a certified soil testing lab, by the Contractor. Should the quantity determined through the Engineer's calculations be less than the tonnage on the certified weight slips, the Contractor shall be compensated for the lesser tonnage. The Contractor shall receive no additional compensation for material removed outside of the approved pay limits. The Owner, and/or their representative, shall have the right to perform independent weighing of trucks. No payment will be made in cases of incomplete documentation of disposal. Payment will be made under the Allowance established in the Form of BID. If the total cost for such charges is greater or less than the Allowance amount stated under this item in the BID, a debit or credit of the difference in cost shall be made to the Owner.

BID ITEM NO. 6: REUSE SOIL/FILL AS DAILY COVER (UNLINED LAND FILL)

A. Under the Allowance established for this Item, the Contractor shall provide all necessary equipment, labor, and material to load, transport, and dispose at an appropriately permitted, solid waste facility, all soil/fill defined as a non-hazardous solid waste suitable for reuse as daily cover at an unlined New Hampshire Landfill as defined by state regulations. Upon City review and approval of the testing and analytical data conducted in accordance with the state regulations and facility specific requirements, soil meeting the criteria of this bid item may be delivered to the City of Nashua's Four Hills Landfill for use as daily cover or structural fill. However, the City reserves the option to reject any of this soil material it deems to be unsuitable regardless of the results of testing and analysis. Work for this bid item will be paid based on the cost to load, transport and dispose (including tipping fees) of the material, and will constitute full payment for the Work described. This cost shall include all fees, permits, and taxes. Soils sampling required by the City Landfill, or any other landfill chosen for disposal shall be considered included under the lump sum for Bid Item No 3. If the material is accepted at the City's landfill, tipping fees will be waived by the City. The Contractor will still be responsible for loading, handling and transporting the material. If the City does not accept the material at its landfill, the Contractor will still be responsible for all costs related to loading, transporting and disposing (including tipping fees) at another landfill.

B. Measurement and payment shall be on the basis of the cost of waste actually disposed, backed up by measurements at the disposal facility by certified scale, and documented on the return manifest or certified weight slip and accompanied by the appropriate Bill of Lading form. The quantity shall be verified by the Engineer by calculation of the in-place tonnage using the trench width pay limited defined in the Contract Drawings, a bulking factor applicable to the soil type, and in place density tests supplied from a certified soil testing lab, by the Contractor. Should the quantity determined through the Engineer's calculations be less than the tonnage on the certified weight slips, the Contractor shall be compensated for the lesser tonnage. The Contractor shall receive no additional compensation for material removed outside of the approved pay limits. The Owner, and/or their representative, shall have the right to perform independent weighing of trucks. No payment will be made in cases of incomplete documentation of disposal. Payment will be made under the Allowance established in the Form of BID. If the total cost for such charges is greater or less than the Allowance amount stated under this item in the BID, a debit or credit of the difference in cost shall be made to the Owner.

BID ITEM NO. 7: DISPOSAL OF RCRA HAZARDOUS WASTE

A. Under the Allowance established for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to load, transport, and dispose at an approved RCRA-permitted facility, all soil and fill material defined as a hazardous waste per state and federal guidelines. Upon City review and approval of the testing and analytical data conducted in accordance with the state regulations and facility specific requirements, soil meeting the criteria of this bid item may be delivered to the City of Nashua's Four Hills Landfill for use as daily cover or structural fill. However, the City reserves the option to reject any of this soil material it deems to be unsuitable regardless of the results of testing and analysis. Work for this bid item will be paid based on the cost to

load, transport and dispose (including tipping fees) of the material, and will constitute full payment for the Work described. This cost shall include all fees, permits, and taxes. Soils sampling required by the City Landfill, or any other landfill chosen for disposal shall be considered included under the lump sum for Bid Item No 3. If the material is accepted at the City's landfill, tipping fees will be waived by the City. The Contractor will still be responsible for loading, handling and transporting the material. If the City does not accept the material at its landfill, the Contractor will still be responsible for all costs related to loading, transporting and disposing (including tipping fees) at another landfill.

B. Measurement and payment shall be on the basis of the cost of waste actually disposed, backed up by measurements at the disposal facility by certified scale, and documented on the return manifest or certified weight slip and accompanied by the appropriate Bill of Lading form. The quantity shall be verified by the Engineer by calculation of the in-place tonnage using the trench width pay limits defined in the Contract, a bulking factor applicable to the soil type, and in place density tests supplied from a certified soil testing lab, by the Contractor. Should the quantity determined through the Engineer's calculations be less than the tonnage on the certified weight slips, the Contractor shall be compensated for the lesser tonnage. The Contractor shall receive no additional compensation for material removed outside of the approved pay limits. The Owner, and/or their representative, shall have the right to perform independent weighing of trucks, No payments will be made in cases of incomplete documentation of disposal. Payment will be made under the Allowance established in the Form of BID. If the total cost for such charges is greater or less than the Allowance amount stated under this item in the BID, a debit or credit of the difference in cost shall be made to the Owner.

BID ITEM NO.8: DISPOSAL OF ASBESTOS CONTAINING WASTE

A. Under the Allowance established for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to load, transport, and dispose all soil and fill material defined as asbestos containing waste. Upon City review and approval of the testing and analytical data conducted in accordance with the state regulations and facility specific requirements, soil meeting the criteria of this bid item may be delivered to the City of Nashua's Four Hills Landfill for use as daily cover or structural fill. However, the City reserves the option to reject any of this soil material it deems to be unsuitable regardless of the results of testing and analysis. Work for this bid item will be paid based on the cost to load, transport and dispose (including tipping fees) of the material, and will constitute full payment for the Work described. This cost shall include all fees, permits, and taxes. Soils sampling required by the City Landfill, or any other landfill chosen for disposal shall be considered included under the lump sum for Bid Item No 3. If the material is accepted at the City's landfill, tipping fees will be waived by the City. The Contractor will still be responsible for loading, handling and transporting the material. If the City does not accept the material at its landfill, the Contractor will still be responsible for all costs related to loading, transporting and disposing (including tipping fees) at another landfill. The work also includes procuring all Health and Safety items and concerns, protecting the excavation from accidental entry, controlling windblown litter, the spread of airborne contaminants and preparing appropriate waste manifests.

B. Measurement and payment shall be on the basis of the cost of waste actually disposed, backed up by measurements at the disposal facility by certified scale, and documented on the return manifest or certified weight slip and accompanied by the appropriate Bill of Lading form. The quantity shall be verified by the Engineer by calculation of the in-place tonnage using the trench width pay limits defined in the Contract, a bulking factor applicable to the soil type, and in place density tests supplied from a certified soil testing lab, by the Contractor. Should the quantity determined through the Engineer's calculations be less than the tonnage on the certified weight slips, the Contractor shall be compensated for the lesser tonnage. The Contractor shall receive no additional compensation for material removed outside of the approved pay limits. The Owner, and/or their representative, shall have the right to perform independent weighing of trucks, No payments will be made in cases of incomplete documentation of disposal. Payment will be made under the Allowance established in the Form of BID. If the total cost for such charges is greater or less than the Allowance amount stated under this item in the BID, a debit or credit of the difference in cost shall be made to the Owner.

BID ITEM NO. 9: ROCK EXCAVATION

A. Under the Unit Price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to excavate, remove and dispose of rock from trenches and excavated areas. This work includes drilling, hammering and all related work.

B. Payment for Rock excavation shall be based on the unit price bid for this item. Measurement for payment will be based on the actual cubic yards of rock excavated, removed and disposed of from within the limits of payment as measured by the Resident Engineer. Rock encountered during excavation that measures less than one cubic yard will not be paid under this item and will not justify any additional payment.

BID ITEM NO. 10: CIPP LINE EXISTING LATERAL UP TO 6 FEET FROM INTERCEPTOR

A. Under the Unit Price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to provide a new CIPP liner in an existing lateral that is not explicitly called out on the contract drawing, as requested by the engineer or owner. Any lateral lining called out on the contract drawings shall be paid for under item 2 of this contract. This pay item is inclusive of cleaning and installation of a lateral liner from the interceptor up to 6 feet up the existing lateral. Any additional length of lining required will be paid for under item 11.

B. Payment for lining of existing laterals shall be based on the unit price bid for this item. Measurement for payment will be based on the actual number of laterals lined as measured by the Resident Engineer. Laterals called out to be lined on the contract drawings will not be paid for under this item.

BID ITEM NO. 11: CIPP LINE ADDITIONAL LENGTH WITHIN EXISTING LATERAL

A. Under the Unit Price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to provide additional length of CIPP liner in an existing lateral that is not explicitly called out on the contract drawing, as requested by the engineer or owner. Any lateral lining called out on the contract drawings shall be paid for under item 2 of this contract. This pay item is inclusive of installation of liner in excess of 6-feet in length in any lateral not explicitly called out on the contract drawings. The initial lining of the lateral, up to 6 feet, will be paid for under item 10.

B. Payment for lining of existing laterals shall be based on the unit price bid for this item. Measurement for payment will be based on the actual length of lateral lined, in excess of 6 feet, as measured by the Resident Engineer. Laterals called out to be lined on the contract drawings will not be paid for under this item.

BID ITEM NO. 12: STRUCTURAL GROUT EXISTING LATERAL

A. Under the Unit Price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to provide structural grouting in an existing lateral that is not explicitly called out on the contract drawing, as requested by the engineer or owner. Any structural grouting called out on the contract drawings shall be paid for under item 2 of this contract

B. Payment for structural grouting of existing laterals shall be based on the unit price bid for this item. Measurement for payment will be based on the number of laterals grouted as measured by the Resident Engineer. Laterals called out to be grouted on the contract drawings will not be paid for under this item.

BID ITEM NO. 13: REMOVE AND REPLACE EXISTING LATERAL

A. Under the Unit Price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to remove and replace and existing sewer service or drainage lateral that is not explicitly called out on the contract drawing, as requested by the engineer or owner. This unit price shall include the cost of pipe excavation, excavation support, gravel subbase and back fill. Any lateral replacements called out on the contract drawings shall be paid for under item 2 of this contract

B. Payment for removal and replacement of existing laterals shall be based on the unit price bid for this item. Measurement for payment will be based on the actual linear feet of lateral removed and replaced as measured by the Resident Engineer. Laterals called out to be removed and replaced on the contract drawings will not be paid for under this item. EXISTING LATERALS REQUIREING REPLACEMENT DUE TO DAMAGE DURING CONSTRUCTION OPERATIONS SHALL BE REPLACED BY THE CONTRACTOR AT NO ADDITIONAL COST TO THE OWNER. SUCH LATERALS WILL NOT BE PAID FOR UNDER THIS ITEM.

BID ITEM NO. 14: INSTALL CLEANOUT ON EXISTING LATERAL

A. Under the Unit Price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to provide a new cleanout on an existing lateral that is not explicitly called out on the contract drawing, as requested by the engineer or owner. Any cleanouts called out on the contract drawings shall be paid for under item 2 of this contract.

B. Payment for installation of new cleanouts on existing laterals shall be based on the unit price bid for this item. Measurement for payment will be based on the number of cleanouts installed as measured by the Resident Engineer. Cleanouts called out to be installed on the contract drawings will not be paid for under this item.

BID ITEM NO. 15: INSTALL NEW CATCH BASIN AND LATERAL

A. Under the Unit Price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to provide a new catch basin and lateral that is not explicitly called out on the contract drawing, as requested by the engineer or owner. Any catch basins called out on the contract drawings shall be paid for under item 2 of this contract. The contractor shall assume installation of a catch basin not more than 7 feet in total depth, with hood, frame and grate per the specifications. The contractor shall assume a 25 foot lateral length provided as 8-inch PVC, buried to a depth of no more than 8 feet.

B. Payment for installation of new catch basins and laterals shall be based on the unit price bid for this item. Measurement for payment will be based on the number of catch basins and laterals installed as measured by the Resident Engineer. Catch basins and laterals called out to be installed on the contract drawings will not be paid for under this item. Additional length of lateral, depth of catch basin or lateral installed at a depth greater than 8 feet shall be paid for at a rate negotiated with the Engineer and the City.

BID ITEM NO. 16: TEST PITS

A. The Unit Price for this item shall constitute full compensation for all labor, equipment and materials required to excavate, backfill and compact test pits as requested by the owner or the engineer. Test pits shall be considered any exploratory excavation outside of the limits of excavation required to install pipe, structures, buried electrical or any other subsurface items. If, in the Contractor's opinion, test pits additional to those shown on the contract drawings, or requested by the Owner or the Engineer, are required to safely and reasonably complete the work he shall notify the engineer prior to any excavation if he intends to seek payment under this bid item.

B. The quantity to be paid for under this item shall be measured by the in-place cubic yard based on the horizontal area and the depth of the test pit. Payment shall be based on the unit price multiplied by the cubic-yard, as measured above.

BID ITEM NO. 17: ASPHALT PAVEMENT

A. Under the Unit Price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to provide any additional finished asphalt pavement that is not explicitly called out on the contract drawing, as requested by the engineer or owner. Pavement thickness shall be per the details on the drawings. No permanent or temporary paving required for subsurface work called out on the contract drawing will be paid for under this pay item. All permanent roadway paving shall be paid under items 26 and 27.

B. Payment for installation of new asphalt pavement shall be based on the unit price bid for this item. Measurement for payment will be square yards of additional asphalt pavement installed as measured by the Resident Engineer. This payment item shall be utilized where additional, unforeseen temporary or permanent pavement is required.

BID ITEM NO. 18: FLAGGERS/POLICE DETAILS

A. Under the Allowance for this item, the Contractor shall furnish, as required, flaggers or police details to direct traffic on Burke street when lane shut downs are necessary, or during operations within the street. Flaggers shall be used where possible, and shall be supplemented by police details as required (for construction at the intersection of Burke and Allds Street for example.)

B. Payment for flaggers and police details shall be based on an hourly rate for flaggers and police details. The contractor will be required to provide labor rates as back up for the hourly cost of flaggers and police details.

BID ITEM NO. 19: REMOVAL OF EXISTING PAVEMENT

A. Removal of existing roadway and driveway pavement (excluding existing sidewalk pavement areas) of varying thicknesses (See Geotechnical Report) shall be measured by the **square yard**, complete in place and shall conform to requirements of Section 02300, Earthwork.

B. The unit price for this item shall include furnishing all materials, labor, tools, and equipment necessary to complete the work all as shown on the plans, or as ordered by the Engineer and shall constitute full compensation for all other work incidental to removal of pavement of whatever depth encountered.

C. The work shall be paid for at the contract unit price per **square yard** in the BID SCHEDULE under **Item 19, Removal of Existing Pavement.**

BID ITEM NO. 20: GRADING AND EARTHWORK

A. Grading and all earthwork including excavation, filling, transportation of materials to establish subgrade shall be measured by the **square yard** based on the **finish pavement area in-place for roadways, driveways, and sidewalks** (excluding cold plane or milled areas), complete in place and shall conform to requirements of Section 02300, Earthwork.

B. The unit price for this item shall include furnishing all materials, labor, tools, and equipment necessary to complete the work all as shown on the plans, or as ordered by the Engineer and shall constitute full compensation for all other work incidental to grading the existing subgrade to meet the intended final lines and grades of the Project.

C. The work shall be paid for at the contract unit price per **square yard** in the BID SCHEDULE under **Item 20, Grading and Earthwork**.

BID ITEM NO. 21: CRUSHED GRAVEL OR CRUSHED STONE (FINE)

A. Crushed Gravel (NHDOT Item 304.3) or Crushed Stone (Fine) (NHDOT Item 304.4) shall be measured per **ton** and shall conform to Section 304 of the NHDOT Standard Specifications, and Specification Section 02745, Paving.

B. The work shall be paid for at the contract unit price per **ton** in the BID SCHEDULE under **Item 21, Crushed Gravel or Crushed Stone (Fine).**

BID ITEM NO. 22: SAWED BITUMINOUS PAVEMENT

A. Sawing bituminous pavement shall be measured per **linear foot** and shall conform to Section 628 of the NHDOT Standard Specifications, and Specifications Section 02745, Paving.

B. Saw-cutting for driveways and intersecting streets shall be measured for payment. All other saw cutting shall be considered incidental and subsidiary to the work.

C. The work shall be paid for at the contract unit price per **linear foot** in the BID SCHEDULE under **Item 22, Sawed Bituminous Pavement**.

BID ITEM NO. 23: COLD PLANING OF BITUMINOUS SURFACE

A. Cold planning shall be measured per **square yard** as determined by the actual surface measurements of the lengths and widths as shown on the plans or as ordered by the Engineer and shall conform to Section 417 of the NHDOT Standard Specifications, and Specifications Section 02745, Paving

B. The work shall be paid for at the contract unit price per **square yard** in the BID SCHEDULE under **Item 23**, **Cold Planing of Bituminous Surface.**

BID ITEM NO. 24: ADJUST EXISTING MANHOLE/CATCH BASIN CASTING TO GRADE

A. Adjusting existing manhole frames and covers, and catch basin frames and grates to finish pavement grades shall be measured by the **each**, complete in place and all work shall conform to requirements of Section 02629, Resetting Sewer or Drainage Castings.

B. The unit price for this item shall include up to 18-inches of actual masonry reconstruction, furnishing all materials, labor, tools, and equipment necessary to complete the work all as shown on the plans, or as ordered by the Engineer and shall constitute full compensation for all other work incidental to resetting a manhole frame and cover, or a

catch basin frame and grate.

C. The work shall be paid for at the contract unit price per **each** in the BID SCHEDULE under **Item 24, Adjusting Manhole/Catch Basin Casting to Grade.**

BID ITEM NO. 25: REPLACE EXISTING CASTING WITH NEW MANHOLE/CATCH BASIN CASTING AND ADJUST CASTING TO GRADE

**A.** Furnishing new casting, and adjusting new manhole frames and covers, and catch basin frames and grates to pavement finish grades shall be measured by the **each**, complete in place and shall conform to requirements of Section 02629, Resetting Sewer or Drainage Castings. **Note: Castings for any new structure shall be paid for as part of the cost of the new structure.**

B. The unit price for this item shall include up to 18-inches of actual masonry reconstruction, furnishing all materials, labor, tools, and equipment necessary to complete the work all as shown on the plans, or as ordered by the Engineer and shall constitute full compensation for all other work incidental to resetting a manhole frame and cover, or a catch basin frame and grate.

C. The work shall be paid for at the contract unit price per **each** in the BID SCHEDULE under **Item 25, Replace Existing Casting with New Manhole/Catch Basin Casting and Adjust to Grade**.

BID ITEM NO. 26: HOT BITUMINOUS PAVEMENT, MACHINE METHOD

A. Hot Bituminous Pavement, Machine Method shall be measured per **ton** and shall conform to Section 403 of the NHDOT Standard Specifications, and Specification Section 02745, Paving.

B. Hot Bituminous Pavement, Machine Method shall be applied in the lifts specified on the plans. Tack coats shall be incidental to this item and not paid for separately.

C. Payment adjustments will be made for the price of liquid asphalt as quantified in Specification Section 02745, Paving.

D. The work shall be paid for at the contract unit price per **ton** in the BID SCHEDULE under **Item 26, Hot Bituminous Pavement, Machine Method**.

BID ITEM NO. 27: HOT BITUMINOUS PAVEMENT, HAND METHOD

A. Hot Bituminous Pavement, Hand Method shall be measured per **ton** and shall conform to Section 403 of the NHDOT Standard Specifications, and Specification Section 02745, Paving.

B. Hot Bituminous Pavement, Hand Method shall be applied in the lifts specified on the plans. Tack coats shall be incidental to this item and not paid for separately.

C. Payment adjustments will be made for the price of liquid asphalt as quantified in

Specification Section 02745, Paving.

D. The work shall be paid for at the contract unit price per **ton** in the BID SCHEDULE under **Item 27, Hot Bituminous Pavement, Hand Method**.

BID ITEM NO. 28 AND 29: NEW VERTICAL GRANITE CURB

A. New granite curbing shall be measured for payment per **linear foot** of curbing furnished and installed and shall conform to Section 609 of the NHDOT Standard Specifications and Specification Section 02500, Curbs and Incidental Items.

B. Curbing damaged by the contractor shall be replaced at no cost to the city.

C. The unit prices under the appropriate subdivisions of this item shall constitute full compensation for furnishing and installing new curbing, complete in place and all work incidental thereto and not specifically included for payment under other items.

D. The work shall be paid for at the contract unit price per **linear foot** in the BID SCHEDULE under **Item 28, Straight Granite Curb,** and **Item 29, Curved Granite Curb.**

BID ITEM NO. 30: REMOVE AND RESET EXISTING VERTICAL GRANITE CURBING

A. The unit price paid for removal and resetting existing vertical granite curbing shall be measured for payment per **linear foot** of finished curbing reset in place, and all work shall conform to Section 609 of the NHDOT Standard Specifications and Specification Section 02500, Curbs and Incidental Items. Only curbing approved and ordered by the Engineer to be reset will be measured for payment. Curbing damaged by the contractor will be reset at no cost to the City.

B. The unit prices for this item shall constitute full compensation for removing and resetting curbing (straight or curved), complete in place, and all work incidental thereto and not specifically included for payment under other items.

C. The unit price shall include delivery of any surplus curb to a location within the City as directed by the Engineer, and considered incidental to this item of work.

D. The work shall be paid for at the contract unit price per **linear foot** in the BID SCHEDULE under **Item 30, Remove and Reset Existing Granite Curbing.**

BID ITEM NO. 31: REMOVE AND RECONSTRUCT EXISTING CONCRETE SIDEWALK

A. The unit price for this item shall be measured for payment per **square yard** of furnished surface area installed, and shall conform to requirements of Specification Section 02514, Sidewalks and Driveway Aprons.

B. The unit price for this item shall constitute full compensation for removal and disposal of the existing concrete sidewalk, excavation and/or filling to establish proposed subgrade, and construction of new 4” reinforced concrete sidewalk as shown on the plans, complete in place and including all work incidental thereto and not specifically included for

payment under other items. **Note:** Crushed Gravel shall be paid for separately under Bid Item 21.

C. The work shall be paid for at the contract unit price per **square yard** in the BID SCHEDULE under **Item 31, Remove and Reconstruct Existing Concrete Sidewalk.**

BID ITEM NO. 32: REMOVE AND RECONSTRUCT EXISTING BITUMINOUS SIDEWALK

A. The unit price for this item shall be measured per **square yard** of finished surface area installed, and shall conform to requirements of Specification Section 02514, Sidewalks and Driveway Aprons.

B. The unit price for this item shall constitute full compensation for removal and disposal of the existing bituminous sidewalk, excavation and/or filling to establish subgrade, and furnishing and installing new 2-1/2" bituminous sidewalk as shown on the plans, complete in place including all work incidental thereto and not specifically included for payment under other items. **Note:** Crushed Gravel shall be paid for separately under Bid Item 21.

C. The work shall be paid for at the contract unit price per **square yard** in the BID SCHEDULE under **Item 32, Remove and Reconstruct Existing Bituminous Sidewalk.**

BID ITEM NO. 33: NEW 2-1/2" BITUMINOUS SIDEWALK

A. The unit price for this item shall be measured per **square yard** of finished surface area, and shall conform to requirements of Specification Section 02514, Sidewalks and Driveway Aprons.

B. The unit price for this item shall constitute full compensation for establishing subgrade, and furnishing and installing new 2-1/2" bituminous sidewalk as shown on the plans, complete in place including all work incidental thereto and not specifically included for payment under other items. **Note:** Crushed Gravel shall be paid for separately under Bid Item 21.

C. The work shall be paid for at the contract unit price per **square yard** in the BID SCHEDULE under **Item 33, New 2-1/2" Bituminous Sidewalk.**

BID ITEM NO. 34: NEW SPECIAL BITUMINOUS SIDEWALK

A. The unit price for this item shall be measured per **square yard** of finished surface area, and shall conform to requirements of Specification Section 02514, Sidewalks and Driveway Aprons.

B. The unit price for this item shall constitute full compensation for establishing subgrade, and furnishing and installing "New Special Bituminous Sidewalk" in accordance with the details on the plans, complete in place including all work incidental thereto and not specifically included for payment under other items. **Note:** Crushed Gravel shall be paid for separately under Bid Item 21.

C. The work shall be paid for at the contract unit price per **square yard** in the BID SCHEDULE under **Item 34, New Special Bituminous Sidewalk.**

BID ITEM NO. 35 AND 36: INSTALLATION OF 2'X4' OR 2'X5' ADA DETECTABLE WARNING PANELS WITH CONCRETE BASE FOR PEDESTRIAN CROSSINGS

A. The installation of ADA Detectable Warning Panels for Pedestrian Crossings shall be paid for per **each**, and shall conform to requirements of Specification Section 02514, Sidewalks and Driveway Aprons.

B. The unit price for this item shall include furnishing all materials, labor, tools, and equipment necessary to complete the work all as shown on the plans, or as ordered by the Engineer and shall constitute full compensation for all other work incidental to installing the detectable warning device.

C. The work shall be paid for at the contract unit price per **each** in the BID SCHEDULE under **Item 35 - 2'x4' ADA Detectable Warning Panels with Concrete Base for Pedestrian Crossings, or Item 36 - 2'x5' ADA Detectable Warning Panels with Concrete Base for Pedestrian Crossings**

BID ITEM NO. 37, 38, 39: INSTALLATION OF MUTCD PEDESTRIAN SIGNS

A. The installation of the MUTCD W11-2 with W16-7p, and W11-2 with 16-9p including post, signs shall be paid for per **each**, and shall conform to requirements of Specification Section 02500, Curbs and Incidental Items.

B. The unit price for this item shall include furnishing all materials including the sign post, labor, tools, and equipment necessary to complete the work all as shown on the plans, or as ordered by the Engineer and shall constitute full compensation for all other work incidental to installation of the sign.

C. The work shall be paid for at the contract unit price per **each** in the BID SCHEDULE under **Item 37 - MUTCD W11-2 with W16-7p Sign, Item 38 – MUTCD W11-2 with 16-9p Sign, and Item 39 –MUTCD R1-1 Sign.**

BID ITEM NO. 40: RESET EXISTING GUARDRAIL

A. Resetting existing guardrail shall be paid for per the **linear foot,** and shall conform to Section 606 of the NHDOT Standard Specifications and Specifications Section 02500, Curbs and Incidental Items.

B. The unit price for this item shall include furnishing all materials including the replacement of any damaged parts, labor, tools, and equipment necessary to complete the work all as shown on the plans, or as ordered by the Engineer and shall constitute full compensation for all other work incidental to removal and reinstallation of the guardrail.

C. The work shall be paid for at the contract unit price per **linear foot** in the BID SCHEDULE under **Item 40, Reset Existing Guardrail.**

BID ITEM NO. 41: FURNISH AND INSTALL SIGNAL DETECTOR LOOP

A. The installation of the signal detector loop at the intersection of Allds Street and Burke Street shall be paid for as a **lump sum**, and shall conform to Section 616 of the NHDOT Standard Specifications, and Specifications Section 02500, Curbs and Incidental Items.

B. The unit price for this item shall include furnishing all materials, labor, tools, and equipment necessary to complete the work all as shown on the plans, or as ordered by the Engineer and shall constitute full compensation for all other work incidental to installing the signal detector loop.

C. The work shall be paid for at the contract unit price per **lump sum** in the BID SCHEDULE under **Item 41, Furnish and Install Signal Detector Loop**.

BID ITEM NO. 42 AND 43: INSTALLATION OF RETROFLECTIVE PAINT PAVEMENT MARKINGS (TEMPORARY AND PERMANENT)

A. The installation of the temporary and permanent retroflective paint pavement markings shall be paid for per **linear foot**, and shall conform to Section 632 of the NHDOT Standard Specifications and Specification Section 02500, Curbs and Incidental Items.

B. The temporary cross walk and stop lines shall be 12- inch width white NH 4.11 lines as shown on the roadway plans.

C. The roadway center lines shall be double 4-inch width yellow NH 4.12 lines and the shoulder lines shall be 4-inch white NH 4.11 lines as shown on the roadway restoration plans.

D. The work shall be paid for at the contract unit price per **linear foot** in the BID SCHEDULE under **Item 42 – 4" Retroflective Paint Pavement Marking and Item 43 - 12" Retroflective Paint Pavement Marking.**

BID ITEM NO. 44: INSTALLATION OF RETROFLECTIVE THERMOPLASTIC PAVEMENT MARKING (12" LINE)

A. The installation of the permanent thermoplastic pavement markings shall be paid for per **linear foot**, and shall conform to Section 632 of the NHDOT Standard Specifications and Specification Section 02500, Curbs and Incidental Items.

B. Thermoplastic cross walk and stop lines shall white lines as shown on the roadway plans and shall be paid for in prorated 12" wide increments. (i.e. 24" wide line would be paid for as 2 linear feet; 18" line would be paid for as 1.5 linear feet).

C. The work shall be paid for at the contract unit price per **linear foot** in the BID SCHEDULE under **Item 44 – Furnish and Install Retroflective Thermoplastic Pavement Marking (12" Line).**

BID ITEM NO. 45: 6” LOAM AND SEED

A. Loam and Seed shall be measured per **square yard** as determined by the actual surface measurements of the lengths and widths as shown on the plans or as ordered by the Engineer and shall conform to Specifications, Section 02920, Loaming and Seeding.

B. The unit prices for this item shall constitute full compensation for establishing subgrade, furnishing, spreading and placing loam, fine grading, seed, mulch, soil amendments, complete in place, and maintenance (including watering) as necessary to establish a viable stand of grass, and all work incidental thereto and not specifically included for payment under other items.

C. The work shall be paid for at the contract unit price per **square yard** in the BID SCHEDULE under **Item 46, 6” Loam and Seed.**

BID ITEM NO. 46: FURNISH AND INSTALL ORNAMENTAL TREE WITH CONCRETE PLANTER

A. Ornamental trees shall be measured by the **each** as shown on the plans or as ordered by the Engineer and shall conform to Specifications, Section 02930 - Planting.

B. The unit prices for this item shall constitute full compensation for furnishing and installing specified tree, loam, mulch, concrete planter, soil amendments, watering and maintenance complete in place, as necessary to establish a viable tree, and all work incidental thereto and not specifically included for payment under other items.

C. The work shall be paid for at the contract unit price per **each** in the BID SCHEDULE under **Item 47, Ornamental Tree including Concrete Planter.**

BID ITEM NO. 47: RESET EXISTING CHAIN LINK FENCE

A. Relocate existing chain link fences that encroach on the proposed work as ordered by the Engineer, and shall conform to the Specifications Section 02830, Resetting Fences & Gates, and paid for per **linear foot**.

B. The unit price for this item shall include furnishing all materials including labor, tools, and equipment necessary to complete the work, or as ordered by the Engineer and shall constitute full compensation for all other work incidental to the removal of the existing fence and installation of the chain link fence.

C. The work shall be paid for at the contract unit price per **linear foot** in the BID SCHEDULE under **Item 48, Reset Existing Chain Link Fence.**

BID ITEM NO. 48: CALCIUM CHLORIDE

A. Calcium chloride shall be measured per **pound** applied as ordered by the Engineer, and shall conform to the Specifications Section 02300, Earthwork. Water for dust control shall not be separately measured, but shall be considered **incidental** to the project.

B. The work shall be paid for at the contract unit price per **pound** in the BID SCHEDULE under **Item 49, Calcium Chloride**.

BID ITEM NO. 49: TEMPORARY TRAFFIC CONTROL PLAN, TRAFFIC CONTROL AND MAINTENANCE

A. Under the Lump Sum price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for traffic management, exclusive of the costs for flaggers and/or police details, which will be paid for under bid item 18. Payment under this item shall include creation of a traffic management plan for review and approval, and all coordination, signage, cones, barrels, markings and other incidentals required to maintain traffic on and around the construction site.

B. Measurement and payment for Temporary Traffic Control shall be based on the percentage of project completion based on elapsed time compared to the contractual construction time limit as per the Contract established lump sum value in the Form of BID.

BID ITEM NO. 50: DYE TESTING OF RESIDENTIAL SEWER SERVICE CONNECTIONS

A. Under the Unit Price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to provide dye testing of existing lateral connections to the interceptor as called out on the drawings, and as required by the Owner or the Engineer. This pay item is inclusive of coordination with the City, notification of the resident prior to testing, testing and reporting on the results of the test. All dye testing shall be witnessed by a representative of the Owner or the Engineer. Each shall be notified no less than 7 days prior to test, as should the resident whose home is to be tested.

B. Payment for dye testing of existing laterals shall be based on the unit price bid for this item. Measurement for payment will be based on the actual number of laterals tested as measured by the Resident Engineer.

PART 2 - PRODUCTS
(NOT USED)

PART 3 - EXECUTION
(NOT USED)

END OF SECTION

NO TEXT ON THIS PAGE

# SECTION 01035

# MODIFICATION PROCEDURES

## PART 1 - GENERAL

### 1.01 THE REQUIREMENT:

A. Work includes all labor, materials, equipment and appliances required for the complete execution of additions, modifications and alterations to existing structures as shown on the Drawings and specified under the various Sections of the Contract Specifications and as required by conditions at the site.

B. The Contractor shall have examined all work to be performed to the existing structures and familiarize himself with the nature and extent to which the existing structures will be damaged, items removed or rearranged due to the work under his Contract.

1. Cutting and patching shall conform to the requirements of the General Conditions, Supplemental Conditions, and as specified herein.

2. Patching work shall be performed with similar materials and in the same manner as adjoining work. Joining between old and new work shall be perfect and practically invisible. All due caution shall be taken to obtain a bond between old and new work.

C. Major portions of the work are indicated on the Drawings and the accompanying Specifications thereto. All work must be complete in all respects and executed with high quality workmanship.

D. Work not specifically indicated by details or general notes on the Drawings may include the following:

1. Re-pointing brickwork; removing and replacing broken, cracked, disintegrating and missing brickwork, utilizing mortar and face brick as specified under Division 4, Masonry.

2. Cutting masonry and installing new expansion and control joints.

3. Patching, cleaning, sealing and resurfacing concrete floors and walls.

4. Cutting and modifying existing openings as necessary to receive new work.

5. Patching and/or replacing broken, spalled, cracked and disintegrating concrete.

### 1.02 SITE:

A. Site Visit

1. Prior to submission of Bids, the Contractor shall have visited the site and thoroughly acquainted himself with the exact nature of the work indicated on the Drawings and the Specifications requirements. Failure to comply with the aforementioned requirements shall not constitute a basis for claims for additional compensation.

B. Measurements

1. Prior to ordering any materials or doing any work, the Contractor shall verify all measurements, dimensions and other conditions of each structure scheduled for work as may be necessary or required in connection with his work. The Contractor shall be responsible for the correctness of same.

1.03 MATERIALS:

A. All materials to perform and complete the work shall be new. Salvaged materials, such as brick, may not be used.

1.04 SHORING, UNDERPINNING AND BRACING:

A. When necessary and required, the Contractor shall provide underpinning and temporary shoring and bracings, all in accordance with code requirements, and as approved by the Engineer.

B. Shoring and bracing shall be of such form and so installed as to safely support the work and interfere as little as possible with the progress of the work. Suitable means shall be provided to adjust any settlement in the shoring supports. Temporary shoring shall consist of sound timbers or rolled shapes of required dimensions which shall be removed after necessity for same ceases to exist. All work removed or damaged through installation of temporary shoring or through improper shoring shall be replaced or repaired after the shoring is removed, at no additional cost to the Owner.

1.05 WORK PREPARATION AND TEMPORARY ACCESS:

A. The Contractor, before commencing work, shall prepare and submit for approval a construction schedule in accordance with the requirements of Section 01311 – Scheduling and Reporting, in order to coordinate the work of all trades and to insure completion on or before the completion date. The Owner and the Engineer reserve the right to revise or modify such schedules as required to expedite each phase of work.

B. No work specified hereinafter shall disturb or interfere with the operation of the existing system function until proposed new work has been completed or satisfactorily installed. Exception may be made to this requirement only by written approval from the Owner and Engineer.

C. Work within existing structures to be performed, once started, shall be completed as quickly as practicable to avoid delays.

1.06 CUTTING, CORING, PATCHING, REPAIRING, AND REFINISHING:

A. The Contractor shall be responsible for cutting all openings in walls, floors and ceilings to accommodate alteration work under his Contract in accordance with the requirements of the General Conditions, Supplemental Conditions, and as hereinafter specified. Rough patching and all finish patching shall be by the Contractor.

1. Where new openings are to occur in existing exterior and interior concrete and masonry bearing walls and structural concrete floor, the Contractor will be required to notify the Owner and Engineer in writing and shall obtain approval prior to cutting operations. The Engineer will determine whether such openings affect the structural stability or load bearing capacities of walls and floors.

2. All holes and openings to be cut in existing concrete pipes, walls, floors and ceilings of any nature shall be geometrically correct, core drilled and no larger than necessary to accommodate the new work

3. No cutting of finished or structural work may be done without the approval of the Engineer.

4. Rough patching shall be such as to bring the cut or cored area flush with existing construction unless otherwise shown. Finish patching shall match existing surfaces as by the Engineer.

5. Coring shall be performed with an approved non-impact rotary tool with diamond core drills. Size of holes shall be suitable for pipe, conduit, sleeve, equipment or mechanical seals to be installed.

6. Provide protection for existing equipment, utilities and critical areas against water or other damage caused by drilling operation.

7. Slurry or tailings resulting from coring operations shall be removed from the area following drilling.

8. Cutting shall be performed with a concrete saw and diamond saw blades of proper size.

9. Corners of square areas shall be cored. Do not overcut corners of openings. Corners shall be chipped out square, if required, so as not to cause cracking at the corners.

10. When cutting reinforced concrete, the cutting shall be done so as not to damage bond between the concrete and reinforcing steel left in the structure. Cut shall be made so that steel neither protrudes nor is recessed from the face of the cut.

11. Adequate bracing and/or shoring of area to be cut shall be installed prior to start of cutting. Check area during sawing operations for cracking and provide additional bracing as required to prevent a partial release of cut area during sawing operations.

12. Provide equipment of adequate size to remove the cut panel.

13. Contractor shall control and properly dispose of all debris.

14 When cutting or coring into existing manholes, piping, structures, etc., the Contractor shall not allow concrete debris to fall into flowing pipes and/or manholes.

15 Contractor shall secure the coupon and/or panel to ensure that it can be removed properly.

16 Concrete and grout for rough patching shall be specified in Divisions 3 and 4, respectively.

17. Repair fractures that may occur in the existing concrete as a result of the sawcutting operation with pressure injected epoxy adhesive at no additional expense to the Owner.

18. Cracked concrete to be repaired with pressure injected epoxy adhesive shall be waterblasted to remove all dirt and deleterious material within the cracks, which would reduce bond of the epoxy to the existing concrete to the complete satisfaction of the Engineer, the epoxy supplier and applicator.

19. Protect all surfaces not scheduled for or undergoing repair.

B. Major demolition and removal work, such as demolition of structures, complete or nearly complete removal of floors, walls and ceilings indicated on the Drawings, shall be performed by the Contractor. The Contractor shall also be responsible for all finish patching operations of holes and openings in existing floors, walls, ceilings and roofs.

1.07 <u>CHIPPING</u>:

A. Chip away cracked, loose, and deteriorated concrete from sound concrete to remain using a hammer and chisel. Pneumatic or electric hammers of 10-lb weight or less are permitted if they can be used without damaging the sound concrete to remain and without damaging the bond between concrete and reinforcing steel to be left in the existing structure. Heavy duty pneumatic hammers are not permitted except in areas of complete concrete demolition and removal, provided they can be used without shattering, disturbing or racking the concrete which is to remain, and without damaging the bond between concrete and reinforcing steel left in the existing structure.

B. Chipping shall be done in a manner that eliminates all abrupt offsets of the surface and

sudden changes in thickness of the new or repair work.

1. Edges to receive concrete or cementitious mortar repair shall have one-inch deep minimum square shoulder at the perimeter of the cavity.

2. Edges to receive shotcrete or epoxy mortar repair shall have tapered edges at the perimeter of the cavity.

C. Reinforcement that is to remain in the completed structure shall be cleaned of all concrete, mortar, and rust.

PART 2 – PRODUCTS

(NOT USED)

PART 3 - EXECUTION

(NOT USED)

END OF SECTION

NO TEXT ON THIS PAGE

# SECTION 01040

# COORDINATION

## PART 1 - GENERAL

### 1.01 COOPERATION:

A. Contractor shall allow Owner or his agents, and other contractors or their agents, to enter upon the work for the purpose of constructing, operating, maintaining, removing, repairing, altering or replacing such pipes, sewers, conduits, manholes, or other structures and appliances which may be required to be installed at or in the work. Contractor shall cooperate with all the aforesaid parties and shall allow reasonable provisions for the performance of any other work by Owner, or others, to be done in connection with his work, or in connection with normal use of the facilities. The Owner's activities shall be given priority over the Contractor's activities unless specifically directed by the Owner.

B. Contractor shall cooperate fully with Owner, Engineer, and any other contractors employed on the work, to effect proper coordination and progress to complete the project on schedule and in proper sequence. Insofar as possible, decisions of all kinds required from Engineer shall be anticipated by Contractor to provide ample time for inspection, or the preparation of instructions.

C. The Contractor shall work with the Owner and the Engineer, and shall provide a detailed plan prior to any work in order to ensure that all utility functions will be uninterrupted during construction operations. Long term shut downs or utility disruptions will not be allowed.

### 1.02 PIPING LAYOUT:

A. Contractor shall coordinate the piping and support layout with his subcontractors.

B. Contractor and each subcontractor shall line up the work properly, and particular care shall be used to obtain the most orderly, systematic, and compact piping, layout possible.

C. Submit a composite drawing of the final arrangement of piping layout per Section 01300-Submittals.

## PART 2 - PRODUCTS
(NOT USED)

## PART 3 - EXECUTION
(NOT USED)

END OF SECTION

NO TEXT ON THIS PAGE

# SECTION 01050

# FIELD ENGINEERING

## PART 1 - GENERAL

### 1.01 SURVEY AND LAYOUT:

A. All work under this Contract shall be constructed in accordance with the lines and grades shown on the Contract Drawings or as directed by Engineer. Elevation of existing ground and appurtenances are believed to be reasonably correct but are not guaranteed to be absolute and therefore are presented only as an approximation. Any error or apparent discrepancy in the data shown or omissions of data required for accurately accomplishing the stake-out survey shall be referred immediately to Engineer for interpretation or correction.

B. The Contractor is advised that elevation and coordinate information is provided on the contract drawings. The elevation information shown on the contract drawings is in Nashua Treatment Plant Datum, which is equal to USGS Datum plus 91.37 feet. Coordinate information is in the City of Nashua Water Pollution Control Facility record drawings, available for contractor review.

C. Based upon the information provided by the Contract Drawings, the Contractor shall develop and make all detailed surveys necessary for construction, including slope stakes, batter boards, stakes for all working points, easements, baselines and elevations.

D. Contractor shall have the responsibility to carefully preserve the bench marks, reference points and stakes, and in the case of destruction thereof by Contractor or resulting from his negligence, Contractor shall be charged with the expense and damage resulting there from and shall be responsible for any mistakes that may be caused by the unnecessary loss or disturbance of such bench marks, reference points and stakes. The contractor shall install and confirm their own control points, and maintain them throughout the project, as required.

E. Existing or new control points, bench marks, property markers and monuments that will be or are destroyed during the normal course of construction shall be reestablished by Contractor and all reference ties recorded therefore shall be furnished to Engineer. All computations necessary to establish the exact position of the work shall be made and preserved by Contractor.

F. Engineer may check all or any portion of the work and Contractor shall afford all necessary facilities and assistance to Engineer in carrying out such checks. Any necessary corrections to the work shall be made immediately by Contractor. Such checking by Engineer shall not relieve Contractor of any responsibilities for the accuracy or completeness of his work.

1.02 CONTRACTOR'S FIELD ENGINEER:

A. Contractor shall employ and retain at the site of the work a field engineer capable of performing all engineering tasks required of Contractor. Tasks included are:

1. Daily reports of project activity to be submitted to the Engineer with all information pertaining to the project as follows:

a. Numbers of employees.
b. Subcontractor employees.
c. Breakdown of employees.
d. Major equipment and materials installed.
e. Major construction equipment utilized.
f. Location of all areas in which construction was done.
g. Materials and equipment received.
h. Work performed.

2. Provide all surveying equipment required including transit, level, stakes and required surveying accessories.

3. Furnish all required lines and grades for construction operations. Check all formwork, reinforcing, inserts, structural steel, bolts, sleeves, piping, other materials and equipment.

4. Maintain field office files and drawings, record drawings, and coordinate engineering services with subcontractors. Prepare Layout and Coordination Drawings for construction operations.

5. Check and coordinate work for conflicts and interferences and immediately advise Engineer of all discrepancies noted.

6. Cooperate with Engineer in field inspections as required.

B. The field engineer shall be qualified to perform the work herein enumerated and acceptable to Owner and Engineer.

1.03 RECORDS:

A. Field engineer shall maintain a complete accurate log of all control and survey work as it progresses.

B. At completion of the work and when requested by Engineer during the work, field engineers shall furnish a certificate to Engineer that the final layout is in

conformance with the Contract Drawings. The Contractor shall provide a Certificate of Surveying by a Registered Land Surveyor at the completion of work.

PART 2 – PRODUCT

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

END OF SECTION

NO TEXT ON THIS PAGE

# SECTION 01064

# BYPASS PUMPING

## PART 1 - GENERAL

### 1.01 THE REQUIREMENT:

A. The work specified in this Section includes all labor, materials, accessories, equipment and tools for performing all operations required to bypass pump sewage in order to maintain operation of the existing sewer during construction. The Contractor shall be required to bypass pump as a part of his operations.

B. The Contractor shall provide all pumps, piping, fittings, power, generators and other equipment to accomplish this task; perform all construction; obtain all permits; provide manned operation; pay all costs; and perform complete restoration of all existing facilities to equal or better condition to the satisfaction of the Engineer.

### 1.02 GENERAL:

A. When required during construction, the Contractor shall provide bypass pumping for the scum, tank drain and blower building floor drain system in order to maintain facility operations. The contractor shall provide a detailed plan, per section 1.03, for all bypassing operations.

B. In some applications, the flow may be plugged and contained within the capacity of the system. This shall only be done when it has been determined the system can accommodate the surcharging without any adverse impact and must be evaluated and approved by the Engineer on a case by case basis.

C. The Contractor shall submit a written plan and pump/bypass the flow as acceptable to the Engineer.

D. The design, installation and operation of the temporary bypass pumping systems shall be the responsibility of the Contractor. The bypass system shall meet the requirements of all codes and regulatory agencies having jurisdiction.

### 1.03 SUBMITTALS:

A. The Contractor shall submit complete, detailed work plans for this aspect of the work for each project site to the Engineer for review as indicated in Section 01300 - Submittals. At a minimum, the Contractor shall submit the following:

1. Bypass pumping plans. The Contractor shall submit to the Engineer detailed plans and descriptions outlining all the provisions and precautions to be taken by the Contractor regarding the handling of existing flows. This plan must be specific and complete,

including such items as schedules, locations, elevations, capacities of equipment, materials and all other incidental items necessary and/or required to ensure proper protection of the access and bypass pumping locations from damage due to discharge flows and compliance with the requirements specified in these Contract Documents. No construction shall begin until all provisions and requirements have been reviewed by the Engineer.

The plan shall include but not be limited to the following details:

a. Plugging method and types of plugs;
b. Number, size, material, location and method of installation of suction and discharge piping and associated fittings and valves;
c. Bypass pump sizes, capacity and number of each size to be on site;
d. Pump curves and system curve with suction lift performance, friction losses and flow velocities;
e. Discharge plan;
f. Method of protecting discharge manholes or structures from erosion and damage.
g. Noise control
h. Any temporary pipe supports and anchoring required;
i. Description of automatic alarm system.

1.04 EQUIPMENT:

A. All pumps used shall be centrifugal, solids handling, end suction, fully automatic self priming pumps that do not require the use of foot valves, vacuum pumps, diaphragm pumps or isolation valves in the priming system. Pumps shall be capable of passing a 3-inch solid sphere.
B. All pumps used must be constructed to allow dry running for long periods of time to accommodate the cyclical nature of effluent flows and shall immediately develop 25” Hg vacuum without adjustment or employ level control devices to regulate on/off or variable speed of the pump.
C. Pumps shall be diesel powered or electric.
D. Contractor to provide controls for each pump
E. Contractor to provide one standby pump of each size to be maintained on-site.
F. All discharge systems must be constructed with positive restrained joints and leak proof connections.

1.05 SYSTEM DESCRIPTION:

A. Design Requirements – Bypass pumping: At a minimum, the pumps used for temporary bypasses shall have the capacity to meet the following flows listed below in gallons per minute (gpm):

| **Location[1]** | **Peak Flow (gpm)** |
|---|---|
| Scum System | 150 |
| Blower Building Drain | 150 |

Note: [1] Additional temporary bypasses may be required in the performance of the work. Contractor shall design and implement bypasses as needed at no additional cost.

PART 2 - PRODUCTS
(NOT USED)

PART 3 - EXECUTION

3.01 OWNER/OPERATOR NOTICE:

A. If interruption of sewage flow must occur, the Contractor shall notify the Owner well in advance of the interruption. The Contractor shall make every effort to minimize inconvenience and service disruption to operation of the sewer. Long term shut downs and service disruptions shall not be allowed.

3.02 PLUGGING AND BLOCKING:

A. A line plug shall be inserted into the line at a upstream from the section being modified or constructed. The plug shall be so designed that all or any portion of the operation flows can be released. During repairs, the flows shall be shut off or pumped/bypassed, as acceptable to the Engineer. After the work, including inspection and testing, has been completed, flows shall be restored to normal. Plugging of pipe within trenches shall be allowed temporarily until such time as bypass pumping operations can be put into service.

3.03 PUMPING AND BYPASSING:

A. Where lines are blocked off and the possibility of surcharging the upstream lines and/or causing harm to public or private property exists, the Contractor shall supply the necessary pumps, conduits and other equipment to divert the flow of flows around the line section or structure in which work is to be performed. The bypass system shall be of sufficient capacity to handle existing flows plus additional flow that may occur during periods of wash down, or other high flow conditions. The Contractor will be responsible for furnishing the necessary labor and supervision to set up and operate the pumping and bypassing system. A "setup" consists of the necessary pumps, conduits and other equipment to divert the flow around a manhole or line section, and to provide appropriate collection and disposal service from the start to finish of work performed in the section.

B. Bypassing shall be accomplished using plugs with pump connections, by pumping down surcharged manholes, or by other methods acceptable to the Engineer. All bypassed flow must be discharged to an appropriate discharge location as approved by the engineer. Bypassed flow shall not be allowed to enter any storm line, drainage ditch or gutter.

C. Pumps and equipment shall be continuously manned by a maintenance person capable of starting, stopping, refueling and maintaining these pumps during the rehabilitation. If

pumping is required on a 24-hour basis, engines shall be equipped in a manner to keep noise to a minimum (65 dBA at 30 feet). The Contractor shall maintain the pump and bypass equipment and shall be responsible for any damages to public or private property due to malfunction of the same.

D. The Contractor shall have adequate standby equipment available and ready for immediate operation and use in the event of an emergency or breakdown. One standby pump for each size pump utilized shall be ready for use in the event of primary pump failure.

E. The Contractor shall periodically inspect bypass pumping system every two hours to ensure that the system is working correctly.

F. The temporary bypass system shall be equipped with alarms, which will automatically notify the Contractor in the event of a shutdown or other problem. The Contractor shall monitor and immediately respond to all alarms 24 hours per day, 7 days per week.

3.04 FLOW CONTROL PRECAUTIONS:

A. Where the raw sewage flow is blocked or plugged, sufficient precautions must be taken to protect the public health. No septic conditions shall be allowed due to Contractor's operations. The sewer lines shall also be protected from damage. The Contractor shall be responsible for maintaining the following conditions at all times:

1. No sewage shall be allowed to back up into any homes or buildings.

2. No sewage shall overflow any manholes, cleanouts or any other access to the sewers.

3. Users upstream of the repair area shall be able to use all their water and sewer utilities without interruption.

B. To maintain the aforestated conditions, the Contractor shall bypass pump. Additionally, the Contractor is required to observe the conditions upstream of the plug and be prepared to immediately start bypass pumping, if needed. It is Contractor's responsibility to pay for all damage claims.

C. Any sump pumps, bypass pumps, trash pumps or any other type pump which pulls sewage/water or any type of material out of the manhole or sewer shall discharge this material into another manhole, or appropriate vehicle or container acceptable to the Engineer. Under no circumstances shall this material be discharged, stored or deposited on the ground, swale, road or open environment.

D. The Contractor shall take appropriate steps to ensure that all pumps, piping and hoses that carry raw sewage are protected from traffic.

E. Contractor to take necessary precautions to prevent flow from freezing in the temporary pipes.

F. In the event, during any form of "Bypass Pumping", that raw sewage is spilled, discharged, leaked or otherwise deposited in the open environment, due to the Contractor's work, the Contractor is responsible for any clean up of solids and disinfecting of the area affected. This work will be performed at the Contractor's expense with no additional cost to the Owner. The Contractor is also responsible for notifying the sewer system maintenance personnel and complying with any and all regulatory requirements in regards to the size spill with no additional cost to the Owner.

END OF SECTION

NO TEXT ON THIS PAGE

SECTION 01070

STATE REGULATION REQUIREMENTS

PART 1 - GENERAL

1.01 EXCERPTS FROM NEW HAMPSHIRE LAWS

A. Particular attention is called to certain stipulations of the Revised Statutes Annotated of the State of New Hampshire and as amended.

1. Chap. 275, Laws of 1967, Sec. 43, Para. II.

a. "I. Every employer shall pay all wages due to his employees who work by the hour or day within eight days including Sunday after expiration of the week in which the work is performed, on regular paydays designated in advance by the employer, in lawful money of the United States or with checks on banks convenient to the place of employment where suitable arrangements are made for the cashing of such checks by employees for the full amount of the wages due, provided, however, that all wages in the nature of health and welfare fund or pension fund contributions required pursuant to a health and welfare fund trust agreement, pension fund trust agreement, collective bargaining agreement, or other agreement, adopted for the benefit of his employees and agreed to by him shall be paid by every such employer within thirty days of the date of demand for such payment, the payment to be made to the administrator or other designated official of the applicable health and welfare or pension trust fund."

2. Chap. 275, Laws of 1963, Sec. 43, Para. II.

a. "II. The commission may, upon application showing good and sufficient reasons, permit an employer as described in section 1 to establish regular paydays less frequently than weekly provided that the worker shall be paid in full at least once each calendar month on a regularly established schedule."

3. Chap. 275, Sec. 30.

a. "In all contracts relating to labor, ten hours actual labor shall be taken to a day's work unless otherwise agreed by the parties. This provision shall not apply to classes of labor for which this law provides day limits."

4. Chap. 275, Sec. 32.

a. "Whoever requires an employee engaged in any occupation to do on Sunday the usual work of his occupation unless he is allowed during the six days next

ensuing twenty-four consecutive hours without labor, shall be fined not more than fifty dollars; provided that this section and the following section shall not be not construed as authorizing any work on Sunday otherwise authorized by law."

5. Chap. 275, Sec. 33.

   a. "No employer shall operate any business on Sunday unless he has posted in a conspicuous place on the premises a schedule containing a list of employees who are required or allowed to work on Sunday and designating the day of rest for each, and shall promptly file a copy of such schedule and every change therein with the labor commissioner. No employee shall be required or allowed to work on the day of rest designated for him. Whoever violates this section shall be fined fifty dollars."

6. Chap. 275, Sec. 33-b.

   a. "Employers may be exempt from sections 32 and 33 where mutual agreements are reached between employer and employees, after approval of the labor commissioner where it appears for the best interests of all parties concerned."

7. Chap. 275, Sec. 35.

   a. "Sections 32 and 33 hereof shall not apply to the following employees. V. Employees engaged in any labor called for by an emergency which could not reasonably have been anticipated."

PART 2 – PRODUCTS

Not used.

PART 3 – EXECUTION

Not used.

END OF SECTION

SECTION 01080

ABBREVIATIONS AND DEFINITIONS

PART 1 - GENERAL

1.01 ABBREVIATIONS:

A. The following is a partial list of typical abbreviations which may be used in the Specifications, and the organizations to which they refer:

| | | |
|---|---|---|
| AASHTO | - | American Association of State Highway and Transportation Officials |
| ACI | - | American Concrete Institute |
| ACIFS | - | American Cast Iron Flange Standards |
| AFBMA | - | Anti-Friction Bearing Manufacturer's Association |
| AGA | - | American Gas Association |
| AGMA | - | American Gear Manufacturers Association |
| AIA | - | American Institute of Architects |
| AISC | - | American Institute of Steel Construction |
| AISI | - | American Iron and Steel Institute |
| AMCA | - | Air Moving and Conditioning Association |
| ANSI | - | American National Standard Institute |
| API | - | American Petroleum Institute |
| ASCE | - | American Society of Civil Engineers |
| ASHRAE | - | American Society of Heating, Refrigeration, and Air Conditioning Engineers |
| ASME | - | American Society of Mechanical Engineers |
| ASTM | - | American Society for Testing and Materials |
| AWG | - | American Wire Gage |
| AWS | - | American Welding Society |
| AWWA | - | American Water Works Association |
| CEMA | - | Conveyor Equipment Manufacturer's Association |
| CL | - | Class |
| CPM | - | Critical Path Method |
| CRSI | - | Concrete Reinforcing Steel Institute |
| CS | - | Commercial Standard |
| NHDES | - | New Hampshire Department of Environmental Services |
| DIPRA | - | Ductile Iron Pipe Research Association |
| EL. | - | Elevation |
| Fed Spec | - | Federal Specifications |
| IBR | - | Institute of Boiler and radiator Manufacturers |
| IEEE | - | Institute of Electrical and Electronic Engineers |
| IPCEA | - | Insulated Power Cable Engineers Association |
| IPS | - | Iron Pipe Size |
| ISO | - | Insurance Services Offices |
| JIC | - | Joint Industry Conference Standards |

| | | |
|---|---|---|
| NBS | - | National Bureau of Standards |
| NHDOT | - | New Hampshire Department of Transportation |
| NEC | - | National Electric Code |
| NEMA | - | National Electrical Manufacturers Association |
| NFPA | - | National Fire Protection Association |
| NPT | - | National Pipe Thread |
| NWTF | - | Nashua Wastewater Treatment Facility |
| OSHA | - | Occupational Safety and Health Act |
| OS&Y | - | Outside Screw and Yoke |
| PCI | - | Precast Concrete Institute |
| Railroad | - | Pan Am Railways/Springfield Terminal Railway Company |
| SMACNA | - | Sheet Metal and Air Conditioning Contractors National Association |
| Stl. WG | - | U.S. Steel Wire |
| UL | - | Underwriters Laboratories, Inc. |
| USSG | - | United States Standard Gage |
| USGS | - | United States Geological Survey |
| WOG | - | Water, Oil, Gas |
| WSP | - | Working steam pressure |

1.02 DEFINITIONS:

A. Wherever the words defined in this sections or pronouns used in their stead occur in the Contract Documents, they shall have the meaning herein given.

As Directed, as Required, Etc.: Wherever in the Contract Documents, or on the Drawings, the words “as directed”, “as permitted”, or words of like import are used, it shall be understood that the direction, order, request, requirement or permission of the Engineer is intended. Similarly, the words “approved”, “acceptable to”, “suitable to”, or “satisfactory to” the Engineer.

Provide: Wherever in the Contract Documents the word “provide” is used, it shall mean to furnish (or supply) and install.

Elevation: The figures given on the Drawings or in other Contract Documents after the word “elevation” or abbreviation of it shall me the distance in feet above the datum adopted by the Engineer.

Rock: The word “rock” wherever used as the name of an excavated material or material to be excavated, shall mean only boulders and pieces of concrete or masonry exceeding 1 cubic yard in volume, or solid ledge rock which, in the opinion of the Engineer, requires for its removal, drilling and blasting, wedging, sledging, barring or breaking up with a power operated tool. No soft or disintegrated rock which can be removed with a hand pick or power-operated excavator or shovel, no loose, shaken, or previously blasted rock or broken stone in rock fillings or elsewhere, and no rock exterior to the maximum limits of measurement allowed, which may fall into the excavation, will be measured or allowed as “rock”.

Earth: The word “earth” wherever used as the name of an excavated material or material to be excavated, shall mean all kinds of material other than rock as above identified.

PART 2 - PRODUCTS
(NOT USED)

PART 3 - EXECUTION
(NOT USED)

END OF SECTION

NO TEXT ON THIS PAGE

# SECTION 01090

# REFERENCE STANDARDS

## PART 1 -- GENERAL

### 1.01 THE REQUIREMENT:

A. Wherever reference is made to any published standards, codes, or standard specifications, it shall mean the latest standard code, specification, or tentative specification of the technical society, organization, or body referred to, which is in effect at the date of invitation for Bids.

B. All materials, products, and procedures used or incorporated in the work shall be in strict conformance with applicable codes, regulations, specifications, and standards.

C. A partial listing of codes, regulations, specifications, and standards includes the following:

Air Conditioning and Refrigeration Institute (ARI)

Air Diffusion Council (ADC)

Air Moving and Conditioning Association (AMCA)

The Aluminum Association (AA)

American Architectural Manufacturers Association (AAMA)

American Concrete Institute (ACI)

American Gear Manufacturers Association (AGMA)

American Hot Dip Galvanizers Association (AHDGA)

American Institute of Steel Construction, Inc. (AISC)

American Iron and Steel Institute (AISI)

American National Standards Institute (ANSI)

American Society of Civil Engineers (ASCE)

American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE)

American Society of Mechanical Engineers (ASME)

American Society for Testing and Materials (ASTM)

American Standards Association (ASA)

American Water Works Association (AWWA)

American Welding Society (AWS)

American Wood-Preserver's Association (AWPA)

Anti-Friction Bearing Manufacturers Association (AFBMA)

Building Officials and Code Administrators (BOCA)

Consumer Product Safety Commission (CPSC)

Factory Mutual (FM)

Federal Specifications

Instrument Society of America (ISA)

Institute of Electrical and Electronics Engineers (IEEE)

National and Local Fire Codes

Lightning Protection Institute (LPI)

National Electrical Code (NEC)

National Electrical Manufacturer's Association (NEMA)

National Electrical Safety Code (NESC)

National Electrical Testing Association (NETA)

National Fire Protection Association (NFiPA)

Regulations and Standards of the Occupational Safety and Health Act (OSHA)

Sheet Metal & Air Conditioning Contractors National Association (SMACCNA)

Standard Building Code

Standard Mechanical Code

Standard Plumbing Code

Uniform Building Code (UBC)

Underwriters Laboratories Inc. (UL)

D. Contractor shall, when required, furnish evidence satisfactory to the Engineer that materials and methods are in accordance with such standards where so specified.

E. In the event any questions arise as to the application of these standards or codes, copies shall be supplied on-site by the Contractor.

PART 2 -- PRODUCTS

(NOT USED)

PART 3 -- EXECUTION

(NOT USED)

END OF SECTION

NO TEXT ON THIS PAGE

# SECTION 01200

# PROJECT MEETINGS

## PART 1 - GENERAL

### 1.01 PRE-BID MEETING:

A. A pre-bid meeting will be held at the time and place designated in the General Conditions.

B. Engineer will be available to discuss the project and answer pertinent questions. No oral interpretation will be made to the meaning of the Contract Documents. Interpretation, if deemed necessary by Engineer, will be in the form of an Addendum to the Contract Documents.

### 1.02 PRE-CONSTRUCTION MEETING:

A. A pre-construction meeting will be held after award of Contract, but prior to starting work at the site.

B. Attendance:
1. Owner
2. Engineer and his consultants
3. Construction Administrator
4. Contractor
5. NHDES representative

C. Minimum Agenda:
1. Tentative construction schedule
2. Critical work sequencing
3. Designation of responsible personnel
4. Processing of field decisions and Change Orders
5. Adequacy of distribution of Contract Documents
6. Submittal of shop drawings and samples
7. Procedures for maintaining record documents
8. Use of site and Owner's requirements
9. Major equipment deliveries and priorities
10. Safety and first-aid procedures
11. Security procedures
12. Housekeeping procedures
13. Emergency Contacts and Emergency Contacts List

1.03 PROGRESS MEETINGS:

A. Progress meetings will be held once per week at the site during the performance of the work of this Contract. Additional meetings may be called as progress of Work dictates, and as specified elsewhere in the Contract.

B. Engineer will preside at meetings and record minutes of proceedings and decisions, and will distribute copies of minutes to participants within ten working days after meetings.

C. Attendance:
   1. Engineer and his consultants as required.
   2. Construction Administrator
   3. NHDES representative
   4. Contractor

D. Minimum Agenda:
   1. Review and approve minutes of previous meetings.
   2. Site Safety Review
   3. Review progress of Work since last meeting.
   4. Note and identify problems which impede planned progress.
   5. Develop corrective measures and procedures to regain planned schedule.
   6. Revise construction schedule as indicated and plan progress during next work period.
   7. Maintaining of quality and work standards.
   8. Complete other current business.

1.04 CLOSEOUT MEETING:

A. A closeout meeting will be held after Final Application for Payment is filed by Contractor to Owner.

B. Attendees:
   1. Owner.
   2. Engineer and his consultants as required.
   3. Construction Administrator
   4. Contractor
   5. NHDES representative
   6. Major subcontractors, only with Engineer’s approval or request.

C. Minimum Agenda:
   1. Review of Final Application for Payment.
   2. Develop a "Punch List" for any deficiencies.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

(NOT USED)

END OF SECTION

NO TEXT ON THIS PAGE

# SECTION 01300

# SUBMITTALS

## PART 1 - GENERAL

### 1.1 DESCRIPTION:

A. This section includes general requirements for project submittals by the Contractor.

### 1.2 PROGRESS REPORTS, RECORDS AND DATA:

A. The Contractor shall submit to the Owner such schedules of quantities and costs, progress schedules, payrolls, reports, estimates, records and other data as outlined in Section 01311 – SCHEDULING AND REPORTING and as the Owner may request concerning work performed or to be performed under this Contract.

### 1.3 SHOP DRAWINGS, SAMPLES, PROJECT DATA:

A. The Contractor shall submit for review by the Engineer six (6) copies of all shop drawings, setting schedules and such other drawings as may be necessary for the prosecution of the work in the shop and in the field as required by the Drawings, Specifications or the Engineer's instructions. Deviations from the Drawings and Specifications shall be called to the attention of the Engineer at the time of the first submission of shop drawings and other drawings for consideration. The Engineer's review of any drawings shall not release the Contractor from responsibility for such deviations. Shop drawings shall be submitted with such promptness as to cause no delay in his work or the work of any other Contractor.

B. When submitted for the Engineers' review, all shop drawings shall bear the Contractor's certification that he has reviewed, checked and approved the shop drawings, that they are in harmony with the requirements of the Project and with the provisions of the Contract Documents, and that he has verified all field measurements and construction criteria, materials, catalog numbers and similar data. The Contractor shall also certify that the work represented by the shop drawings is recommended by the Contractor and the Contractor's Guaranty will fully apply.

C. All submittals shall be bound, dated, properly labeled and consecutively numbered. This shall include and not be limited to catalog cuts, manufacturer's literature, etc. Information on the label shall indicate

specification section, contract drawing number, subcontractor name, manufacturer's or supplier's name and name or type of item the submittal covers. Each part of a submittal shall be marked and tabulated and only one document (drawing, brochure, etc.) shall be as typical to each number on the submittal. Only one specification section shall be allocated to any submittal.

D. Submittals shall contain:
   1. The date of the submission and the dates of any previous submission.
   2. The project title and number
   3. Contractor identification
   4. The names of the Contractor; Supplier; Manufacturer
   5. Identification of the product
   6. Field dimensions
   7. Applicable standards, such as ASTM or Federal Specification numbers.
   8. Identification of deviations from contract documents
   9. Identification of revisions on resubmittals
   10. An 8-inch x 3-inch blank space for Contractor and Engineer stamps

E. Working drawings shall be submitted as a single complete package for any operating system and shall include all items of equipment and any mechanical units involved or necessary for the functioning of such system. Where applicable, the submittal shall include elementary wiring diagrams showing circuit functioning and necessary interconnection wiring diagrams for construction.

F. Submittals shall be made in accordance with the following numbering system:

| | |
|---|---|
| Specification Section: | i.e., 11215, 11220, 11240 |
| Paragraph number, subsection and subnumber: | i.e., 2.01, 2.01A, 2.01.A.1 |
| Item number, in particular paragraph: | i.e., 01, 02, 03 |
| Revision number: | i.e., R0, R1, R2 |

Example: 11220-2.01.A.-01-R0

G. Each item shall have a specific number as indicated. Shop Drawings will be returned not-reviewed to Contractor if correct numbering system is not used.

H. Where errors, deviations, and/or omissions are discovered at a later date in any of the submittals, Engineer's prior review of the submittals does not relieve Contractor of the responsibility for correcting all errors, deviations and/or omissions.

I. All samples called for in the Specifications or required by the Engineer shall be furnished by the Contractor and shall be submitted to the Engineer for his review. Samples shall be furnished so as not to delay fabrication, and to allow the Engineer reasonable time for the consideration of the samples submitted.

J. Checking of submittals is only for general conformance with the design concept of the project and general compliance with the information given in the contract documents. Any action shown is subject to the requirements of the plans and specifications. Contractor is responsible for: dimensions which shall be confirmed and correlated at the job site; fabrication processes and techniques of construction; coordination of his work with that of all other trades; and the satisfactory performance of his work.

K. The Contractor may only proceed with fabrication and construction of items with returned submittals marked "Furnish as Corrected" or "Furnish as Submitted." Resubmit submittals if marked "Rejected", "Revise and Resubmit." If submittals are returned “Furnish as Corrected – Confirm,” the Contractor shall submit the items called out in the submittal review in order to complete the documentation prior to releasing items for fabrication and construction.

L. The Contractor shall furnish such samples of material as may be required for examination and test. All samples of materials for tests shall be taken according to ASTM Specifications or as provided in the Contract Documents.

M. All samples shall be submitted by the Contractor with a covering letter indicating that such samples are recommended by the Contractor for the service intended and that the Contractor's Guaranty will fully apply.

N. All materials, equipment and workmanship shall be in accordance with samples guaranteed by the Contractor and reviewed by the Engineer.

O. Record Working Drawings

1. Prior to final payment, Contractor shall furnish Engineer one complete set of mylars, or other approved reproducible material, of all accepted Working Drawings, including shop drawings, for equipment, piping, electrical work, heating system, ventilating

system, air conditioning system, instrumentation system, plumbing system, structural, interconnection wiring diagrams, etc.

2. Prior to final payment, Contractor shall furnish Engineer one complete set of electronic drawings, of all accepted Working Drawings, including shop drawings, for equipment, piping, electrical work, heating system, ventilating system, air conditioning system, instrumentation system, plumbing system, structural, interconnection wiring diagrams, etc.

3. Manufacturers' publications, submitted in lieu of prepared shop drawings, will not be required in reproducible form. However, four sets of such material shall be furnished by Contractor to Engineer.

4. Working Drawings furnished shall be corrected to include any departures from previously accepted drawings.

## 1.4 OPERATION AND MAINTENANCE MANUALS:

A. For all equipment, materials, valves and structures provided as part of this contract, the Contractor shall provide an Operation and Maintenance Manual that details the standard operation and preventative maintenance procedures for said items.

B. Operation and Maintenance Manuals shall include, but not be limited to:

1. Exploded equipment drawings with parts labeled
2. Wiring and flow diagrams
3. Spare parts lists
4. Parts numbers and ordering data
5. Name and contact information for the Contractor, the manufacturer and the local manufacturer’s representative.
6. Manufacturer’s warranty information

C. Factory O&M Manuals are acceptable provided any data pertaining to models, sizes or optional equipment not provided is crossed out, and items provided are called out with arrows or boxes, and all items above are included.

## 1.5 CERTIFICATION FORMS:

A. If specifically required in other Sections of these Specifications so that the Contractor shall submit the applicable Certificate of Design for each item

required, and in the form attached to this Section completely filled in and signed and sealed by a registered New Hampshire Professional Engineer.

1.6 CONTRACTOR'S ORDER OF CONSTRUCTION:

A. The Contractor shall submit schedules and reporting information in accordance with the requirements of Section 01311 – SCHEDULING AND REPORTING.

1.7 CONTRACTOR'S COST BREAKDOWN:

A. The Contractor shall submit a schedule of values in accordance with the requirements of Section 01301 – SCHEDULE OF VALUES.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

CERTIFICATE OF DESIGN

The undersigned hereby certifies that he/she is a Professional Engineer registered in the state of _____ and that he/she has been employed by (Name of Contractor) _____ to design _____ in accordance with Specifications Section _____ for the (Name Project) _____. The undersigned further certifies that he/she has performed similar designs previously and has performed the design of the _____; and regulations and professional practice standards; that his/her signature and Professional Engineer (P.E.) Stamp have been affixed to all calculations and drawings used in, and resulting from, the design; and that the use of that stamp signifies the responsibility of the undersigned for that design.

The undersigned hereby certifies that he/she has Professional Liability Insurance and a Certificate of Insurance is attached.

The undersigned hereby agrees to make all original design drawings and calculations available to the Owner or Engineer within seven (7) days following written request by the Owner or Engineer.

| | |
|---|---|
| _____ | _____ |
| P.E. Name | Contractor's Name |
| _____ | _____ |
| Signature | Signature |
| _____ | _____ |
| Title | Title |
| _____ | _____ |
| Address | Address |

END OF SECTION

SECTION 01301

SCHEDULE OF VALUES

PART 1 – GENERAL

1.1 DESCRIPTION:

A. This Section defines the process whereby the Schedule of Values shall be developed and incorporated into the cost loading function of the CPM Schedule as specified in Section 01311 – SCHEDULING AND REPORTING. Monthly progress payment amounts shall be determined from the monthly progress updates of the CPM Schedule activities.

B. The Schedule of Values shall be developed independently but simultaneously with the development of the CPM Schedule activities and logic as follows:

1.2 PRELIMINARY SCHEDULE OF VALUES:

A. The Contractor shall submit a preliminary Schedule of Values for the major components of the work at the Preconstruction Conference. The listing shall include, at a minimum, the proposed value for the following major work components:

1. Mobilization.

2. The total value of civil piping work inclusive of excavation, support of excavation, pipe installation, bypass pumping, dewatering, testing and backfill of pipe or other structures, and all incidental work associated with underground pipe installations. Additionally, this total value shall be broken down into separate values for water lines, drain lines, sanitary sewer lines, and appurtenant work such as manholes and service connections constructed or modified as a part of the work.

3. The total value of structural reinforced concrete work inclusive of all excavation, support of excavation, dewatering, testing, subgrade preparation, backfill and incidental work for all new structures. Additionally, this total value shall be broken down into separate values for each new structure constructed as a part of the work. Miscellaneous and minor concrete work may be listed as one item in this breakdown.

4. The total value of site civil work inclusive of regrading and

landscaping.

5. The total value of all other work not specifically included in the above items.

B. After the Pre-construction meeting, the Contractor and Engineer shall meet and jointly review the preliminary Schedule of Values and make any adjustments in value allocations if, in the opinion of the Engineer, these are necessary to establish fair and reasonable allocation of values for the major work components. Front end loading will not be permitted. The Engineer may require reallocation of major work components from items in the above listing if in the opinion of the Engineer such reallocation is necessary. This review and any necessary revisions shall be completed within fourteen (14) calendar days from the date of Notice to Proceed.

1.3 DETAILED SCHEDULE OF VALUES:

A. The Contractor shall prepare and submit a detailed Schedule of Values to the Engineer within twenty-eight (28) calendar days from the date of Notice to Proceed. The detailed Schedule of Values shall be based on the accepted preliminary Schedule of Values for major work components. Because the ultimate requirement is to develop a detailed Schedule of Values sufficient to determine appropriate monthly progress payment amounts through cost loading of the CPM Schedule activities, sufficient detailed breakdown shall be provided to meet this requirement. The Engineer shall be the sole judge of acceptable numbers, details and description of values established. If, in the opinion of the Engineer, a greater number of Schedule of Values items than proposed by the Contractor is necessary, the Contractor shall add the additional items so identified by the Engineer.

B. All lump sum, allowance and unit price items included for payment in the Contract shall be included in the schedule of values. Greater detail shall be provided for the following items and as further directed by the Engineer.

1. Mobilization by activity.

2. Scheduling and Reporting broken down by submittal.

3. Soil and Fill Management

4. All other work not specifically included in the above items shall be broken down as necessary for establishment of pay and Schedule activity items.

C. The Contractor and Engineer shall meet and jointly review the detailed Schedule of Values within thirty-five (35) calendar days from the date of Notice to Proceed. The value allocations and extent of detail shall be reviewed to determine any necessary adjustments to the values and to determine if sufficient detail has been proposed to provide cost loading of the CPM Schedule activities. Any adjustments deemed necessary to the value allocation or level of detail shall be made by the Contractor and a revised detailed Schedule of Values shall be submitted within thirty-eight (38) days from the date of Notice to Proceed.

D. Following acceptance of the detailed Schedule of Values, the Contractor shall incorporate the values into the cost loading portion of the CPM Schedule. The CPM activities and logic shall have been developed concurrent with development of the detailed Schedule of Values; however, it shall be necessary to adjust the detailed Schedule of Values to correlate to individual Schedule activities. It is anticipated that instances will occur, due to the independent but simultaneous development of the Schedule of Values and the CPM Schedule activities, where interfacing these two documents will require changes to each document. Schedule activities may need to be added to accommodate the detail of the Schedule of Values. Schedule of Value items may need to be added to accommodate the detail of the CPM Schedule activities. Where such instances arise, the Contractor shall propose changes to the Schedule of Values and to the CPM Schedule activities to satisfy the CPM Schedule cost loading requirements.

1.4 CROSS REFERENCE LISTING:

A. To assist in the correlation of the Schedule of Values and the CPM Schedule, the Contractor shall provide a Cross Reference Listing which shall be furnished in two parts. The first part shall list each Scheduled Activity with the breakdown of the respective valued items making up the total cost of the activity. The second part shall list the valued item with the respective Scheduled Activity or Activities that make up the total cost indicated. In the case where a number of schedule items make up the total cost for a valued item (shown in the Schedule of Values) the total cost for each scheduled item should be indicated.

B. These listings shall be updated and submitted in conjunction with the CPM monthly submittals as stated in Specification Section 01311 – SCHEDULING AND REPORTING.

C. Approved change orders reflected in the CPM Schedule shall be incorporated into the Schedule of Values as a single unit identified by the change order number.

1.5 CHANGES TO SCHEDULE OF VALUES:

A. Changes to the CPM Schedule which add activities not included in the original schedule but included in the original work (schedule omissions) shall have values assigned as approved by the Engineer. Other activity values shall be reduced to provide equal value adjustment increases for added activities as approved by the Engineer.

B. In the event that the Contractor and Engineer agree to make adjustments to the original Schedule of Values because of inequities discovered in the original accepted detailed Schedule of Values, increases and equal decreases to values for activities may be made.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION

# SECTION 01311

# SCHEDULING AND REPORTING

## PART 1 - GENERAL

### 1.1 DESCRIPTION:

A. This section includes scheduling and reporting requirements of the Contractor.

### 1.2 GENERAL:

A. The scheduling of the Work under the Contract shall be performed by the Contractor in accordance with the requirements of this Section. The development of the schedule, the cost loading of the schedule, monthly payment requisitions and project status reporting requirements of the Contract shall employ computerized Critical Path Method (CPM) scheduling. The CPM Schedule shall be cost loaded based on the schedule of values as approved by the Owner in accordance with the requirements of Section 01301 – SCHEDULE OF VALUES. The CPM schedule and all reports should be prepared with Primavera software. Where submittals are required hereunder, the Contractor shall submit four copies of each submittal item.

### 1.3 INITIAL QUALIFICATIONS:

A. The Contractor shall submit a statement of computerized CPM capability at the First Progress Meeting verifying that either the Contractor has in-house capability qualified to use CPM techniques and the Primavera software, or that the Contractor will employ a CPM consultant so qualified. In either event the statement shall identify the individual who will perform the CPM scheduling. Capability shall be verified by description of construction projects on which the individual has successfully applied computerized CPM and shall include at least two projects of similar nature, scope and value not less than one-half the Total Bid Price of this project. The statement shall also provide the contact persons for the referenced projects with current telephone and address information.

### 1.4 INITIAL SCHEDULE SUBMITTALS:

A. The Contractor shall submit two short term schedule documents at the First Progress Meeting which shall serve as the Contractor's Plan of Operation for the initial sixty (60) day period of the Contract Time and to identify the

manner in which the Contractor intends to complete all work within the Contract Time. The Contractor shall submit: (1) a sixty (60) day Plan of Operation bar chart, and (2) a project overview bar chart type plan for all work as indicated below.

1. Sixty (60) Day Plan of Operation: During the initial sixty (60) days of the Contract Time, the Contractor shall conduct Contract operations in accordance with the sixty (60) day bar chart Plan of Operation. The bar chart so prepared and submitted shall show the accomplishment of the Contractor's early activities (mobilization, permits, submittals necessary for early material and equipment procurement, submittals necessary for long lead equipment procurement, CPM submittals, initial site work and other submittals and activities required in the first sixty (60) days).

2. Project Overview Bar Chart: The overview bar chart shall indicate the major components of the project work and the sequence relations between major components and subdivisions of major components. The overview bar chart shall indicate the relationships and time frames in which the various components of the Work will be made substantially complete and placed into service. Each major component and subdivision component shall be accurately plotted on time scale sheets not to exceed 36-inch by 60-inch in size. Not more than three sheets shall be employed to represent this overview information.

B. The Owner and the Contractor shall meet to review and discuss the sixty (60)-day plan of operations and project overview bar chart within one week after they have been submitted to the Owner. The Contractor shall make corrections to the schedules necessary to comply with the Contract requirements and shall adjust the schedules to incorporate any missing information requested by the Owner.

1.5 CPM SCHEDULE SUBMITTALS:

A. Original CPM Schedule Submittal: Within thirty (30) calendar days after the commencement date stated in the Notice to Proceed, the Contractor shall submit for review by the Owner a hard copy of the CPM Network Schedule. This submittal shall have already been reviewed and approved by the Contractor's Project Manager, Project Superintendent, and the Project Estimator prior to submission. The CPM Schedule shall be a time-scaled network diagram of the "i-j" activity-on-arrow or precedence type. The Network Diagram shall describe the activities to be accomplished and their logical relationships and show the Critical Path.

B. As stated in Paragraph 1.7.F herein, all float indicated in the schedule shall belong to the project. The Computerized Schedule Report tabulations shall include the following:

1. Report of activities sorted by Activity Number.

2. Report of activities sorted by Early Start date.

3. Report of activities sorted by Total Float.

4. Report of activities sorted by Responsibility Code. Responsibility Codes shall be established for the Contractor, Owner, subcontractors, suppliers, etc. These codes shall be identified in the Network Diagram.

5. A successor-predecessor report which shall identify the successor and predecessor activities for each activity and ties between schedule activities.

C. Original CPM Schedule Review Meeting: The Contractor shall, within forty (40) calendar days from the commencement date stated in the Notice to Proceed, meet with the Owner and Engineer to review the original CPM schedule submittal. The Contractor shall have the Project Manager, Project Superintendent, and the Project Scheduler in attendance. The Owner's review will be limited to the submittal's conformance to the Contract requirements. However, the review may also include:

1. Clarifications of the design intent, process, and startup requirements.

2. Directions to include activities and information missing from the submittal.

3. Requests to the Contractor to clarify the schedule.

D. Revisions to the Original CPM Schedule: Within fifty (50) calendar days after the commencement date stated in the Notice to Proceed, the Contractor shall have revised the original CPM schedule submittal to address all review comments from the original CPM schedule review meeting and resubmit the network diagrams and reports for the Owner's review. The Owner, within fourteen (14) calendar days from the date that the Contractor submitted his revised schedule will either (1) accept the schedule and cost loaded activities as submitted, or (2) advise the Contractor in writing to review any part or parts of the schedule which either do not meet the Contract requirements or are unsatisfactory for the Owner to monitor the project's progress and status or evaluate monthly payment requests by the Contractor. The Owner may accept the schedule with conditions that the first monthly CPM schedule update be revised to correct deficiencies identified. When the schedule is

accepted, it shall be considered as the "Original CPM Construction Schedule" until an updated schedule has been submitted. The Owner reserves the right to require that the Contractor adjust, add to, or clarify any portion of the schedule which may later be discovered to be insufficient for the monitoring of the Work or approval of partial payment requests. No additional compensation will be provided for such adjustments, additions or clarifications.

E. Acceptance: The acceptance of the Contractor's schedule by the Owner will be based solely upon the schedule's compliance with the Contract requirements. By way of the Contractor assigning activity duration and proposing the sequence of the Work, the Contractor agrees to utilize sufficient and necessary management and other resources to perform the work in accordance with the schedule. Upon submittal of a schedule update, the updated schedule shall be considered the "current" project schedule.

F. Submission of the Contractor's progress schedule to the Owner shall not relieve the Contractor of total responsibility for scheduling, sequencing, and pursuing the Work to comply with the requirements of the Contract Documents, including adverse effects such as delays resulting from ill-timed work.

G. Monthly Updates and Periodic CPM Schedule Submittals: Following the acceptance of the Contractor's Original Construction Schedule, the Contractor shall monitor the progress of the Work and adjust the schedule each month to reflect actual progress and any changes in planned future activities. Each schedule update submitted must be complete including all information requested in the original schedule submittal and that shown in Paragraph 1.7. Each update shall continue to show all work activities including those already completed. These completed activities shall accurately reflect the "as built" information by indicating when the work was actually started and completed.

H. Neither the submission nor the updating of the Contractor's original schedule submittal nor the submission, updating, change or revision of any other report, curve, schedule or narrative submitted to the Owner by the Contractor under this Contract, nor the Owner's review or acceptance of any such report, curve, schedule or narrative shall have the effect of amending or modifying, in any way, the Contract completion date or milestone dates or of modifying or limiting, in any way, the Contractor's obligations under this Contract. Only a signed, fully executed change order can modify these contractual obligations.

I. Weekly schedule updates shall be submitted by the Contractor and will be reviewed with the Contractor during the weekly construction progress

meetings. The goal of these meetings is to enable the Contractor and the Owner to initiate appropriate remedial action to minimize any known or foreseen delay in completion of the Work and to determine the amount of Work completed since the last month's schedule update. The status of the Work will be determined by the percent complete of each activity shown in the Network Diagram. These meetings are considered a critical component of the overall monthly schedule update submittal and the Contractor shall have appropriate personnel attend. As a minimum, these meetings shall be attended by the Contractor's Project Manager and General Superintendent.

J. The Contractor shall submit the revised CPM Network Diagram, the revised successor/predecessor report, the Project Status Reports as defined by Paragraph 1.8 of this Section with the Contractor's Application for Payment. Applications for Payment which are submitted without the proper CPM Updates shall be held until the Contractor has satisfied the Contract requirement. Within five (5) working days of receipt of the above noted revised submittals, the Owner will either accept or reject the monthly schedule update submittal. If accepted, the percent complete shown in the monthly update will be the basis for the Application for Payment to be submitted by the Contractor. If rejected, the update shall be corrected and resubmitted by the Contractor before the Application for Payment for the update period can be processed.

K. Schedule Revisions: The Contractor shall highlight or otherwise identify all changes to the Network Diagram Schedule Logic or activity durations made from the previous schedule. The Contractor shall modify any portions of the CPM schedule which become infeasible because of activities behind schedule or for any other valid reason.

1.6 CHANGE ORDERS:

A. Upon written approval of a change order, or upon written receipt by the Contractor of authorization to proceed with additional work, the change shall be reflected in the next submittal of the CPM schedule by the Contractor. The Contractor shall utilize a sub-network in the schedule depicting the changed work and its effect on other activities. This sub-network shall be tied to the main network with the appropriate logic so that a true analysis of the Critical Path can be made. No Change Order related work shall be undertaken prior to written approval of the Change Order associated with that work.

1.7 CPM STANDARDS:

A. Definitions: CPM, as required by this Section, shall be interpreted to be generally as outlined in the Association of General Contractors (AGC)

publication, "The Use of CPM in Construction." except that either "i-j" arrow diagrams or precedence diagramming format may be utilized. In the case of conflicts between this specification and the AGC Document, this specification shall govern.

B. Construction Schedules: Construction schedules shall include a graphic network diagram and computerized construction schedule reports as described in Paragraph 1.8.

C. Networks: The CPM network shall be in a form of a time scaled "i-j" activity-on-arrow or precedence type diagram and may be divided into a number of separate sheets with suitable match lines relating the interface points among the sheets. Individual sheets shall not exceed 36-inch by 60-inch.

D. All construction activities and procurement shall be indicated in a time-scaled format and a calendar time line shall be shown along the entire sheet length. Each activity arrow or node shall be plotted so that the beginning and completion dates of each activity are accurately represented along the calendar time line. All activities shall be shown using the symbols that clearly distinguish between critical path activities, non-critical activities and free float for each non-critical activity. All activity items shall be identified by their respective Activity Number, Responsibility Code, Work Duration, and their Dollar Value. All non-critical path activities shall show their total float time in scale form by utilizing a dotted line or some other graphical means.

E. Duration Estimates: The duration estimate indicated for each activity shall be computed in working days and shall represent the single best estimate considering the scope of the activity work and resources planned for the activity. Except for certain non-labor activities, such as curing of concrete or delivery of materials, activity duration shall not exceed 10 working days nor be less than one working day unless otherwise accepted by the Owner.

F. Float Time: Float time shall be as follows:

1. Definition: Unless otherwise provided herein, float as referenced in these documents, is total float. Total float is the period of time measured by the number of working days each non-critical path activity may be delayed before it and its succeeding activities become part of the critical path. If a non-critical path activity is delayed beyond its float period, that activity then becomes part of the critical path and controls the end date of the project. Thus, the delay of the non-critical path activity beyond its float period will cause delay to the project itself.

2. Float is not for the exclusive benefit of the Contractor, but is an expiring resource available to the Owner, or the Contractor, to accommodate changes in the Work, however originated, or to mitigate the effect of events which may delay performance or completion of all or part of the Work within the Late Dates, the Contractor's anticipated completion, or Contract Time. Contract time extensions for the Contract performance will be granted only to the extent that delays or disruptions to affected work paths exceed total float along those paths of the current Working Schedule (updated schedule) in effect at the time of delay or disruption. Delays and disruptions which cause the end date of the Work to exceed current contract completion date must be beyond control and without fault or negligence of the Contractor or any Subcontractor at any tier. In the event that the delays or disruptions impact an already negative float path, the Contractor will not receive a time extension unless and until the activity with the highest negative float is driven even further negative. Delays or disruptions are not considered a basis for time extension to this contract unless and until such delays or disruptions are resolved as set forth in the General Conditions.

3. Pursuant to the float sharing requirements of this Section, the use of float suppression techniques such as preferential or logic sequencing (crew movement, equipment use, etc.), special lag/lead restraints, and extended activity times or duration, imposed dates, scheduling of work not required for a Contract Time as required work, and others, are expressly prohibited. Use of float time disclosed or implied by use of alternate float suppression techniques shall be shared to the benefit of both the Owner and the Contractor. Justify use of preferential sequencing, special lag/lead relationships and other network techniques that may be construed as float suppression techniques as being necessary for efficient utilization of resources in execution of the Contract. Use of any network techniques solely for the purpose of suppressing float will be cause for rejection of schedule submittal. The Contractor shall adjust or remove any float suppression techniques as a prerequisite to a request for an increase in Contract Price or Contract Time.

## 1.8 SCHEDULE REPORTS (FORMAT):

A. Schedule Reports: Schedule Reports shall be prepared based on the Construction Schedule, and shall include the following minimum data for each activity:

1. Activity Numbers and Responsibility Codes.

2. Work Order No.

3. CIP No.

4. Estimated Activity Duration.

5. Activity Description.

6. Activity's Percent Completion.

7. Early Start Date (Calendar Dated).

8. Early Finish Date (Calendar Dated).

9. Late Start Date (Calendar Dated).

10. Late Finish Date (Calendar Dated).

11. Status (Whether Critical).

12. Total Float for Each Activity.

13. Free Float for Each Activity.

14. Cost Value for Each Activity.

B. Project Information: Each Schedule Report shall be prefaced with the following summary data:

1. Project Name.

2. Contractor.

3. Type of Tabulation.

4. Project Duration.

5. Contract Completion Date (revised to reflect time extensions).

6. The Commencement Date Stated in the Notice to Proceed.

7. The Data Date and Plot Date of the Network Diagram.

8. If an update, cite the new schedule completion date.

1.9 PROJECT STATUS REPORTING:

A. In addition to the submittal requirements for the CPM scheduling identified in this Section, the Contractor shall provide monthly project status reports (Overview Bar Chart and a written narrative report) to be submitted in

conjunction with the revised CPM Schedules as specified in Paragraph 1.4. Status reporting shall be in the form specified below.

B. The Contractor shall prepare and submit monthly an Overview Bar Chart schedule of the major project components. The overview bar chart schedule shall be a summary of the current CPM schedule (original and as updated and adjusted throughout the entire construction period). It shall be limited to not more than four sheets which shall not exceed 8-1/2-inch by 11-inch. The major project components shall be represented as time bars which shall be subdivided into various types of work.

C. Each major component and subdivision shall be accurately time scale plotted consistent with the project overview bar chart specified above. It shall represent the same status indicated by early start and finish activity information contained in the latest update of the CPM schedule. In addition, a percent completion shall be indicated for each major component and subdivision. The initial submittal of the overview bar chart schedule shall be made at the time that the revised original CPM schedule is submitted to the Owner. The Contractor shall amend the overview schedule to include any additional detail required by the Owner. The Contractor shall include any additional information requested by the Owner at any time during the construction of the Work.

D. The Contractor shall prepare monthly written narrative reports of the status of the project for submission to the Owner. Written status reports shall include:

1. The status of major project components (Percent Complete, amount of time ahead or behind schedule) and an explanation of how the project will be brought back on schedule if delays have occurred.

2. The progress made on critical activities indicated on the CPM schedule.

3. Explanations for any lack of work on critical path activities planned to be performed during the last month.

4. Explanations for any schedule changes, including changes to the logic or to activity duration.

5. A list of the critical activities scheduled to be performed in the next two month period.

6. The status of major material and equipment procurement.

7. The value of materials and equipment properly stored at the site, but not yet incorporated into the work-in-place.

8. Any delays encountered during the reporting period.

9. An assessment of inclement weather delays and impacts to the progress of the Work.

10. A statement as to the adequacy of remaining contract time to complete Work.

E. The Contractor may include any other information pertinent to the status of the project. The Contractor shall include additional status information requested by the Owner.

1.10 INCLEMENT WEATHER PROVISIONS OF THE SCHEDULE:

A. The Contractor's construction schedule shall include lost days on the CPM schedule's critical path due to inclement weather during an active period of Work. The Contractors schedule shall also include lost days due to an inclement weather related shutdown at the direction of the City, see Article 18 of the General Conditions. The Contractor will not be allowed an increase in the contract price as a result of lost days due to an inclement weather related shutdown but an extension of contract time only.

1.11 ONE WEEK LOOK AHEAD SCHEDULES:

A. At each construction meeting, the Contractor shall provide a 1 week look ahead schedule of work to be undertaken. The schedule shall call out all work that will be done in the 7-days between weekly construction meetings.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

# SECTION 01380

# CONSTRUCTION PHOTOGRAPHS

## PART 1 - GENERAL

### 1.1 CONSTRUCTION PHOTOGRAPHS AND VIDEOTAPE:

A. Prior to Construction the Contractor shall videotape each project site to document the existing conditions.

B. The Contractor shall continuously record the progress of the work using a digital camera and shall provide the Engineer with digital photos on a monthly basis.

B. Sufficient photographs to document the work, but no less than fifty, shall be taken per month. Provide two CD copies of digital photographs on a monthly basis. Each CD shall be identified with project name, job number, and location where photographs where taken and dated.

## PART 2 – PRODUCTS

### 2.01 DIGITAL PHOTOGRAPHS:

A. Furnish the Engineer two compact disks of all digital photographs on a monthly basis throughout the project

## PART 3 – EXECUTION

### 3.01 DIGITAL PHOTOGRAPHY:

A. Contractor shall keep a continuous record of the project's progress using a digital camera.

B. Coordinate with Engineer on views to be taken. In general, views from locations to adequately illustrate state of project and condition of construction.

C. Progress photography during construction of facilities. Photos of any month need only new work performed during month.

D. Succeeding photography of same photographic subject to be taken, insofar as practical, from the same view points as preceding photographic sessions.

E. Detailed views shall contain a relative dimension reference that is easily recognizable by the average person. In views where dimensions are critical, use a recognizable measuring device such as a measuring tape in a manner

so that the markings are clear and sharp in the photograph and the device located in close relationship with subject of photograph.

END OF SECTION

# SECTION 01400

# QUALITY CONTROL

## PART 1 - GENERAL

### 1.01 RESPONSIBILITIES:

A. General

1. If the Contract Documents, laws, ordinances, rules, regulations or order of any public authority having jurisdiction require any portion of the Work to be inspected, tested or approved, the Contractor shall give the Engineer timely notice of its readiness so the Engineer may observe such inspection, testing, or approval. The Contractor shall bear all costs of such inspections, tests or approvals.

2. The Contractor’s inspections or tests, or approvals by persons other than the Engineer, shall not relieve the Contractor from his obligation to perform the Work in accordance with the contract documents.

B. Additional Inspection

1. If the Engineer determines that any Work requires inspection beyond the requirements listed above, the Engineer will instruct the Contractor to order such inspection, testing or approval. If such inspection or testing reveals a failure of the Work to comply with the requirements of the Contract Documents, the Contractor shall bear all costs thereof, including compensation for the Engineer's additional services made necessary by such failure. If the Work complies, the Owner shall bear such costs and an appropriate Change Order shall be issued.

2. Any materials which fail to meet the requirements of these Specifications shall not be used whether or not previously approved by the Engineer. If they have been delivered to the job, they shall be removed. If they have already been incorporated into the Work, the Engineer may order them removed, or, at the discretion of the Owner, they may be permitted to remain in place providing the Contractor agrees to a proper deduction from the contract sum.

C. Certificates

Required certificates of inspection, testing or approval shall be secured by the Contractor and promptly delivered by him to the Engineer. The Contractor shall maintain a file of all test reports. The file shall be available for inspection by the Engineer at all times.

## 1.04 MATERIALS TESTING:

A. General

1. Laboratory testing and checking required by the Specifications, including the cost of transporting all samples and test specimens, shall be provided and paid for by Contractor. Contractor shall submit the names of three experienced testing laboratories, one of which will be chosen by the Owner to conduct all field and sampling and testing specified.

2. Materials to be tested include, but are not necessarily limited to, the following: cement, concrete aggregates, concrete, bituminuous paving materials, structural and reinforcing steel, waterproofing, select backfill, crushed stone or gravel and sand and filter media.

3. Tests required by Owner shall not relieve Contractor from the responsibility of supplying certificates from manufacturers or suppliers to demonstrate conformance with the Specifications.

B. Procedure

1. Contractor shall plan and conduct his operations to permit taking of field samples and test specimens, as required, and to allow adequate time for laboratory tests.

2. The collection, field preparation and storage of field samples and test specimens shall be as directed by Engineer, and shall be the responsibility of Contractor.

C. Test Reports

1. During the progress of the Work, four copies of all test reports shall be submitted directly to Engineer from the testing laboratory, as they are completed, with a copy sent to Contractor.

2. Each test report will be signed and certified by a responsible officer of the testing laboratory.

D. Significance of Tests

Test results shall be binding on both Contractor and Owner, and shall be considered irrefutable evidence of compliance or non-compliance with the Specification requirements, unless supplementary testing shall prove, to the satisfaction of Engineer, that the initial samples were not representative of actual conditions.

E. Supplementary and Other Testing

Nothing shall restrict Contractor from conducting tests he may require. Should Contractor at any time request Owner to consider such test results, the test reports shall be certified by an independent testing laboratory acceptable to Owner. Testing of this nature shall be conducted at Contractor's expense.

1.05 WATERTIGHTNESS OF STRUCTURES:

A. General

1. It is the intent of these Specifications that all concrete work, sealing work around built-in items and penetrations be performed as required to insure that:

a. Groundwater, surface water, and water or liquids in tanks, channels and containers will not intrude into surrounding areas.

b. Leakage in other areas does not exceed the limits specified hereinafter.

2. The required watertightness, as noted below, shall be achieved by quality concrete construction and proper sealing of all joints and penetrations.

3. Each unit shall be tested separately and the leakage tests shall be made prior to backfilling and before equipment is installed.

4. The concrete Contractor shall provide at his own expense all labor, material, temporary bulkheads, pumps, water, measuring devices, etc., necessary to perform the required tests.

5. Contractor shall submit for approval a plan for carrying out the watertightness tests of structures. The plan shall include details of the source and safe disposal of water to be used in the tests.

B. Built-In Items and Penetrations

1. All pipe sleeves, built-in items and penetrations, including watertight access hatches shall be sealed as detailed and as required to ensure a continuous watertight seal.

2. Penetrations through roofing areas shall be made prior to application of the roofing utilizing suitable sleeves and flashings as required. If roofing surfaces are penetrated after roofing has been applied, the waterproofing integrity shall be restored in a manner acceptable under the roofing guarantee.

C. Structures

1. Structures or portions of structures shall be tested for leakage by the Contractor as required by the Specifications herein.

D. Notification by Engineer

If any leaks are in excess of the specified amount and are not remedied by the Contractor within four weeks of notification by Engineer, regardless of whether the cause of these leaks is or is not determined, Engineer shall have the authority to have these leaks repaired by others. The cost of repairs, by others, shall be deducted from monies due or to become due Contractor.

1.06 PRELOADING AND LEAKAGE TESTING OF TANKS AND STRUCTURES:

A. No backfilling, floor finish, concrete or mortar fill, protective coatings, or permanent pipe connections shall be applied to or installed in any new wastewater containment structures until they have been subjected to loading for settlement and tested for leakage. Testing shall not be done until the concrete has reached its 28 day design strength.

B. During the test period, the excavation around the structure shall be kept dewatered by the Contractor. The Contractor shall temporarily close all bottom openings and wall openings below maximum water level in the structures; furnish and fill the structures to the design maximum water level with water and let it stand for 24-hours before testing. The Contractor shall make his own arrangements for handling the water for testing and its transfer from one structure to another and its final disposal. After 24-hours the Contractor shall take all necessary elevations and measurements prior to testing of the structures.

C. For the Preloading Test the Contractor shall maintain the liquid level in the structures at the design maximum water level for 72-hours. If the characteristics of settlement of the structure so require, the loading shall continue for a longer period to permit the necessary consolidation of the foundation material, in which case the Contractor shall be entitled to no extra compensation, but a commensurate extension of time for completion of the whole work under this contract shall be allowed.

D. Leakage testing shall be carried out in accordance with ACI350.1 - Tightness Testing of Environmental Engineering Concrete Structures. The test criterion shall be HST-NML (no measurable loss) as defined by ACI 350.1.

E. During the leakage test period, the Engineer shall inspect the structure for leakage. If moist spots become visible, indicating the existence of minor leaks, or if the water level indicates hidden leakage, the Contractor shall furnish all materials and do all work necessary to locate the leaks and make the structure watertight to the complete satisfaction of the Engineer. This includes the repair of cracks, tie holes, etc. No additional compensation shall be allowed for such work. If, in the opinion

of the Engineer, during the course of the test weather conditions are such that it becomes difficult to accurately monitor the water level in the tank, the test shall be stopped, and started over again when weather permits.

F. On conclusion of the test, the Contractor shall pump or drain the water from the structure and dispose of it without injury to structures or surfaces.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

3.01 QUALITY CONTROL:

A. Quality control is the responsibility of the Contractor, and the Contractor shall maintain control over construction and installation processes to assure compliance with specified requirements.

B. Certifications for personnel, procedures and equipment associated with special processes (e.g. welding cable splicing, instrument calibration, surveying) shall be maintained in the Contractor's field office available for inspection by the Engineer.

C. Means and methods of construction and installation processes are the responsibility of the Contractor and at no time is it the intent of the Engineer to supersede or void that responsibility.

END OF SECTION

NO TEXT ON THIS PAGE

SECTION 01504

MOBILIZATION

PART 1 - GENERAL

1.01 DESCRIPTION:

A. This section includes mobilization consisting of obtaining all permits; moving all equipment onto the site required for the first month's operations; furnishing and erecting project and other construction facilities; erecting project signs and traffic management signs; implementing security features and requirements; all as required for the proper performance and completion of the Work. Mobilization shall further include the following principal items:

1. Installing temporary construction utilities.

3. Providing field office trailers for the CONTRACTOR and the ENGINEER, complete with all specified furnishings, office equipment, communications facilities and utility services.

4. Providing on-site sanitary facilities and potable water.

5. Arranging for and erection of Contractor's work and storage yard(s).

6. Having all OSHA required notices and establishment of safety programs.

7. Having the CONTRACTOR's superintendent at the job site full time.

8. Submitting initial submittals.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

NO TEXT ON THIS PAGE

# SECTION 01505

# NOISE CONTROL

## PART 1 – GENERAL

### 1.01 DESCRIPTION OF WORK:

A. The Contractor shall take reasonable steps to minimize noise issues during construction.

B. The intent of this Section is to minimize the construction noise within construction areas, laydown areas, and the facilities that constitute the project site. To this end, the Contractor and all subcontractors are required to comply with applicable noise regulations, specification requirements, and the noise level limits specified herein.

C. The Contractor shall use equipment with efficient noise-suppression devices and employ other noise abatement measures necessary for protection of the public. In addition, the Contractor shall schedule and conduct operations in a manner that will minimize, to the greatest extent feasible, the disturbance to the public in areas adjacent to the Work and to occupants of homes in the vicinity of the Work.

D. Compliance with the requirements of this Section may require the use of equipment with special mufflers or enclosures, and construction of temporary enclosures or sound barriers around operations as determined by the Engineer. Contractors shall be required to use approved haul routes to minimize noise at residential and other sensitive receptor sites.

E. Compliance with the requirements of the Section shall not relieve the Contractor from responsibility for compliance with applicable Federal, State, and Local ordinances, regulations, and other Sections of these construction specifications.

### 1.02 DEFINITIONS:

A. Construction Site shall mean that area within the contract limits of a construction operation. This includes defined boundary lines of the project itself.

B. Daytime refers to the period from 7:00 AM to 4:00 PM local time daily, except Saturday, Sundays and legal holidays.

C. Nighttime refers to all other times other than daytime, and includes all day Saturday, Sunday and legal holidays.

D. Noise is any unwanted sound which annoys or disturbs humans, or which causes or tends to cause an adverse psychological or physiological effect on humans.

E. Noise Sensitive Locations shall mean residential areas, institutions, hospitals, parks, and other location so named herein.

F. Nuisance Conditions refer to the sound levels that annoy or disturb a reasonable person of normal sensitivities but which do not exceed applicable Federal, State and Local ordinances and regulations.

1.03 RESPONSIBILITIES OF CONTRACTOR:

A. The Contractor shall perform all Work within the permissible noise levels, work schedule limitations, and procedures provided for in this Section and in all applicable Federal, state, and municipal codes, regulations, and standards.

B. Other than those provided herein, the Contractor shall be responsible for obtaining, at Contractor's own expense permits, variances, equipment certifications, and other documents required by this Section and by all applicable Federal, State, and municipal codes, regulations and standards.

1.04 NOISE LEVEL LIMITATIONS:

A. The Contractor shall use only equipment that, operating under full load, does not exceed 80 dBA at daytime and 50 dBA at nighttime when measured 50-feet from construction equipment.

B. Compliance with the noise limits may require the use of mufflers, shields, enclosures around equipment, or sound barriers around the operations.

C. The Engineer may choose at anytime, but especially upon receipt of a noise complaint from surrounding area residents, to conduct noise measurements on construction activities. If the Contractor's existing on-site equipment does not meet the noise emission limits specified above, the Contractor shall remove the equipment from service, or take prompt remedial action to comply with these specifications.

1.05 NOISE REDUCTION METHODS:

A. Notwithstanding the specific noise level limitations specified herein, the Contractor shall use all reasonable efforts to include reduction measures listed below to minimize the amount of feasible construction noise emission levels. Noise reduction measures shall include, but not be limited to the following:

1. Scheduling truck loading, unloading, and hauling operations so as to minimize noise impact near noise sensitive locations and surrounding communities.

2. Locating and/or shielding stationary equipment so as to minimize noise impact on the community.
3. Limiting the number and time of equipment pieces idling time on the site at one time.
4. Limited the use of annunciators or public address systems, except for emergencies and other such notifications.
5. Maintaining all equipment such that parts of vehicles and loads are secure against rattling and banging.

6. Securely installing any required precast decking, steel decking or plates so as to avoid unnecessary rattling.
7. Modification of equipment to reduce noise, provided that such modifications are made with the written approval of the equipment manufacturer.
8. Grading of all surfaced irregularities on construction sites to prevent the generation of impact noise and ground vibrations by passing vehicles.

1.06 COMPLIANT PROCEDURES:

A. The primary objective of the compliant procedure is to ensure that public and agency complaints are addressed and resolved consistently and expeditiously. The secondary objective is to facilitate evaluation and prediction of construction noise impacts on abutters as manifested by the receipt of external complaints.

B. Upon receipt of the noise complaint for either the Owner or the Engineer, the Contractor shall take all necessary actions to resolve noise complaints promptly.

C. If any noise complaints are the result of construction activities that are conducted at nighttime, the Contractor must terminate all work activities immediately, and may lose permission to continue working at nighttime in the future.

PART 2 – PRODUCTS

2.01 MATERIALS AND EQUIPMENT:

A. Noise reduction equipment specified in this Section shall remain the property of the Contractor.

B. Noise reduction materials may be new or used. Used materials shall be of a quality and condition necessary to perform their designed function.

C. Noise reduction equipment and materials may include, as necessary to meet the noise abatement provisions specified herein, the following:

1. Specially selected quiet methods, means, techniques and equipment.
2. Shields, shrouds, or intake and exhaust mufflers.

3. Noise deadening material to line hoppers, conveyors, transfer points, storage bins or chutes.
4. Noise barriers.

D. Contractor vehicles and mobile equipment with audible back-up alarms used on the construction site shall be of the ambient sensing self-adjusting type, with no more than 5 dBA increment above background noise level, sufficient to satisfy the performance requirements of the Society of Automotive Engineers (SAE) J994 and OSHA requirements, as manufactured by: PRECO, Boise, Idaho; ECCO, Boise, Idaho; GROTE, Madison, Indiana. Self-adjusting back-up alarms shall be mounted as far as possible from equipment sound sources, such as engines or exhaust stacks, preferably at the rear of the equipment.

E. Only hydraulic type percussion drills shall be used.

F. Materials used for temporary noise barriers shall last through the duration of construction. Noise barriers in public view shall be kept painted, free of graffiti and repaired if damaged by the Contractors operators.

## PART 3 – EXECUTION

### 3.01 GENERAL PROVISIONS:

A. The Contractor shall minimize construction noise reaching communities adjacent to construction site. The Contractor shall comply will all applicable noise regulations, as well as the noise abatement requirements and noise level limits specified herein.

B. Compliance with noise abatement requirements specified herein may necessitate any or all of the following: use of special quiet machinery and equipment, equipment with efficient noise reduction devices or enclosures, construction of temporary enclosures or sound barriers and scheduling of activities to avoid noise-sensitive time periods.

### 3.02 EQUIPMENT:

A. The Contractor shall minimize the use of impact devices, such as jackhammers, pavement breakers, and hoe rams. Where possible, concrete crushers or pavement saws shall be used rather that hoe rams.

B. All pneumatic impact tools and equipment used at the construction site shall have intake and exhaust mufflers recommended by the manufacturers thereof, to meet relevant noise ordinance limitations.

C. All noise producing equipment shall be equipped with acoustically attenuating shields or shrouds recommended by the manufacturers thereof, to meet relevant noise ordinance limitations.

D. Hoppers, conveyor transfer points, storage bins, and chutes shall be lined or covered with sound-deafening material.

E. The Contractor shall minimize the use of air or gasoline-driven hand tools.

F. All other equipment, including internal combustion engines, shall have mufflers and shield paneling recommended by manufacturers thereof.

END OF SECTION

NO TEXT ON THIS PAGE

SECTION 01510

TEMPORARY UTILITIES

PART 1 - GENERAL

1.01 TEMPORARY UTILITIES:

A. General

1. Contractor shall provide temporary power, water service, and sanitary facilities for the project. The temporary services shall be provided for use throughout the construction period.

2. Contractor shall coordinate and install all temporary services in accordance with the requirements of the utility companies having jurisdiction and as required by applicable codes and regulations.

3. At the completion of the work, or when the temporary services are no longer required, the temporary facilities area(s) shall be restored to their original conditions.

4. All costs in connection with the temporary services including, but not limited to, installation, utility company service charges, maintenance, relocation and removal shall be borne by the Contractor.

B. Temporary Power

1. The Contractor shall provide temporary power for construction purposes, lighting, and for field offices.

C. Temporary Heating

1. The Contractor shall provide temporary heating, ventilation coverings and enclosures necessary to properly protect all work and materials against damage by dampness and cold, to dry out the work and to facilitate work in all structures.

2. The equipment, fuel, materials, operating personnel and methods used shall be at all times satisfactory and adequate to maintain critical installation temperatures and ventilation for all work in those areas where the same is required.

3. After any structure is enclosed (protected from the outside elements), the minimum temperature to be maintained is 50$^{o}$F, unless otherwise specified, where work is actually being performed.

4. Before and during the application of interior finishing, painting, etc., the Contractor shall provide sufficient heat to maintain a surface temperature 5 degrees above the dew point temperature and the temperature shall be in accordance with the manufacturer's recommendations. A temperature of not less than 55$^{o}$F shall be used unless approved by the Engineer.

5. Any work damaged by dampness or insufficient or abnormal heating shall be replaced by the Contractor at no additional cost to Owner.

D. Temporary Sanitary Service

Sanitary conveniences in sufficient numbers for the use of all persons employed on the work and properly screened from public observation, shall be provided and maintained at suitable locations by the Contractor, all as prescribed by State Labor Regulations and local ordinances. The contents of same shall be removed and disposed of in a manner consistent with local and state regulations, as the occasion requires. Contractor shall rigorously prohibit the committance of nuisances within, on, or about the work. Sanitary facilities shall be removed from the site when no longer required.

E. Temporary Water

1. The Contractor shall provide temporary water service for construction purposes, sanitary facilities, fire protection, field offices and for cleaning. When Owner water is used, it must be metered and protected from contamination in accordance with the applicable provisions of the local and state building codes and State and County Health Departments.

2. Large volume water use is the responsibility of the Contractor according to Section 01400.

3. Contractor shall supply potable water for his employees either by portable containers or drinking fountains.

4. The Contractor shall supply potable water for his offices.

5. An adequate number of hoses and watertight barrels shall be provided for the distribution of water, by the Contractor.

6. Water service shall be protected from freezing and the service shall be extended and relocated as necessary to meet temporary water requirements.

PART 2 – PRODUCTS - (NOT USED)

PART 3 – EXECUTION - (NOT USED)

END OF SECTION

# SECTION 01530

# PROTECTION OF WORK AND EXISTING FACILITIES

## PART 1 - GENERAL

### 1.01 PROTECTION OF WORK AND MATERIAL:

A. Contractor shall be responsible for the preservation and protection of property adjacent to the work site against damage or injury as a result of his operations under this Contract. Any damage or injury occurring on account of any act, omission or neglect on the part of the Contractor shall be restored in a proper and satisfactory manner or replaced by, and at the expense of, the Contractor to an equal or superior condition than previously existed.

B. Contractor shall comply promptly with such safety regulations as may be prescribed by the Owner or the local authorities having jurisdiction and shall, when so directed, properly correct any unsafe conditions created by, or unsafe practices on the part of, his employees. In the event of the Contractor's failure to comply, the Owner may take the necessary measures to correct the conditions or practices complained of, and all costs thereof will be deducted from any monies due the Contractor. Failure of the Engineer to direct the correction of unsafe conditions or practices shall not relieve the Contractor of his responsibility hereunder.

C. In the event of any claims for damage or alleged damage to property as a result of work under this Contract, the Contractor shall be responsible for all costs in connection with the settlement of or defense against such claims. Prior to commencement of work in the vicinity of property adjacent to the work site, the Contractor, at his own expense, shall take such surveys as may be necessary to establish the existing condition of the property. Before final payment can be made, the Contractor shall furnish satisfactory evidence that all claims for damage have been legally settled or sufficient funds to cover such claims have been placed in escrow, or that an adequate bond to cover such claims has been obtained.

D. During the progress of the work and up to the date of final payment, the Contractor shall be solely responsible for the care and protection of all work and materials covered by the Contract.

E. All work and materials shall be protected against damage, injury or loss from any cause whatsoever, and the Contractor shall make good any such damage or loss at his own expense. Protection measures shall be subject to the approval of the Engineer. No driving or wheeling, walking or placing of heavy loads on newly constructed Work shall be allowed.

F. Site disturbance shall be kept to a minimum. The Contractor shall confine all operations to within the site disturbance limit lines as shown on the Drawings.

G. The protection, removal, and replacement of existing physical features along the line of work shall be a part of the work under the Contract, and all costs in connection therewith shall be included in the Bid Proposal unless a Bid Item has been established elsewhere in these Construction Documents for the express payment of that specific item of Work.

H. Along the location of this Work, all fences, walks, bushes, trees, shrubbery, and other physical features shall be protected and restored in a thoroughly workmanlike manner. Fences and other features removed by the Contractor shall be replaced in their original location or at a location indicated on the Drawings as soon as conditions permit. All grass areas beyond the limits of construction which have been damaged by the Contractor shall be graded and seeded.

I. All elements of the Work shall be protected in a manner approved by the Engineer. Should any part of the Work become heaved, cracked, or otherwise damaged, all such damaged portions of the Work shall be completely repaired and made good by the Contractor at his own expense and to the satisfaction of the Engineer.

J. If, in the final inspection of the Work, any defects, faults or omissions are found, the Contractor shall cause the same to be repaired or removed and replaced by proper materials and workmanship without extra compensation for the materials and labor required. Further, the Contractor shall be fully responsible for the satisfactory maintenance and repair of the construction and other work undertaken herein for at least the guarantee period described in the Contract Documents.

1.02 BARRICADES, WARNING SIGNS AND LIGHTS:

A. The General Contractor shall provide, erect and maintain as necessary, strong and suitable barricades, danger signs and warning lights along all roads accessible to the public, as required by the authority having jurisdiction, to insure safety to the public. All barricades and obstructions along public roads shall be illuminated at night and all lights for this purpose shall be kept burning from sunset to sunrise.

B. The Contractor shall provide and maintain such other warning signs and barricades in areas of and around their respective work as may be required for the safety of all those employed in the work, the Owner's operating personnel, or those visiting the site.

1.03 EXISTING UTILITIES AND STRUCTURES:

A. The term existing utilities shall be deemed to refer to both publicly-owned and privately-owned utilities such as electric power and lighting, telephone, water, gas, storm drains, process lines, sanitary sewers and all appurtenant structures.

B. Where existing utilities and structures are indicated on the Drawings, it shall be understood that all of the existing utilities and structures affecting the work may not be shown and that the locations of those shown are approximate only. It shall be the responsibility of the Contractor to ascertain the actual extent and exact location of existing utilities and structures. In every instance, the Contractor shall notify the proper authority having jurisdiction and obtain all necessary directions and approvals before performing any work in the vicinity of existing utilities.

C. Prior to beginning any excavation work, the Contractor shall, through field investigations, determine any conflicts or interferences between existing utilities and new utilities to be constructed under this project. This determination shall be based on the actual locations, elevations, slopes, etc., of existing utilities as determined in the field investigations, and locations, elevation, slope, etc. of new utilities as shown on the Drawings. If an interference exists, the Contractor shall bring it to the attention of the Engineer as soon as possible. If the Engineer agrees that an interference exists, he shall modify the design as required. Additional costs to the Contractor for this change shall be processed through a Change Order as detailed elsewhere in these Contract Documents. In the event the Contractor fails to bring a potential conflict or interference to the attention of the Engineer prior to beginning excavation work, any actual conflict or interference which does arise during the Project shall be corrected by the Contractor, as directed by the Engineer, at no additional expense to the Owner.

D. The work shall be carried out in a manner to prevent disruption of existing services and to avoid damage to the existing utilities. Temporary connections shall be provided, as required, to insure no interruption of existing services. Any damage resulting from the work of this Contract shall be promptly repaired by the Contractor at his own expense in a manner approved by the Engineer and further subject to the requirements of any authority having jurisdiction. Where it is required by the authority having jurisdiction that they perform their own repairs or have them done by others, the Contractor shall be responsible for all costs thereof.

E. Where excavations by the Contractor require any utility lines or appurtenant structures to be temporarily supported and otherwise protected during the construction work, such support and protection shall be provided by the Contractor. All such work shall be performed in a manner satisfactory to the Engineer and the respective authority having jurisdiction over such work. In the event the Contractor fails to provide proper support or protection to any existing utility, the Engineer may, at his discretion, have the respective authority to provide such support or protection as may be necessary to insure the safety of such utility, and the costs of such measures shall be paid by the Contractor.

PART 2 – PRODUCTS - (NOT USED)

PART 3 – EXECUTION - (NOT USED)

END OF SECTION

# SECTION 01540

# DEMOLITION, REMOVAL AND ABANDONMENT OF EXISTING STRUCTURES

## PART 1 - GENERAL

### 1.01 DESCRIPTION:

A. This Section covers the demolition, removal, and disposal of existing structures, piping, pavement, curbs, and sidewalk, removal and disposal of asbestos materials, and any other items as indicated on the Drawings and as specified hereinafter. The Contractor shall furnish all labor, materials and equipment to perform the demolition, removal and/or abandonment of said items.

### 1.02 TITLE TO EQUIPMENT AND MATERIALS:

A. Coordinate with Engineer and Owner, who will make final determination as to whether an item is to be salvaged or removed. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, demolished materials shall become Contractor's property and shall be removed from Project site.

B. Contractor shall have no claim against the Owner because of the absence of such fixtures and materials.

C. Storage or sale of removed items or materials on-site will not be permitted.

### 1.03 CONDITION OF STRUCTURES AND EQUIPMENT:

A. The Owner does not assume responsibility for the actual condition of structures and equipment to be demolished and removed.

B. Conditions existing at the time of inspection for bidding purposes will be maintained by the Owner so far as practicable.

C. The information regarding the existing structures and equipment shown on the Drawings is based on visual inspection and a walk-through survey only. Neither the Engineer nor the Owner will be responsible for interpretations or conclusions drawn therefrom by the Contractor.

D. Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition, removal and/or abandonment operations.

### 1.04 SUBMITTALS:

A. Submit the following in accordance with Section 01300 – SUBMITTALS:

1. Removal and abandonment procedures that shall provide for safe conduct of the Work, careful removal and disposition of materials and equipment, protection of utilities, structures, property, or other features which are to remain undisturbed and coordination with existing utilities or owners responsible for those nearby elements to remain in service.

2. A detailed work plan to include a list of items to be removed and/or abandoned, sequence and schedule.

B. Schedule of Selective Demolition, Removal and Abandonment Activities

1. The Schedule of Selective Demolition, Removal and Abandonment Activities shall be subject to approval by the City.

Indicate the following:

a. Detailed sequence of selective demolition, removal and abandonment work, with starting and ending dates for each activity. Ensure the Owner's operations are uninterrupted.

b. Interruption of utility services.

c. Coordination for shutoff, capping, bulkheading and continuation of utility services.

d. Proposed materials, construction details, locations of temporary utilities, abandonment materials, and means of access.

C. Additional Submittals for Selective Demolition, Removal, and Abandonment Activities

1. Inventory: After selective demolition or modifications are complete, submit a list of items that have been removed and salvaged.

2. Landfill Records: Indicate receipt and acceptance of all wastes by disposal facility licensed to accept the wastes to be disposed.

1.05 QUALITY ASSURANCE:

A. Professional Engineer Qualifications (where required): Comply with Section 01400 - QUALITY CONTROL

B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

C. Pre-Demolition, Modification, and Abandonment Conference: Conduct conference at Project site, which includes Owner and Engineer. Review methods and procedures related to selective demolition.

D. Review and finalize selective demolition, modification and abandonment schedule and verify availability of materials, labor, equipment, and facilities needed to make progress and avoid delays.

1.06 WARRANTY:

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

PART 2 -- PRODUCTS

(NOT USED)

PART 3 – EXECUTION

3.01 DEMOLITION, REMOVAL AND ABANDONMENT PROCEDURES:

A. The removal of all equipment and piping, and all materials from the demolition of structures, when released by the Owner and Engineer, shall be done by the Contractor and shall become the Contractor's property, unless otherwise noted, for disposition in any manner not contrary to the Contract requirements and shall be removed from the site to the Contractor's own place of disposal.

B. Any equipment piping and appurtenances removed without proper authorization, which are necessary for the operation of the existing facilities shall be replaced to the satisfaction of the Engineer at no cost to the Owner.

C. Excavation caused by demolitions shall be backfilled with fill free from rubbish and debris.

D. Verify that utilities have been disconnected and capped, shut-off, or bulkheaded. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition, modification and abandonment required.
Inventory and record the condition of items to be removed.

E. Existing landscaping materials, structures, pipes and appurtenances, which are not to be removed/abandoned shall be protected and maintained as directed by the Engineer and as specified.

F. When existing pipe is removed, the Contractor shall plug all resulting abandoned connections whether or not shown. Where removed piping is exposed, the remaining piping shall be fitted with a removable cap or plug, or bulkheaded. Where existing

piping, to include catch basin laterals, is to be abandoned, the Contractor shall cut back the abandoned pipe for a distance of 5 feet from any connecting structures to remain. Pipes to be abandoned in structures to be abandoned may be capped, plugged or bulkheaded from inside the structure. All holes at the existing structures shall be repaired. Abandoned pipe smaller than 15 inches diameter shall be capped or plugged at both ends prior to backfill. Abandoned pipe 15 inches diameter and larger shall be filled with Controlled Density Fill (CDF) prior to being capped, plugged, or bulkheaded and backfilling unless otherwise noted. Requirements for Controlled Density Fill are described in Section 02200 – EARTHWORK.

G. Where existing drainage structures such as catch basins, drain manholes, sewer manholes, and combined sewer manholes are to be abandoned in place, the Contractor shall remove the frames, grates, and covers and cut the structures down a minimum of 2 feet below final grade. The Contractor shall put a minimum of four (4), 2-inch diameter drainage holes in the invert of each structure and then backfill the structure with flowable fill or sand as specified and as approved by the Engineer. Backfill around the structure shall be in accordance with Section 02200 – EARTHWORK

H. Permanent plugs shall be constructed of Class B concrete, brick or other material approved by the Engineer.

3.02 SELECTIVE DEMOLITION:

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Neatly cut openings, joints and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Temporarily cover openings to remain.

2. Dispose of demolished items and materials promptly.

3. Existing Facilities: Comply with Owner's requirements for using and protecting utilities, structures, properties and other facilities.

3.03 DISPOSAL OF REMOVED/DEMOLISHED MATERIALS:

A. The Contractor shall prepare and transport all demolition debris, materials, refuse, and abandoned equipment to an approved disposal site as part of the work under this section. All costs associated with the proper performance of this work shall be borne solely by the Contractor at no additional cost to the Owner.

B. Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site. Demolition material shall be reused as fill to the extent

possible. Removal of demolition debris, not utilized as fill, shall be conducted to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities which shall not be closed or obstructed without permission from the Owner. Alternate routes shall be provided around closed or obstructed traffic ways.

C. Burning: Do not burn demolished materials.

D. Disposal: Transport demolished materials off Owner's property and legally dispose of them. See Sections 02220 - Soil and Material Management Plan as it relates to the transportation and disposal of non-hazardous and hazardous solid waste.

3.04 PROTECTION:

A. Demolition and removal work shall be performed by competent experienced workmen for the various types of demolition and removal work and shall be carried out through to completion with due regard to the safety of Owner employees, workmen on-site and the public. The work shall be performed with as little nuisance as possible.

B. The work shall comply with the applicable provisions and recommendations of ANSI A10.2 - Safety Code for Building Construction, OSHA requirements, all governing codes, and as hereinafter specified.

C. The Contractor shall make such investigations, explorations and probes as are necessary to ascertain any required protective measures before proceeding with demolition and removal. The Contractor shall give particular attention to shoring and bracing requirements so as to prevent any damage to new or existing construction.

D. The Contractor shall provide and maintain temporary protection of the existing structure designated to remain where demolition, removal and new work is being done, connections made, materials handled or equipment moved.

E. The Contractor shall take necessary precautions to prevent dust from rising by wetting demolished masonry, concrete, plaster and similar debris. Unaltered portions of the existing structures affected by the operations under this Section shall be protected by dust-proof partitions and other adequate means.

G. The Contractor shall provide adequate fire protection in accordance with local Fire Department requirements.

H. The Contractor shall conduct operations with minimum traffic interference.

I. The Contractor shall be responsible for any damage to the existing structure or contents by reason of the insufficiency of protection provided. Damage shall be repaired at no additional cost to the Owner.

J. Damaged items shall be repaired or replaced with new materials as required to restore damaged items or surfaces to a condition equal to start of work of this Contract. Use repair materials identical to existing materials. If identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible. Use materials whose installed performance equals or surpasses that of existing materials.

3.05 WORKMANSHIP:

A. The demolition and removal work shall be performed as described in the Contract Documents. The work required shall be done with care, and shall include all required shoring, bracing, etc. The Contractor shall be responsible for any damage which may be caused by demolition and removal work to any part or parts of existing structures or items designated for reuse or to remain. The Contractor shall perform patching, restoration and new work in accordance with applicable Technical Sections of the Specifications and in accordance with the details shown on the Drawings. Prior to starting of work, the Contractor shall provide a detailed description of methods and equipment to be used for each operation and the sequence thereof for review by the Engineer.

B. All supports, pedestals and anchors shall be removed with the equipment and piping unless otherwise specified or required. Concrete bases, anchor bolts and other supports shall be removed to approximately 1-inch below the surrounding finished area and the recesses shall be patched to match the adjacent areas. Superstructure wall and roof openings shall be closed, and damaged surfaces shall be patched to match the adjacent areas, as specified under applicable Sections of these Specifications, as shown on the Drawings, or as directed by the Engineer. Wall sleeves and castings shall be plugged or blanked off, all openings in concrete shall be closed in a manner meeting the requirements of the appropriate Sections of these Specifications, as shown on the Drawings, and as directed and approved by the Engineer.

C. Materials or items designated to remain the property of the Owner shall be removed with care and stored at a location at the site to be designated by the Owner.

D. Where equipment is shown or specified to be removed and relocated, such items shall be removed with care, under the supervision of the trade responsible for reinstallation and protected and stored until required. Material or items damaged during removal shall be replaced with similar new material or item. Any equipment that is removed without proper authorization and is required for facility/structure operation shall be replaced at no cost to the Owner.

E. Materials or items demolished and not designated to become the property of the Owner or to be reinstalled shall become the property of the Contractor and shall be removed from the property and legally disposed of.

F. The Contractor shall execute the work in a careful and orderly manner, with the least possible disturbance to the public.

G. In general, masonry shall be demolished in small sections, and where necessary to prevent collapse of any construction, the Contractor shall install temporary shores, struts, and bracing.

H. Where alterations occur, or new and old work join, the Contractor shall cut, remove, patch, repair or refinish the adjacent surfaces to the extent required by the construction conditions, so as to leave the altered work in as good a condition as existed prior to the start of the work. The materials and workmanship employed in the alterations, unless otherwise shown on the Drawing or specified, shall comply with that of the various respective trades which normally perform the particular items or work.

I. The Contractor shall finish adjacent existing surfaces to new work to match the specified finish for new work. The Contractor shall clean existing surfaces of dirt, grease, loose paint, etc., before refinishing.

J. The Contractor shall cut out embedded anchorage and attachment items as required to properly provide for patching and repair of the respective finishes.

K. The Contractor shall remove temporary work, such as enclosures, signs, guards, and the like when such temporary work is no longer required or when directed at the completion of the work.

3.06 MAINTENANCE:

A. The Contractor shall maintain the structures and public properties free from accumulations of waste, debris and rubbish, caused by the demolition and removal operations.

B. The Contractor shall provide on-site dump containers as necessary for collection of waste materials, debris and rubbish, and he shall wet down dry materials to lay down and prevent blowing dust.

C. At reasonable intervals during the progress of the demolition and removal work or as directed by the Engineer, the Contractor shall clean the site and properties, and dispose of waste materials, debris and rubbish.

END OF SECTION

NO TEXT ON THIS PAGE

# SECTION 01550

# SITE ACCESS AND STORAGE

## PART 1 - GENERAL

### 1.01 ACCESS ROADS AND PARKING AREAS:

A. Access Roads

1. The Contractor shall maintain access roads as required to perform the work of this Contract.

2. Access roads, where possible, shall be located over the areas of the existing road system.

3. No tree clearing for installation of access roads is allowed without approval from the Engineer.

4. Access to project sites via permanent and/or temporary construction easements shall be clearly marked and/or staked by Owner.

B. Parking Areas

1. Contractor shall provide suitable parking areas for his construction personnel on the project. The Contractor shall coordinate with the Engineer and plant personnel in order to determine the best locations for parking areas to best accommodate continued plant operation.

C. Restoration

1. At the completion of the work, the surfaces of land used for access roads and parking areas shall be restored by Contractor to the satisfaction of the Resident Representative.

### 1.02 TRAFFIC REGULATIONS:

A. Contractor shall obey all traffic laws and comply with all the requirements, rules and regulations of the New Hampshire Department of Transportation and local authorities having jurisdiction to maintain adequate warning signs, lights, barriers, etc., for the protection of traffic on public roadways.

B. The contractor shall pay special attention to obeying all speed limits and traffic control regulations in the neighborhood surrounding the site.

1.03 PROTECTION OF WORK AND MATERIAL:

A. During the progress of the work and up to the date of final payment, Contractor shall be solely responsible for the care and protection of all work and materials covered by the Contract.

B. All work and materials shall be protected against damage, injury or loss from any cause whatsoever, and the Contractor shall make good any such damage or loss at his own expense. Protection measures shall be subject to the approval of the Resident Representative.

1.04 STORAGE OF EQUIPMENT AND MATERIALS:

A. Storage of equipment and materials shall be at lay down areas secured by the Contractor at the Contractor's expense and to areas indicated on the drawings. Store all equipment and materials in accordance with manufacturer's recommendations and in conformity to applicable statutes, ordinances, regulations and rulings of the public authority having jurisdiction. Storage of material and equipment at the project site(s) will be and shall be coordinated with the Engineer and plant personnel in order to best accommodate ongoing plant operations.

B. Enforce the instructions of Owner and Engineer regarding the posting of regulatory signs for loadings on structures, fire safety, and smoking areas.

C. Do not store materials or encroach upon private property without the written consent of the owners of such private property.

D. Do not store unnecessary materials or equipment on the job site, and take care to prevent any structure from being loaded with a weight which will endanger its security or the safety of persons.

E. Do not place materials within ten (10) feet of fire hydrants. Gutters, drainage channels and inlets shall be kept unobstructed at all times.

F. Provide adequate temporary storage buildings/facilities, if required, to protect materials or equipment on the job site.

G. Comply with all applicable NHDOT regulations regarding storage of equipment and materials in the right-of-way. Any permits required for afore-mentioned storage shall be the responsibility of the Contractor.

H. Comply with Railroad regulations regarding location of lay down areas. Under no circumstances shall the Contractor's lay down area for the project extend within 10-feet of the centerline of any railroad track.

PART 2 - PRODUCTS
(NOT USED)

PART 3 - EXECUTION
(NOT USED)

END OF SECTION

NO TEXT ON THIS PAGE

SECTION 01555

TRAFFIC CONTROL AND SIGNAGE

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. This Section covers furnishing and installing traffic control signs and other devices.

B. Perform all work in such a manner as to provide safe passage at all times for the public and with a minimum of obstruction to traffic.

C. Project Sign.

1.02 SYSTEM DESCRIPTION:

A. The Contractor shall furnish and install all construction signs deemed necessary by and in accordance with the latest edition of Part VI of the Manual on Uniform Traffic Control Devices (MUTCD) as published by the U.S. Department of Transportation.

B. The Contractor shall furnish and install all signage, barrels, cones, barriers and other traffic control devices as required to complete the project.

C. The Contractor shall furnish and install Electronic Message Boards as required to properly manage traffic in the project area.

D. The Contractor is responsible for preparing a work area that is free of parked vehicles or other obstructing objects. This includes, but is not limited to, erecting temporary "No Parking" signs as required and provided by the City of Nashua. All signs shall be returned to the City after use. The Engineer may direct the Contractor to erect temporary "No Parking" signs if it is their opinion that parked cars within the vicinity could pose an obstruction, or construction operations may pose a hazard to the parked vehicles.

PART 2 - PRODUCTS

2.01 TRAFFIC WARNING AND REGULATING DEVICES:

A. Contractor shall provide illumination, warning signs, barricades and other devices in accordance with the specifications provided in the MUTCD. Size of signs, lettering, colors, method of support and other factors prescribed in the MUTCD shall be adhered to.

B. The Contractor shall furnish and install Solar Message Boards as required to manage traffic. The Solar Message Boards shall have three line capability, 360 degree sign rotation, and approximate 6-foot by 11-foot display panel as carried by New England Barricade Company, U.S. Barricade, Northeast Traffic Control, or approved equal. The

location of the message boards shall be determined by the Engineer as the construction activity proceeds through the project area.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Contractor shall erect the project sign, barricades, barrier fences, traffic signs, and other traffic control devices as required by the MUTCD, or as directed by the Engineer, to protect the work area from traffic, pedestrians, and animals.

B. Contractor shall relocate barricades, signs and other devices as necessary as the work progresses.

D. Unless extended protection is required for specific areas, when the work has been completed, all temporary warning and regulatory devices used by the Contractor shall be removed so that traffic can move unimpeded through the area.

E. All detour and traffic routing plans shall be submitted to the City of Nashua Traffic Department for their review and approval, prior to implementation. The Engineer shall also receive a copy.

F. The solar message boards shall be mobile units that can be periodically relocated to best inform the general public about the projected construction activities. The location and wording of the message shall be approved by the Engineer.

G. An additional 25 square feet of signage shall be provided as requested by the Engineer to be installed in the project area as needed to assist the public in direction to local businesses or general movement through the project area.

END OF SECTION

SECTION 01560

TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 - GENERAL

1.01 ENVIRONMENTAL CONTROLS:

A. Dust Control

1. The Contractor shall take all necessary measures to control dust from his operations, and to prevent spillage of excavated materials on public roads.

2. The Contractor shall remove all spillage of excavated materials, debris or dust from public roads by methods as approved by the Resident Representative.

3. The Contractor shall sprinkle water at locations and in such quantities and at such frequencies as may be required to control dust and prevent it from becoming a nuisance to the surrounding area.

4. Dust control and cleaning measures shall be provided at no additional cost to Owner.

B. Water Control

1. Provide methods to control surface water and water from excavations and structures to prevent damage to the work, the site, or adjoining properties. Control fill, grading and ditching to direct water away from excavations, pits, tunnels and other construction areas; and to direct drainage to proper runoff courses so as to prevent any erosion, damage or nuisance.

2. Provide, operate and maintain equipment and facilities of adequate size to control surface water.

3. Dispose of drainage water in a manner to prevent flooding, erosion, or other damage to any portion of the site, reservoir or to adjoining areas and in conformance with all environmental requirements.

C. Pollution Control

1. Provide methods, means and facilities required to prevent contamination of soil, water or atmosphere by the discharge of noxious substances from construction operations.

2. Provide equipment and personnel, perform emergency measures required to protect public waters. Prevent disposal of wastes, effluents, chemicals, or

other such substances adjacent to waterways, or in sanitary or storm sewers.

3. Take special measures to prevent harmful substances from entering public waters. Prevent disposal of wastes, effluent, chemicals, or other such substances adjacent to waterways, or in sanitary or storm sewers.

4. Provide systems for control of atmospheric pollutants.

    a. Prevent toxic concentrations of chemicals.

    b. Prevent harmful dispersal of pollutants into the atmosphere.

5. All Contractor's equipment used during construction shall conform to all current federal, state and local laws and regulations.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

(NOT USED)

END OF SECTION

# SECTION 01590

# FIELD OFFICE, EQUIPMENT AND SERVICES

## PART 1 - GENERAL

### 1.01 THE REQUIREMENT:

A. The Contractor shall provide field offices, equipment and services for the use of the Engineer and its own use as specified herein.

### 1.02 SUBMITTALS:

A. The Contractor shall submit shop drawings and other information as required to the ENGINEER for review in accordance with Section 01300 entitled "Submittals".

### 1.03 GENERAL FIELD OFFICE REQUIREMENTS:

A. Contractor shall provide steps and platforms to permit entry to the offices. This work shall conform to the New Hampshire Building Code and OSHA requirements.

B. CONTRACTOR retains responsibility for procuring all necessary permits for the installation of the field offices. Contractor is responsible for securing the location of the field offices. Location of the field offices shall be located as close as possible to the CSO 004 work site and the location is subject to the approval of the Owner and Engineer.

## PART 2 - PRODUCTS

### 2.01 FIELD OFFICES:

A. Contractor's Field Office: The Contractor shall furnish, equip and maintain a field office at the site of a size required for his operations. The Contractor shall provide his own utility and telephone service. The Contractor shall have readily accessible at the field office, copies of the Contract Documents, latest approved Shop Drawings and all field Project related correspondence, Change Orders, etc.

B. Engineer's Field Office: The Contractor shall provide and equip a suitable office for the exclusive use of the Engineer and the Contractor shall maintain this office thereafter until the completion of the work to be done under this contract.

1. The Contractor shall provide and maintain at an approved location at or near the site, for the duration of the Contract, a separate office building or trailer, minimum interior dimension 9 feet x 12 feet one-room mobile trailer with a cylinder lock and key for the exclusive use of the Engineer. The exterior doors shall also be provided with a hasp for which the Engineer will furnish his own locks. The plans and construction of the office

shall be approved by the Engineer.

2. The office shall be equipped with electric lights, heating facilities and air conditioner, water and on-site sanitary services. The office shall also be equipped with internet service. Windows shall be equipped with locks and shall have security bars and horizontal blinds. The office shall be equipped with the following furniture and accessories:

- 1 flat top desk with drawers
- 1 desk lamp
- 1 drafting table
- desk chair with casters and one adjustable drafting stool with casters
- 1 - 4-section fireproof lockable file case
- 1 - 10 gallon wastepaper baskets
- 1 – 4 cubic foot refrigerator and microwave
- Thermostatically controlled heating unit or system of adequate capacity to maintain a temperature of not less than 65 degrees F under all cold weather conditions.
- Thermostatically controlled refrigerant type air conditioners or system of adequate capacity to maintain a maximum temperature of not more than 72 degrees F under all hot weather conditions.
- 1 5-pound fire extinguisher
- 1 industrial type first aid kit
- 1 potable water cooler with hot and cold taps

3. The Contractor shall maintain the office during construction and remove it upon completion of the work. The cost for operation of the Engineer's field office shall be the responsibility of the Contractor and included into his Bid price. Operation and maintenance shall include: supplying toilet paper, paper towels, liquid hand soap, bottled water, marking paint in assorted colors, monthly utility costs, heating, cooling costs, restocking the first aid kit and cleaning of the inside of the trailer on a weekly basis.

C. The Engineer’s field office shall be delivered to the site and fully set-up as described above two (2) weeks prior to work beginning on the site.

## PART 3 - EXECUTION

### 3.01 UTILITY SERVICES:

A. The Contractor shall pay all costs for potable water services for the Contractor’s and Engineer’s field offices over the duration of the project as indicated on the Drawings.

B. Telephone/Internet Service: The Contractor shall be responsible for providing his own telephone services for the duration of the project. Promptly after starting work at the site, the Contractor shall provide the Engineer with a cell phone equipped with internet and text

messaging service. The Contractor shall be responsible for all phone charges for the duration of the project. Upon completion of the project, the phone will be returned to the Contractor.

C. Power: The Contractor shall be responsible for providing electric services for the duration of the project for all field offices.

D. Sanitary Services: The Contractor shall provide sanitary facilities for all field offices in accordance with the section entitled “Temporary Utilities”.

END OF SECTION

NO TEXT ON THIS PAGE

# SECTION 01600

# MATERIAL AND EQUIPMENT

## PART 1 - GENERAL

### 1.01 STANDARD PRODUCTS:

A. All materials, equipment and accessories shall be new and unused and shall be essentially the standard product of a manufacturer regularly engaged in the production of such material or equipment, and shall essentially duplicate material or equipment that has been in satisfactory operation at least 5 years.

B. Owner reserves the right to reject any material or equipment manufacturer who, although he meets the above requirements, does not provide satisfactory evidence indicating adequate and prompt post-installation repair and maintenance service, as required to suit the operational requirements of the Owner. Items of any one type of materials or equipment shall be the product of a single manufacturer.

C. All piping, materials and equipment furnished under this contract shall be fabricated of such materials that, under normal operating conditions, harmful substances are not imparted to the water supply system.

### 1.02 STORAGE OF EQUIPMENT AND MATERIALS:

A. Contractor shall store his equipment and materials at the job site in accordance with the manufacturer's recommendations and as directed by Owner or Engineer, and in conformity to applicable statutes, ordinances, regulations and rulings of the public authority having jurisdiction. Arrange storage to permit access for inspection.

B. Cement and lime shall be stored under a roof and off the ground and shall be kept completely dry at all times. All structural, miscellaneous and reinforcing steel shall be stored off the ground or otherwise to prevent accumulation of dirt or grease, and in a position to prevent accumulations of standing water and to minimize rusting. Beams shall be stored with the webs vertical. Precast concrete shall be handled and stored in a manner to prevent accumulations of dirt, standing water, staining, chipping or cracking. Brick, block and similar masonry products shall be handled and stored in manner to reduce breakage, cracking and spalling to a minimum.

C. Store loose granular materials on solid flat surface in a well-drained area. Prevent mixing with foreign matter

D. Contractor shall not store unnecessary materials or equipment on the job site and shall take care to prevent any structure from being loaded with a weight that will endanger its security or the safety of persons.

E. Materials shall not be placed within 10 feet of fire hydrants. Gutters, drainage channels and inlets shall be kept unobstructed at all times.

F. Contractor shall enforce the instructions of Owner and Engineer regarding the posting of regulatory signs for loadings on structures, fire safety, and smoking areas.

G. Contractor shall not store materials or encroach upon private property without the written consent of the owners of such private property.

1.03 INSTALLATION OF EQUIPMENT:

A. General

1. Contractor shall have on hand sufficient personnel, proper equipment, and machinery of ample capacity to facilitate the work.

2. Contractor shall be responsible for locating, aligning and leveling all equipment and shall employ a competent surveyor to set all lines and levels of equipment to the accuracy required.

3. Complete manufacturer's installation instructions, including permissible tolerances, shall be furnished in duplicate with each unit of equipment or set of identical units.

4. All equipment shall be installed in accordance with the approved manufacturer's specifications, drawings and tolerances, under the direct supervision of the required manufacturer's engineer.

5. Equipment shall be erected in a neat and workman-like manner on the foundations at the locations and elevations shown on the drawings unless directed otherwise by Engineer during installation.

1.04 SUBSTITUTIONS:

A. Whenever a particular brand or make or type of material, equipment or other item is specified or is indicated on the Contract Drawings and followed by the term "or equal" or a similar term, it is for the purpose of establishing a standard of quality, design and type desired and to supplement the detailed specifications. Any other brand or make of type which, in the opinion of Engineer, is equivalent to that specified or indicated may be offered as substitute subject to the following provisions:

1. Contractor shall submit for each proposed substitution sufficient details, complete descriptive literature and performance data together with samples of the materials, where feasible, to enable Engineer to determine if the proposed substitution is equal.

2. Contractor shall submit certified tests, where applicable, by an independent laboratory attesting that the proposed substitution is equal.

3. A list of installations where the proposed substitution is used.

4. Requests for substitutions shall include full information concerning differences in cost, and any savings in cost resulting from such substitutions shall be passed on to Owner.

5. Where the approval of a substitution requires revision or redesign of any part of the work, all such revision and redesign, and all new drawings and details required therefore, shall be provided by Contractor at his own cost and expense, and shall be subject to the approval of Engineer.

6. In the event that Engineer is required to provide additional engineering services, then Engineer's charges for such additional services shall be charged to Contractor by Owner.

7. In all cases, Engineer shall be the sole judge as to whether a proposed substitution is to be approved. The Contractor shall abide by the Engineer's decision when proposed substitute items are judged to be unacceptable and shall in such instances furnish the item specified or indicated. No substitute items shall be used in the work without approval of Engineer.

B. Contractor shall have and make no claim for an extension of time or for damages by reason of the time taken by Engineer in considering a substitution proposed by Contractor or by reason of the failure of Engineer to approve a substitution proposed by Contractor.

C. Acceptance of any proposed substitution shall in no way release Contractor from any of the provisions of the Contract Documents.

1.05 TRANSPORTATION AND DELIVERY:

A. Transport and handle items in accordance with manufacturer's instructions.

B. Schedule delivery to reduce long term on-site storage prior to installation and/or operation. Under no circumstances shall equipment be delivered to the site more than one month prior to installation without written authorization from the Engineer.

C. Coordinate delivery with installation to ensure minimum holding time for items that are hazardous, flammable, easily damaged or sensitive to deterioration.

D. Deliver products to the site in manufacturer's original sealed containers or other packing systems, complete with instructions for handling, storing, unpacking, protecting; and installing.

E. All items delivered to the site shall be unloaded and placed in a manner which will not hamper the Contractor's normal construction operation nor those of subcontractors and other contractors and will not interfere with the Owner's operations.

F. Provide necessary equipment and personnel to unload all items delivered to the site.

G. Promptly inspect shipment to assure that products comply with requirements, quantities are correct, and items are undamaged. For items furnished by others (i.e. Owner, other Contractors), perform inspection in the presence of the Engineer. Notify Engineer verbally and in writing, of any problems.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

(NOT USED)

END OF SECTION

# SECTION 01630

# RESTORATION OF GROUNDS AND CLEANING UP

## PART 1 - GENERAL

### 1.1 THE REQUIREMENT:

A. The Contractor on or before the completion of the work, except as otherwise expressly directed or permitted in writing by the Owner, shall tear down and remove and legally dispose of all temporary structures built or used by him; shall remove all rubbish and debris of all kinds from all Contract structures and from any grounds which he shall have occupied within the limits of the project site; shall leave the site of the work in a satisfactorily neat and clean condition; shall remove from the land all abandoned materials and plant; and shall leave the spoil areas and the property which may have been affected by his operations in a neat and satisfactory condition. Also included is the restoration of all private grounds, including lawns, landscaped areas, driveway aprons and walkways damaged or disturbed in connection with the new work not elsewhere specified. Unless otherwise specified, all materials salvaged and not required to be reused shall be the property of the Contractor, and shall be legally disposed of off the site of the work.

B. Included in the work under this Section is the restoration, including replacement of damaged and disturbed shrubs and trees, retaining walls, of all grounds and grassed and landscaped areas removed or disturbed or damaged during the construction of the new work, including pipe laterals within private property areas, and storage and field office areas.

C. Also included in the work under this Section is the furnishing of all labor, materials, and equipment required to remove, store, and reset or replace bumper posts, stone walls of all types, flagstone walks, fences of all types, railings, signs and sign posts, signal posts, and such other miscellaneous objects damaged or disturbed during construction.

## PART 2 – PRODUCTS
(NOT USED)

## PART 3 – EXECUTION
(NOT USED)

END OF SECTION

NO TEXT ON THIS PAGE

# SECTION 01700

# PROJECT CLOSEOUT

## PART 1 - GENERAL

### 1.01 THE REQUIREMENT:

A. Final Cleaning

1. At the completion of the work, remove all rubbish from and about all of the project sites, lay down areas and work areas, and remove all temporary structures, construction signs, tools, scaffolding, materials, supplies and equipment which may have been used in the performance of the work. Broom clean paved surfaces and rake clean other surfaces or grounds.

2. Thoroughly clean all materials, and structures so as to leave work in a clean and new appearing condition.

3. Maintain cleaning until project, or portion thereof, is accepted by the Owner.

B. Final Cleanup; Site Rehabilitation

1. Before finally leaving the site, wash and clean all exposed surfaces which have become soiled or marked, and remove from the site of work all accumulated debris and surplus materials of any kind which result from his operation, including construction equipment, tools, sheds, sanitary enclosures, etc. Leave all work in a clean condition and turn over project area to Owner in a neat and orderly condition.

2. Rehabilitate or develop the site in accordance with other sections of the Specifications and the Drawings. In the absence of any portion of these requirements, completely rehabilitate the site to a condition and appearance equal or superior to that which existed just prior to construction, except for those items whose permanent removal or relocation was required in the Contract Documents or ordered by the Owner.

C. Final Inspection

1. Notify the Owner upon completion of the modifications to the existing regulator structures and pipe installation and successful testing of each sewer segment and structural modification.

D. Project Close Out

1. As construction of the project enters the final stages of completion, in concert with accomplishing the requirements set forth in the Contract Documents, attend to or complete the following items as they apply:

   a. Required testing of project components.
   b. Correction or replacement of defective work, including completion of items previously overlooked or work which remains incomplete, all as evidenced by the Engineer's "Punch Lists".
   c. Completion of any other items listed herein or brought to the Contractor's attention by the Engineer.

2. In addition, and before the Certificate of Substantial Completion is issued, submit to the Engineer (or to the Owner if indicated) certain records, record drawings, test results certifications, etc., which are specified elsewhere in the Contract Documents. A partial list of such items appears below, but it shall be the Contractor's responsibility to submit any other items which are required in the Contract Documents:

   a. Test results of project components.
   b. Maintenance stock items; spare parts, special tools.
   b. Certification of materials in compliance with Contract Documents.
   c. One set of neatly marked-up record drawings showing as-built changes and additions to the work under his Contract.
   d. Any special guarantees or bonds (Submit to Owner).
   e. Certificates of inspection and acceptance by local governing agencies having jurisdiction.
   f. Release of all parties who are entitled to claims against the subject project, property or improvement pursuant to the provisions of law.

3. The Contractor's attention is directed to the fact that required certifications and information under Item 2 above, must actually be submitted earlier in accordance with other Sections of the Specifications.

PART 2 – PRODUCTS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

END OF SECTION

# SECTION 01740

# WARRANTIES AND BONDS

## PART 1 - GENERAL

### 1.1 SUMMARY:

A. This Section specifies general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturer's standard warranties on products and special warranties.

### 1.2 RELATED WORK:

A. Refer to General Conditions of the Contract for the general requirements relating to warranties and bonds.

B. General closeout requirements are included in Section 01700 - PROJECT CLOSEOUT.

C. Specific requirements for warranties for the Work and products and installations that are specified to be warranted, are included in the individual Specification Sections.

D. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.

### 1.3 SUBMITTALS:

A. Submit written warranties to the Owner prior to the date fixed by the Engineer for Substantial Completion. If the Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Owner.

B. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Owner within fifteen days of completion of that designated portion of the Work.

C. When a special warranty is required to be executed by the Contractor, or the Contractor and a subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution

by the required parties. Submit a draft to the Engineer for approval prior to final execution.

D. Refer to individual Specification Sections for specific content requirements, and particular requirements for submittal of special warranties.

E. At Final Completion, compile two copies of each required warranty and bond properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Contract Specifications.

F. Bind warranties and bonds in heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-in. by 11-in. paper.

G. Table of Contents: Neatly typed. Identified each item with the number and title of the Specification Section in which the Work and Warranty and Bond requirement was specified, and the name of the product or work item.

H. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address and telephone number of the installer, supplier, and manufacturer.

I. Identify each binder on the front and the spine with the typed or printed title "WARRANTIES AND BONDS," the Project title or name, and the name, address, and telephone numbers of the Contractor and equipment supplier.

1.4 WARRANTY REQUIREMENT:

A. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.

B. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

C. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has

benefited from use of the Work through a portion of its anticipated useful service life.

D. Owner's Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights or remedies.

E. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.

F. The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

G. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

1.5 DEFINITION:

A. Standard Product Warranties are pre-printed written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.

B. Special Warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

PART 2 - PRODUCTS –
(Not Used)

PART 3 - EXECUTION –
(Not Used)

END OF SECTION

NO TEXT ON THIS PAGE

# SECTION 01800

# SPECIAL CONSTRUCTION REQUIREMENTS

## PART 1 - GENERAL

### 1.01 THE REQUIREMENT:

A. General Requirements and Sequences

1. The requirements and sequences specified herein shall comply with applicable requirements contained in these Specifications.

2. Detailed requirements as set forth in this section shall take precedence over general requirements specified elsewhere.

3. The time to substantial completion included in the Owner-Contractor Agreement is based on the work to be performed and completed for the Burke Street Phase 2 Project.

4. Whenever bypassing or plugging of the interceptor or service laterals is required the contractor shall provide a minimum of 48 hours notice to the City and the Engineer. For work on service laterals, residents shall be provided notice no less than 72 hours prior to work that will affect their service or property.

5. Other time constraints and limitations specific to the construction at the site may be contained in required permits and in Section 01010, Summary of Work. The Contractor shall consider all such constraints in scheduling and sequencing the work and shall be responsible for complying with all permit conditions contained herein. Nothing in the Contract Documents shall be interpreted to relieve the Contractor of the permit obligations or restrictions.

B. Special Sequence Requirements

1. Contractor shall submit a Preliminary Construction Schedule in accordance with Section 01311 – Scheduling and Reporting, for the Owner's consideration. The schedule shall be prepared taking into account restrictions given by the applicable issued permits and approvals.

C. Special Construction Requirements

1. The contractor shall be report or assist the field engineer in recording and reporting the condition of all existing laterals to which connections are made as part of the construction contract. If, while excavated, it becomes evident that the existing lateral to remain is in exceptionally poor condition the contractor shall make provisions to ensure that photographs of the lateral are taken, and a report

provided. If a resident engineer is on site at the time of excavation and connection, the Contractor shall inform the resident that the lateral is exposed, at which point the resident will photograph and provide a conditional assessment. If a resident engineer is not on site at the time of excavation and connection, the contractor shall photograph and provide a conditional assessment.

2. The contractor shall be allowed a maximum of 1200 linear feet of unpaved road at any time during the duration of the project. Dust control on the project site is the responsibility of the contractor.

3. Access to the bus yard at the end of Burke Street shall be maintained at all times. Any required detouring shall be planned and approved a minimum of 2 weeks prior to and changes to the existing traffic pattern.

1.02 HYDRAULIC UPLIFT OF STRUCTURES:

A. The Contractor shall be responsible for the protection of all structures against hydraulic uplift until such structures have been accepted finally by the Owner.

B. In this regard, the Contractor is advised that all tanks when completed are designed to resist hydraulic uplift from groundwater up to the surface elevation indicated on the structural drawings when the structure is completed. The concrete slab bottoms shall be placed in the dry, with the use of well points or other dewatering means to keep the water elevation sufficiently low to carry on the work.

1.03 PRECAUTIONS AGAINST HYDROSTATIC UPLIFT DURING CONSTRUCTION:

A. The Contractor shall maintain a low groundwater elevation in the vicinity of the structures until they are complete. In case of extremely high water during construction of the structures, it may be necessary to flood the structures to maintain stable conditions.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

(NOT USED)

END OF SECTION

# SECTION 02050

# STORM WATER POLLUTION PREVENTION PLAN (SWPPP)

## PART 1 – GENERAL

### 1.01 RESPONSIBILITIES:

A. Federal law requires that all construction sites with disturbed areas over one-acre comply with notification and other requirements of the Environmental Protection Agency (EPA) National Pollutant Discharge Elimination System (NPDES) General Permit. The law requires the "Operator" of the site to prepare a Stormwater Pollution Prevention Plan (SWPPP) and submit a Notice of Intent for Storm Water Discharges Associated with Construction Activity (NOI) form to the EPA at least seven days prior to commencement of construction activity. The SWPPP must be maintained and retained at the construction site. The Contractor shall assume the duties of the "Operator" of the SWPPP, which shall include preparation of the SWPPP, signing and forwarding a copy of the NOI to the EPA and performing the duties of the "Operator" during construction activities and provide to the EPA a Notice of Termination (NOT) form at the completion of the work.

B. The duties of the "Operator" during construction shall include, but are not limited to, the following:

1. Preparation of the SWPPP. The SWPPP shall detail the methods planned for accomplishment of temporary and permanent erosion control work for operations including, but not limited to, clearing, grubbing, grading, and drainage operations, especially in or adjacent to existing waters, water courses, or wetlands. The SWPPP shall include proposed methods of erosion control in the project areas as well as on haul roads, borrow pits, and disposal areas.
2. Implementation of the SWPPP
3. Oversee maintenance practices identified as Best Management Practices (BMPs) in the SWPPP
4. Conduct or provide for inspection and monitoring of temporary and permanent erosion and storm water controls
5. Provide spill prevention measures for non-storm water pollutants that are expected to be present

C. All costs incurred in the preparation and implementation of the requirements of the Phase I and Phase II stormwater program rules of the

EPA NPDES General Permits for Storm Water Discharges from Construction Activities shall be borne by the Contractor.

1.02 RELATED WORK:

A. Section 02200 – EARTHWORK
B. Section 02276 – EROSION AND SEDIMENTATION CONTROL
C. Section 02220 – Soil and Materials Management Plan
D. Section 02140 – Dewatering

1.03 STANDARD REFERENCE:

A. Reference is made to the Phase I and Phase II stormwater program rules of the Environmental Protection Agency NPDES General Permits for Storm Water Discharges from Construction Activities. For additional information, contact (202) 564-9545 or www.epa.gov/npdes/stormwater.

1.04 SUBMITTALS:

A. The contractor shall submit an executed copy of the Stormwater Pollution Prevention Plan (SWPPP), signed and stamped by a New Hampshire Professional Engineer, to the Engineer for review and approval.
B. Once the SWPPP is approved by the Engineer, the Contractor shall submit three (3) signed and executed copies to the Engineer for submittal to the City and New Hampshire Department of Environment Services.
C. The contractor shall submit a signed executed copy of the Notice of Intent (NOI), certifications and Notice of Termination (NOT) to the Engineer and the City of Nashua for safe record keeping.

1.05 EMPLOYEE TRAINING:

A. It shall be the Contractor's responsibility to develop an employee-training program to educate employees about the requirements of the SWPPP. This program shall include background on the components and goals of the SWPPP and hands-on training in erosion controls, spill prevention and response, good housekeeping, material handling disposal and control of waste, equipment fueling and inspection procedures.

PART 2 – PRODUCTS:

(NOT USED)

PART 3 – EXECUTION:

3.01 CONSTRUCTION SEQUENCING:

A. The Contractor shall adhere to the general Construction Sequence as approved by the Engineer. The Contractor shall notify the Engineer of any change to the schedule of construction activities.

3.02 EROSION CONTROLS:

A. The Contractor shall provide temporary and permanent erosion control measures during construction to ensure soil stabilization for disturbed areas and structural controls to manage storm water runoff. This work shall be performed in accordance with the plans, details, Section 02276, Erosion and Sedimentation Control and other applicable sections of the project specifications.

B. Temporary stabilization measures shall include temporary seeding/mulching of stockpile areas or disturbed areas, temporary ditches and embankments, silt fence/hay bale barriers, protections of trees to be saved, stabilized construction entrances and temporary sedimentation basins. A number of these BMP's have been shown on the Erosion Control Plan and detail sheet.

C. Permanent erosion control measures for this project include immediate seeding/mulching of disturbed areas once final grading has been performed, riprap protection at headwall outlet. These BMP's are shown on the site drawings and detail sheets.

3.03 MAINTENANCE/INSPECTIONS:

A. The Operator/Contractor shall be responsible for maintenance of all temporary and permanent controls throughout the duration of this contract. Maintenance practices shall include, but are not limited, to:
   1. Inspections as outlined in 3.03 B.
   2. Removal of built-up sediment along silt fences and/or temporary stone check dams.
   3. Temporary seeding.
   4. Reconstructing the stabilized construction entrance if not working properly.
   5. Treatment of non-storm water discharges such as water from water line flushings or groundwater from dewatering excavations. Such flows should be directed to a temporary sedimentation basin or storm water management area.

B. The Operator/Contractor shall inspect all control measures at least once a week and within twelve hours of the end of a storm with rainfall amount

greater than 0.5 inches. The inspections will verify that the structural BMP's described in the plans are in good condition and are minimizing erosion. A maintenance inspection report will be made after each inspection. Completed inspection forms shall be submitted to the City of Nashua and Engineer and a copy kept on-site for the duration of the project. Following construction, the completed forms shall be retained at the Operator/Contractors office for a minimum of one-year.

C. The Operator/Contractor shall be responsible for inspection of the final storm water controls before exiting the project. Any deficiencies noted in the operation of these controls shall be brought to the attention of the Engineer. All deficiencies must remedied within 24-48 hours.

3.04 MATERIAL MANAGEMENT PRACTICES:

A. All solid waste materials and hazardous waste materials shall be handled and disposed of in a legal manner. All sanitary waste collected from portable units shall be disposed of in accordance with all local, state and federal health codes.

B. The Contractor shall employ measures and practices to reduce the risk of spills or other accidental exposure of materials to storm water runoff. The Contractor shall pay special attention to the handling, use and disposal of materials such as petroleum products, fertilizers and paints to ensure that the risk associated with the use of these products are minimized. The following "good housekeeping" practices shall be followed during construction of the project:

1. An effort shall be made to store only enough product required to do the job.
2. All materials stored on-site shall be stored in a neat, orderly manner in their appropriate containers and, if possible, under a roof or other enclosure.
3. Products shall be kept in their original containers with their manufactures label.
4. Whenever possible, all of a product shall be used before disposing of the container.
5. Manufacturers recommendations for proper use and disposal shall be followed.
6. The Contractor shall inspect daily to ensure proper use and disposal of materials.

C. In addition to the good housekeeping and material management practices discussed in the previous sections of this plan, the following practices will be followed for spill prevention and cleanup:

1. Manufacturers' recommended methods for spill cleanup will be clearly posted and site personnel will be made aware of the procedures and the location of the information and cleanup supplies
2. Materials and equipment necessary for spill cleanup will be kept in the material storage area onsite. Equipment and material will include but not be limited to brooms, dustpans, mops, rags, gloves, goggles, kitty litter, sand, sawdust, and plastic and metal trash containers specifically for this purpose.
3. All spills will be cleaned up immediately after discovery.
4. The spill area will be kept well ventilated and personnel will wear appropriate protective clothing to prevent injury from contact with a hazardous substance.
5. Spills of toxic or hazardous material will be reported to the appropriate State or local government agency, regardless of the size.
6. The spill prevention plan will be adjusted to include measures to prevent this type of spill from reoccurring and how to clean up the spill if there is another one. A description of the spill, what caused it, and the cleanup measures will also be included.

3.05 MEASUREMENT AND PAYMENT:

All work performed as described in this Section will be paid for under one or more of the payment items listed in Section 01270 - Measurement and Payment, and in the **BID SCHEDULE.** The payment items are intended to provide full payment for the work shown on the Contract drawings and specified herein. Any work called for or implied in the documents but not listed as a payment item shall be considered **incidental** to the overall project.

END SECTION

NO TEXT ON THIS PAGE

# SECTION 02140

# DEWATERING

## PART 1 - GENERAL

### 1.01 SUMMARY:

A. Section Includes:

1. Design, furnish, install, operate, maintain, remove and dispose of site drainage and dewatering as necessary to control and remove surface water and to lower and control groundwater levels to permit construction in the dry, to preserve the undisturbed bearing capacity of subgrade soils, to maintain stable soil conditions and to prevent damage to adjacent structures and completed portions of the Work.

2. Furnish and install observation wells.

3. Engage services of a Registered Professional Engineer in the State of New Hampshire for the design and supervision of the dewatering system(s).

4. Non-applicable subsections with N/A designations.

B. Related Sections:

1. Section 02160 – Excavation Support

2. Section 02220 – Soil and Materials Management

3. Section 02229 – Backfill and Compaction

### 1.02 DEFINITIONS:

A. City:

1. City of Nashua, New Hampshire

### 1.03 SYSTEM DESCRIPTION:

A. Design Requirements:

1. Provide a dewatering system and site drainage, as needed, adjacent to the excavation. Dispose of dewatering system effluent in accordance with all Federal, State and local Rules and Regulations, and the applicable section(s) of these Specifications.

2. Contractor is responsible for obtaining all Federal, State and local permits including, but not limited to the NPDES General Permit for construction dewatering discharges, as required.

3. Methods are the option of the Contractor and may include sump pumping, wellpoints, deep wells, or combinations thereof. The Contractor shall implement whatever pre-drainage techniques are necessary as determined by the Contractor's Dewatering System Design Engineer to meet the performance requirements specified herein.

4. Modify, at no additional cost to the City, dewatering procedures which cause, or threaten to cause, damage to new or existing facilities.

B. Performance Requirements:

1. To ensure proper conditions at all times during construction, the Contractor shall provide and maintain ample means and devices with which to intercept and/or remove promptly and dispose of all water entering trenches and other excavations. Excavations shall be kept dry until the structures, pipes and appurtenances to be built or installed therein have been completed and backfilled to such extent that they shall not float or otherwise be damaged by water in the excavation. Dewatering shall be conducted as necessary to maintain stability of the excavation lateral support systems, and to prohibit loss of ground outside of the excavations.

2. Dewatering for the subgrade preparation shall be such that the undisturbed bearing character of the natural soils is maintained.

3. Lower and maintain groundwater a minimum of 1 foot below excavation bottom during excavation and subgrade preparation.

4. Sufficient standby pumping equipment, including backup power source, shall be installed and mounted for immediate use in case of emergencies. Control groundwater and surface drainage at all times for protection of adjacent public and private property from damage. Any damage to permanent work or existing property resulting from the failure of the Contractor to provide an adequate dewatering system shall be repaired by the Contractor at no additional cost to the City.

5. Filter pack materials shall be compatible with surrounding soils and screen size, and designed in accordance with standard filter criteria.

6. Dewatering systems shall be designed and operated so as not to induce migration of contaminated groundwater or otherwise exacerbate existing conditions at contaminated sites adjacent to the Work area.

1.04 SUBMITTALS:

A. Product Data:

1. Type of dewatering system. Arrangement, location and depths of system components.

2. Complete description of equipment and instrumentation to be used including installation, operation, maintenance and removal.

B. Shop Drawings:

1. The Contractor shall submit to the Engineer at least ten (10) calendar days prior to construction of the proposed method of dewatering and details, method of water treatment and disposal, and a location plan of proposed system components on the project site.

2. The Contractor shall perform the Work in accordance with the submitted design and with all requirements of the Contract Documents.

1.05 QUALITY ASSURANCE:

A. Qualifications:

1. The Contractor shall retain the services of a dewatering system design engineer who shall be a Professional Engineer registered in the State of New Hampshire to be responsible for design and monitoring of groundwater control system installation and operation during construction.

2. The dewatering system design engineer shall have a minimum of 5 years experience and shall have performed similar work as specified on at least five projects during the last 5-year period of time. If requested by the Engineer, the dewatering system design engineer shall demonstrate his/her ability to perform the duties in compliance with the Specifications.

3. The dewatering system design engineer shall visit the site as needed or as requested by the Engineer to review the operation and performance of the dewatering and monitoring systems.

PART 2 - PRODUCTS(NOT USED)

PART 3 - EXECUTION:

3.01 EXAMINATION:

A. Verification of Conditions:

1. Locate and identify underground and overhead utilities and site conditions that may interfere with dewatering.

2. Examine the site. Contractor may conduct additional borings or pump tests at the site at no additional cost to the City, subject to the approval of the City, to verify site conditions.

3. Contractor shall examine all available data regarding site conditions contained in the following reports and drawings which summarize subsurface and environmental conditions within the Contract area. This information is made available to the Contractor for information only and shall not be interpreted as a warranty of subsurface conditions whether interpreted from written text, boring logs, or other data. The reports and drawings listed below can be reviewed at the offices of the Nashua Department of Public Services, 9 Riverside Street, Nashua, NH 03062:

4. Report – Pavement Exploration and Evaluation Services dated January 2015 (appendix A of these specifications)

5. Record drawings for Burke Street Overflow (Sheet 12 of 16) and NMRI Cross Country Sta. 19+68 to Sta. 30+87 (Sheet 3 of 16), "Sewage Works Improvements – North Merrimack River Interceptor – I" by Camp Dresser & McKee, dated 1968.

6. Full depth borings were not conducted as part of the design process; however, groundwater in the area of construction is expected to be within 10 feet of the elevation of the adjacent Merrimack River (EL. 0.5 feet +/- Nashua City Datum).

7. If obvious contamination (visual or odor) is apparent in groundwater the Contractor is required to test the groundwater for contaminants and provide appropriate treatment for any contaminants found.

## 3.02 INSTALLATION:

A. Install dewatering system as shown on the reviewed Shop Drawings. Advise the Engineer of field changes in system and resubmit information on Shop Drawings showing installed configuration.

B. Maintain auxiliary equipment at the site to continue uninterrupted dewatering 24 hours per day seven days per week while any excavations are opened below existing or final grade. Shutting down dewatering system and flooding excavations will not be allowed without prior written approval by the Engineer.

C. Remove pumps and seal all dewatering wells left-in-place upon completion of dewatering operations.

D. Provide for continuous control of water and safety of excavations at all times during the course of construction, including weekends and holidays and during periods of work stoppages. Method of control, handling and disposal of groundwater and surface water from dewatering operations shall be in compliance with all applicable Federal, State and local laws, regulations and requirements and the NPDES General Permit for construction dewatering discharges.

E. Provide drainage, pumping and disposal without damage to adjacent property or structures, and without interference to construction operations and other contractors, or rights of public or private owners, or pedestrian and vehicular traffic. Modify water control system at no additional cost to the City, if it causes or threatens to cause damage to adjacent property or to existing buildings, structures, utilities or resource areas.

F. Intercept and divert surface drainage away from work sites by use of dikes, ditches, sumps, or other means. Design surface drainage systems so as to not cause erosion on or off site. Remove surface drainage systems when no longer required.

G. Use groundwater control systems appropriate to ground conditions, construction operations, and requirements of the Contract Documents. Prevent adverse effects of elevated or reduced water pressures on work, surrounding ground and adjacent facilities. Design and operate water control system so as to prevent removal of in-situ materials.

H. Dewater all excavations which approach or extend down to or below groundwater by lowering and keeping groundwater 1 foot or more below bottom of excavation.

I. Control groundwater and surface water such that excavation of trenches, placement of embedment, installation of pipes, and placement of backfill are performed in the dry and hydrostatic uplift will be prevented until backfilling has been completed.

J. Leave all pipes used for drainage purposes clean and free of sediment.

K. Backfill trenches so that water will not accumulate in unfilled or partially filled trenches.

L. Any damage resulting from the failure of the dewatering operations of the Contractor, and any damage resulting from the failure of the Contractor to maintain all the areas of Work in a stable, dry condition shall be repaired by the Contractor at no additional cost to the City. The Contractor's pumping and dewatering operations shall be executed in a manner that will prevent damage to the Work and will result in no loss of ground from these operations. The Contractor shall protect new Work from flooding due to storms or other causes.

Pumping shall be continuous to protect the Work and/or to maintain progress of the Work.

M. Discharge from the excavation or dewatering facilities and drainage from any areas used or occupied by the Contractor for construction or other purposes, shall be disposed of in accordance with these Specifications and any applicable permit conditions. Water from the trenches, excavations, and drainage operations shall be disposed of such a manner as to avoid public nuisance, injury to public health or the environment, damage to public or private property, or damage to the work completed or in progress. Discharge into sanitary sewers will not be allowed.

N. All dewatering operations shall use the best management practices in order to avoid the entrainment of sediment in the discharge water; discharges that would result in turbid water shall be filtered prior to discharge to any receiving wetlands, waterways, or upland areas; discharge of dewatering effluent into these areas shall be performed in a manner that will not result in soil erosion due to the velocity and duration of such discharges.

O. Repair any damage resulting from dewatering operations at no additional cost to the City.

P. Removal of Dewatering system

1. After the dewatering system is no longer required, the material and equipment constituting the system shall be removed, filled, and graded by the Contractor.

2. Pipes, casings, well, wellpoints and risers extending below the final surface shall be filled with cement grout.

END OF SECTION

# SECTION 02160

# EXCAVATION SUPPORT

## PART 1 – GENERAL

### 1.01 SUMMARY:

A. DESCRIPTION

1. Design, furnish, install, and remove temporary excavation support systems.

2. Engage services of a Registered Professional Engineer in the State of New Hampshire for the design and supervision of the support systems.

B. RELATED SECTION

1. Section 02140 – Dewatering

2. Section 02229 – Backfill and Compaction

### 1.02 REFERENCES:

A. AWPA: AMERICAN WOOD PRESERVERS ASSOCIATION

B. ASTM: AMERICAN SOCIETY OF TESTING AND MATERIALS

1. ASTM A328: Standard Specifications for Steel Sheet Piling

2. ASTM A6: Specifications for General Requirements for Rolled Steel Sheet Plates, Shapes, Steel Piling, and Bars for Structural Use

C. AWS: AMERICAN WELDING SOCIETY

1. AWS D1.1: Welding of Structural Steel

D. AISC: MANUAL OF STEEL CONSTRUCTION

E. AASHTO "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES"`

F. OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) STANDARD REGULATION CONTAINED IN TITLE 29: “SUBPART P – EXCAVATION, TRENCHING AND SHORING”

G. THE LATEST VERSION OF THE STATE OF NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION (NHDOT) “STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION”

1.03 DEFINITIONS:

A. CITY: CITY OF NASHUA, NEW HAMPSHIRE

1.04 SYSTEM DESCRIPTION:

1. Design Requirements:

a. Provide for the design of temporary excavation support systems. The design calculations and shop drawings shall be prepared and stamped by a Professional Engineer registered in the State of New Hampshire who is experienced in designing excavation support systems.

b. Design temporary excavation support systems in accordance with requirements of this Section.

c. The type and shape of temporary excavation support systems shall be at the option of the Contractor, subject to approval by the Engineer.

d. Design internal bracing support members for the maximum loading combinations to which they will be subjected including, but not limited to, soil loads, water loads, temperature fluctuation loads, prestressing loads, traffic decking loads, and removal loads.

e. Design temporary excavation support systems in a manner permitting safe and expeditious construction of temporary and permanent structures while minimizing movement or settlement of the ground and preventing damage to adjacent facilities.

f. Penetration of support systems shall be to adequate depth below bottom of excavation to permit lowering of indicated bottom of excavation at least 2 feet without any change in support system as installed (except for additional lagging if used) and without exceeding allowable movement criteria.

g. If used for excavation support, all steel and wood sheet piles below the base slab of structures and below mid-diameter of pipe shall be left in place.

h. If soldier piles are used for excavation support and are driven below a reference line drawn downward and outward from the outside edge of the mid-diameter of the pipe at a 1 horizontal to 1 vertical slope, they shall not be extracted unless the inside face of the soldier pile is greater than 3 feet from the outside of the pipe at mid-diameter of the pipe.

i. All sheeting not left in place shall be carefully removed in such a manner as to not endanger the construction or other structures, utilities, or property. All voids left or caused by withdrawal shall be immediately backfilled with sand by ramming with tools adapted to that purpose, or as otherwise approved by the Engineer.

8. All steel sheet piles, soldier piles and wood sheeting left-in-place shall be cut off at least 5 feet below the ground surface but no lower than 1 foot above the top of the pipe. Materials removed shall become the Contractor's property and shall be removed from the site. Timber, lagging and sheeting left in place shall be treated in accordance with the AWPA Standards.

i. Conform to all Federal, State and Local Rules, Orders and Regulations applicable to the design and installation of excavation support systems.

2. Performance Requirements:

a. Settlement of the ground surface and existing utilities adjacent to temporary excavation support systems shall be limited to 0.5 inch.

## 1.05 SUBMITTALS:

1. Product Data: Manufacturer's data for trench box and other excavation support system materials.

2. Shop Drawings: For all fabricated materials.

a. The Contractor shall submit shop drawings for temporary excavation support systems which indicate the following:

a. Full depth of excavation.

b. Depths below the main excavation to which the excavation support system will be installed.

c. Locations of utilities in vicinity of excavations.

d. Details, arrangement and method of construction of the proposed excavation support system and sequence of construction, including

disposition of utilities to be supported in-place or relocated in connection with excavation support system construction.

e. Procedures for resolving difficulties from misalignment of vertical excavation support system elements during excavation and criteria for implementing those procedures.

f. Loads on the excavation support system for the various stages of excavation, bracing removal, including equipment loads on decking or adjacent ground surface during construction.

g. Revise shop drawings to show as-built configuration of temporary excavation support systems.

h. Drawings shall be signed and stamped by a Professional Engineer registered in the State of New Hampshire. The Contractor shall perform the Work in accordance with the submitted design and with all requirements of the Contract Documents.

i. Contractor reference and qualification documentation specified in herein.

## 1.06 QUALITY ASSURANCE:

1. Qualifications:

   a. The Contractor shall retain the services of an excavation support system design engineer who shall be a Professional Engineer registered in the State of New Hampshire to be responsible for design and monitoring of excavation support systems during construction.

   b. The excavation support design engineer shall have a minimum of 5 years experience and shall have performed similar work as specified on at least five projects during the last 5 years. Submit a qualifications statement which includes the excavation support system design engineer's educational background, licenses and certifications, and project experience to the Engineer for approval at least two weeks prior to the start of Work.

   c. The excavation support design engineer shall visit the site and review the excavation support and monitoring systems at least once a week during construction and as requested by the Engineer.

2. Regulatory Requirements:

   a. Conform to all Federal, State and Local Rules, Orders and Regulations applicable to the design and installation of excavation support systems.

3. Certifications:

a. All welding by Certified Welders.

1.07 PROJECT/SITE CONDITIONS:

1. Existing Conditions:

The Contractor shall examine all available data regarding site conditions contained in the following reports and drawings which summarize subsurface and environmental conditions within the Contract area. This information is made available to the Contractor for information only and shall not be interpreted as a warranty of subsurface conditions whether interpreted from written text, boring logs, or other data. The reports and drawings listed below can be reviewed at the offices of the Nashua Department of Public Services, 9 Riverside Street, Nashua, NH 03062:

a. Report – Pavement Exploration and Evaluation Services dated January 2015 (appendix A of these specifications)

b. Record drawings for Burke Street Overflow (Sheet 12 of 16) and NMRI Cross Country Sta. 19+68 to Sta. 30+87 (Sheet 3 of 16), "Sewage Works Improvements – North Merrimack River Interceptor – I" by Camp Dresser & McKee, dated 1968.

c. Full depth borings were not conducted as part of the design process; however, groundwater in the area of construction is expected to be within 10 feet of the elevation of the adjacent Merrimack River (EL. 0.5 feet +/- Nashua City Datum).

2. The construction work includes excavation, backfilling, and dewatering in connection with the installation of new sewer service laterals, catch basin laterals, new catch basins and surface work, as detailed in the contract drawings.

3. Although asbestos was not encountered during construction of other infrastructure improvements at the site, the Contractor is advised that asbestos containing fill is prevalent in the Nashua area and can be encountered randomly throughout the City. Accordingly, the Contractor should be prepared to take appropriate actions should asbestos be encountered during construction.

PART 2 - PRODUCTS:

A. MATERIALS:

1. Soldier Piles:

a. ASTM A709, Grade 36.

2. Steel Sheet Piling:

   a. ASTM A328, Continuous Interlocking Type.

   b. Sheet pile splices shall be full butt welded designed to develop full strength of the sheet pile both in bearing and bending. Welded piles shall be straight.

3. Timber, Lagging and Sheeting:

   a. Treated per appropriate AWPA Standards.

## PART 3 - EXECUTION

### 3.01 EXAMINATION:

1. Verification of Conditions:

   a. Examine the site: Contractor may conduct additional borings at the site at no additional cost to the City, subject to the approval of the City, to verify conditions.

### 3.02 INSTALLATION:

1. Soldier Piles and Lagging:

   a. Install soldier piles and lagging in accordance with the reviewed shop drawings.

   b. Lagging shall be first installed when excavation is a maximum depth of 4 feet or sooner if the excavation walls appear unstable. At no time after the installation of lagging begins shall excavation bottom elevation be more than 2 feet deeper than the lowest installed lagging board.

   c. Immediately backfill voids that form behind the lagging with materials acceptable to the Engineer. If voids are large or show signs of progressive movement, backfill them with lean concrete.

   d. Timbers not treated in accordance with AWPA Standards shall be removed at the completion of the Work.

2. Sheet Piling:

   a. Install steel or timber piling in accordance with the reviewed shop drawings.

   b. If sheet piling bends, twists, rotates, pulls out of interlock, or fetches up in an unusual manner at a substantially different elevation than the immediately adjacent sheeting, pull the section and inspect it for damage. Do not redrive

sheeting if damaged. Replace damaged sheets with new sheets after removal of obstructions at no additional cost to the City.

c. Bottom edge of timber sheeting shall be sharpened so as to lead the toe of the sheeting away from the excavation.

4. Seal leaks in sheeting to prevent migration of fines into the excavation, loss of soil from outside the excavation support system, and excavation bottom instability. If pre-trenching is performed for installation of sheet piling, the trenches shall be backfilled before driving sheeting with Select Borrow. See Section 02229 for gradation requirements.

3. Trench Box:

a. Construction may require the use of a trench box. The Contractor shall take all necessary precautions to prevent damage to existing pipe. The Contractor is solely responsible for any damage to existing pipeline caused by the trench box, excavation operations, or any other activities during construction.

b. The Contractor may use a trench box if the allowable ground surface and utility movements can be maintained within the limits specified herein.

c. Extreme care shall be utilized when a trench box is moved ahead to prevent separation of pipe joints already installed or to create voids in the backfill. Line and grade shall be rechecked in completed sections of the pipe after the trench box is advanced.

d. The width of the trench box shall be consistent with the trench widths shown on the Contract Drawings.

e. If at any time during pipeline installation, the bottom of the trench box extends below pipe invert, bedding stone shall be placed to pipe invert and the trench box raised to pipe invert prior to placement of the pipe in the trench.

f. Fill all voids between the trench box and undisturbed trench wall to 1 foot above the top of pipe with lean concrete, controlled density fill (flowable fill), bedding stone, or other material acceptable to the Engineer.

4. Bracing:

a. Install all bracing immediately upon reaching each bracing level in accordance with the reviewed shop drawings. Do not excavate below bracing level until bracing system is installed and prestressed, if designed to be prestressed.

b. Prestress struts or braces, if designed to be prestressed, immediately after installation by jacking and maintain load with steel wedge shims welded or fixed in place.

5. Removal:

a. Remove excavation support system as specified herein.

b. Fill all voids created by removal of excavation support members with lean concrete if required by the Engineer.

c. Cut off excavation support system elements to remain in the ground not less than 5 feet below finished grade, but not lower than 1 foot above the top of the pipe.

d. Provide as-built drawings for excavation support systems left-in-place.

e. Vibratory extraction methods shall be used only when it can be demonstrated that settling of pipe and structures will not occur. If such settling occurs, it shall be corrected at no additional cost to the City.

END OF SECTION

# SECTION 02200

# EARTHWORK

## PART 1 GENERAL

### 1.01 SUMMARY

A. Furnish all labor, equipment and materials required to complete all work associated with excavation, including off-site borrow excavation, dewatering, backfill, drainage layers beneath and around structures, foundation and backfill stone, filter fabric, embankments, stockpiling topsoil and any excess suitable material in designated areas, in place compaction of embankments, backfill and subgrades beneath foundations and roadways, excavation support, disposing from the site all unsuitable materials, providing erosion and sedimentation control grading, site grading and preparation of pavement and structure subgrade, and other related and incidental work as required to complete the work shown on the Drawings and specified herein

B. All excavations shall be in conformity with the lines, grades, and cross sections shown on the Drawings or established by the Engineer.

C. It is the intent of this Specification that the Contractor conduct the construction activities in such a manner that erosion of disturbed areas and off-site sedimentation be absolutely minimized.

1. Related Sections:

a. Section 02140 – Dewatering

b. Section 2050 – SWPPP

c. Section 02160 – Excavation Support

d. Section 02276 - Erosion and Sedimentation Control

### 1.02 REFERENCES

1. ASTM D422 – “Standard Test Method for Particle-Size Analysis of Soils”

2. ASTM D1557 – “Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort”

3. ASTM D2922 – “Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)”

4. ASTM D2974 – “Standard Test Methods for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils”

5. The latest version of the State of New Hampshire Department of Transportation (NHDOT) “Standard Specifications for Road and Bridge Construction”

6. Occupational Safety and Health Administration (OSHA) Standard Regulation contained in Title 29: “Subpart P – Excavation, Trenching and Shoring”

## 1.03 DEFINITIONS

A. Rock:

1. Rock is naturally occurring, intact material that cannot be broken and removed by large power excavation equipment and requires use of hoe rams, systematic drilling and blasting, or other mechanical means to fracture and remove. Boulders over 1 cubic yard in volume located within soil in open excavation or in trenches are also defined as rock excavation. Rock does not include boulders less than 1 cubic yard in volume, or loose, weathered, or fragmented rock that can be excavated with a large backhoe. Removal of existing structures, masonry, pavements, pipes, or similar structures, is not considered rock excavation.

2. Earth:

a. All material not classified as Rock.

3. City:

a. City of Nashua, New Hampshire

## 1.04 SUBMITTALS

A. Submit the following information at least seven (7) calendar days prior to use:

1. Fill and Backfill Materials: For each fill and backfill material proposed, submit a minimum 5-lb sample and results of gradation tests (ASTM D422) and laboratory compaction tests (ASTM D1557).

2. Erosion Control Blankets: Submit product information, specifications, and manufacturer’s instructions for installation for all proposed erosion control blankets.

B. At least seven (7) days prior to the start of work, submit the following information:

1. Written detailed method statement including drawings for his proposed excavation, dewatering and construction sequence. The Contractor shall review carefully the available subsurface data including the reports referenced below prior to submitting this method statement. The method statement shall include descriptions and locations for cut slopes, trench box, and other excavation support, dewatering methods and procedures, and methods for ensuring stability of excavations.

2. Name, qualifications, and experience of independent testing laboratory proposed for laboratory and field testing of soils.

1.05 SUBSURFACE CONDITIONS

A. Information on subsurface conditions is referenced under Division 1, General Requirements.

B. Attention is directed to the fact that there may be water pipes, storm drains and other utilities located in the area of proposed excavation. Perform all repairs to same in the event that excavation activities disrupt service.

1.06 PROTECTION OF EXISTING PROPERTY:

**A.** The work shall be executed in such manner as to prevent any damage to facilities at the site and adjacent property and existing improvements, such as but not limited to streets, curbs, paving, service utility lines, structures, monuments, bench marks, observation wells, and other public or private property. Protect existing improvements from damage caused by settlement, lateral movements, undermining, washout and other hazards created by earthwork operations. **Note: The Contractor shall take special care not to disturb existing curb that is to remain. Any curb designated to remain that is disturbed by the Contractor shall be reset at its own expense.**

B. In case of any damage or injury caused in the performance of the work, the Contractor shall, at its own expense, make good such damage or injury to the satisfaction of, and without cost to, the Owner. Existing roads, sidewalks, and curbs damaged during the project work shall be repaired or replaced to at least the condition that existed at the start of operations. The Contractor shall replace, at his own cost, existing benchmarks, observation wells, monuments, and other reference points which are disturbed or destroyed.

C. Buried drainage structures and pipes, and observation wells, including those which project less than eighteen inches (18") above grade, which are subject to damage from construction equipment shall be clearly marked to indicate the hazard. Markers shall indicate limits of danger areas, by means which will be clearly visible to operators of trucks and other construction equipment, and shall be maintained at all times until completion of project.

1.07 SUBSURFACE SOIL DATA:

A. A geotechnical report has been prepared for the Owner. The report is entitled:

"Pavement Exploration and Evaluation – Burke Street, Nashua, New Hampshire", prepared by SW Cole Engineering." dated January 6, 2015.

B. The Contractor may review logs of borings, jar soil samples, records of explorations and other pertinent subsurface data for the site. After obtaining Owner's permission, the Contractor may take whatever additional subsurface explorations deemed necessary at no expense to the Owner.

C. The above data are for general information and are accurate only at the particular locations and times the subsurface explorations were made. It is the Contractor's responsibility to make interpretations and to draw conclusions based on the character of materials to be encountered and the impact of his work based on his expert knowledge of the area and of earthwork techniques.

D. The existing ground elevations depicted on the Drawings and the Test Boring Logs in the geotechnical report are approximate and the Surveyors, the Owner, and/or their Representatives are not responsible for the accuracy and/or the reliability of the information given.

1.08 DRAINAGE:

A. The Contractor shall provide, at its own expense, adequate drainage facilities to complete all work items in an acceptable manner. Drainage shall be done in a manner so that runoff will not adversely affect construction procedures or cause excessive disturbance of underlying natural ground or abutting properties.

1.09 FROST PROTECTION AND SNOW REMOVAL:

A. The Contractor shall, at its own expense, keep earthwork operations clear and free of accumulations of snow as required to carry out the work
.

B. The Contractor shall protect the subgrade beneath new structures and pipes from frost penetration when freezing temperatures are expected. Any frost shall be removed prior to placing any backfill material, new structures, or pipes.

C. 1.10 DISPOSITION OF EXISTING UTILITIES:

A. Active utilities existing on the site shall be carefully protected from damage and relocation or removed as required for the Work. When an active utility line is exposed during construction, plot its location and elevation on the plans and notify in writing both the Engineer and the utility owner.

B. Inactive or abandoned utilities encountered during construction operations shall be removed, plugged or capped. Note the location of such utilities and report in writing to the Engineer.

C. Active utility lines damaged in the course of construction operations shall be

repaired or replaced as determined by the Engineer without additional cost to the Owner.

D. Notify the Owner at least three days in advance of the proposed time for shutting down or interrupting utilities or services. In no case shall any services or utilities be interrupted prior to notification and authorization by the Owner.

E. The Contractor shall be responsible for contacting "Dig Safe" at 1-888-344-7233 at least 72 hours prior to digging.

PART 2 PRODUCTS

2.01 EARTH MATERIALS

A. Select Borrow: Select Borrow shall consist of clean gravelly sand or sandy gravel free of organic material, loam, trash, snow, ice, frozen soil, or other objectionable material, and shall be graded within the following limits:

| Sieve Size | Percent Finer by Weight |
|---|---|
| 2 in. | 100 |
| No. 4 | 30 – 90 |
| No. 40 | 10 – 50 |
| No. 200 | 0 - 8 |

B. Common Borrow: Common Borrow shall be naturally occurring, mineral soil, well graded and free from trash and all organic, weak, compressible, and frozen materials. It shall be of such nature and character that it can be readily spread and compacted and shall be free of all expansive materials (such as highly plastic clays) and of materials subject to decay, decomposition, or dissolution. Common Borrow placed within 12 in. of a pipe or structure shall have a maximum stone size of 3 in. At distances greater than 12 in. from a pipe or structure, the maximum stone size shall be 6 in.

C. Crushed Stone: Crushed stone shall be used under all tanks, structures and as otherwise shown on the Contract Drawings. Stone shall meet requirements of NHDOT Item 304.4. Crushed stone shall meet the following gradation requirements:

| Sieve Size | Percent Finer by Weight |
|---|---|
| 1 in. | 100 |
| ½ in. | 90 - 100 |
| ¼ in. | 0 – 15 |

D. Loam Borrow:

1. Loam Borrow shall consist of a fertile, friable, natural topsoil typical of the locality, without admixture of subsoil, refuse or other foreign

materials, and shall be obtained from a well-drained arable site. It shall be such a mixture of sand, silt and clay particles as to exhibit sandy and clayey properties in and about equal proportions. It shall be reasonably free of stumps, roots, heavy or stiff clay, stones larger than 1 in. in diameter, lumps, coarse sand, noxious weeds, sticks, brush or other litter.

2. Prior to stripping, the loam shall have demonstrated by the occurrence upon it of healthy crops, grass or other vegetative growth, that is reasonably well drained and that it does not contain toxic amounts of either acid or alkalin

3. e elements.

4. The loam shall contain not less than 4 percent nor more than 20 percent organic matter as determined by ASTM D2974.

E. CRUSHED GRAVEL:

Crushed Gravel shall meet the requirements of NHDOT Item 304.3, of the Standard Specifications.

F. CALCIUM CHLORIDE:

Calcium Chloride shall be provided in 50 pound bags for use as dust control on the Project.

2.02 EROSION CONTROL BLANKET

A. Erosion control blankets shall be placed within the limits indicated on the Contract Drawings. The limits indicated on the Drawings may be adjusted in the field by the Engineer, depending on field conditions. Erosion control blankets shall consist of the following:

1. On sloped areas: North American Green C125BN or East Coast ECC-S2, or approved equivalent.

2. On flat areas: North American Green S75 or East Coast EC-S1, or approved equivalent.

3. Erosion control blankets shall be installed in accordance with the manufacturer's installation instructions. Staples for securing the blankets to the ground shall be spaced as follows:

a. On sloped areas: 1.75 staples per square yard, or closer

b. On flat areas: 0.7 staples per square yard, or closer

4. Seeding: Prior to placing erosion control blankets, the loam surface shall be seeded with NHDOT Slope Seed Type 44, or other mix

approved by the Engineer.

2.03 SAMPLING AND TESTING

A. All imported and on-site fill materials requested to be used shall be subjected to the testing requirements contained in Part 3 of this Section. An independent testing laboratory retained by the Contractor shall perform all testing. Certified test results will be submitted to the Engineer for review to determine if a material meets the specifications. The Contractor shall furnish all necessary samples for laboratory tests and shall provide to the Engineer a minimum 5-lb sample of each material proposed for use. The Contractor shall plan his operations to allow adequate time for laboratory tests and to permit performance of field density tests during compaction. All costs associated with laboratory and field testing, including re-testing of materials that fail to meet the specifications, shall be borne by the Contractor.

PART 3 EXECUTION

3.01 GENERAL

A. Stripping of Topsoil

1. In all areas to be excavated, the topsoil shall be stripped to its full depth, and shall be stored on the site at the location approved by the Engineer for subsequent re-use. Topsoil shall be kept separated from other excavated materials and shall be piled free of roots and other undesirable materials. For stockpiles that will remain in place for thirty (30) days or longer, seed and mulch stockpiles immediately after placement of material. For stockpiles stored less than thirty (30) days, mulching or covering is required.

2. Topsoil shall be considered the surface layer of soil and sod, suitable for use in seeding and planting. It shall not contain refuse or any material toxic to plant growth, and shall be free from subsoil, stumps, roots, brush, stones, clay lumps, or similar objects larger than 1 in. in size. Unsuitable materials shall be disposed of in accordance with the requirements of this Section and Section 02220.

B. Disposal of Excavated Materials

1. Excavated materials to be re-used, shall be stored on-site at locations approved by the Engineer, in an orderly manner at a sufficient distance from excavations to avoid overloading and to prevent slides or cave-ins. Storage over existing underground pipelines and other utilities will not be permitted.

2. Stored or piled material shall not obstruct access roads, or interfere

with drainage along gutters, ditches or drainage channels.

3. Disposal of excavated material in streams or other drainage channels will not be permitted under any circumstances. Any sediment deposited in the bed of streams or drainage channels as a result of the Contractor's operations shall be removed in an approved manner. Any damage to existing stream or channel beds and banks and any disruption to flow shall be repaired and restored as approved by the Engineer at no additional cost to the City.

C. Erosion Control

1. The Contractor shall maintain the site's erosion control measures and immediately correct any deficiencies when notified by the Engineer. These measures may require correction at any time of day, or day of week, for the duration of the project and will in no way be limited to normal working hours.

2. Soil and erosion control measures shall be as shown on the Contract Drawings and in Section 02276, Erosion and Sedimentation Control.

## 3.02 PROTECTION

A. Clear and grub areas required for construction operations in the permanent or temporary easements, as indicated on the Drawings or specified herein.

1. Do not cut or injure any trees or other vegetation outside the limits of the area required for construction operations without permission of the Engineer.

2. Do not use mechanical excavation equipment in locations where its operations would cause damage to trees, buildings, culverts, or other existing property, utilities, or structures above and below ground. Any damage to these items as a result of work performed by the Contractor shall be repaired by the Contractor at no additional cost to the City.

3. Utility agencies shall be contacted and advised of proposed Work prior to the start of excavation by the Contractor.

4. The Contractor shall obtain information from the proper sources and authorities concerning locations of all utilities within the scope of this Work.

5. If and when encountered, utilities shall be supported and protected, and the Engineer shall be notified. Ample time shall be allowed for entrance and taking such measures as may be required for the continuance of such services by the utility owner.

6. Rules and regulations governing the respective utilities shall be

observed.

7. Existing property boundary markers, control points and datum elevation markers or benchmarks shall be preserved, and all such established survey points that are displaced or destroyed by the Contractor shall be replaced by a Registered Land Surveyor at no additional cost to the City.

8. Cutting trench banks on slopes to reduce earth load to prevent sliding and caving is to be done only in areas where increased trench width will not interfere with surface features or encroach on right-of-way limits.

9. Sheet, brace and shore excavation for structures and trenches as needed to prevent caving or sliding.

10. The Contractor shall completely enclose any excavation or trench not backfilled at the end of each workday. This enclosure shall be made of steel plates or other suitable covers acceptable to the Engineer. These covers shall be capable of supporting maximum anticipated traffic loads for the conditions at grade (e.g., roadway or sidewalk). The covers shall be secured during all periods of inactivity.

## 3.03 EXCAVATION

A. General

1. Excavation shall include the removal and disposition of topsoil, sand, gravel, clay, muck, debris, organic silt, loam, glacial till, hardpan, soft or disintegrated rock, boulders, and rock.

2. Excavation shall be carried to the elevations indicated on the Drawings and shall extend sufficient distance from foundation walls and footings to provide adequate clearances for construction operations, including sheeting and bracing, and for inspection purposes.

3. **The objective of the project is to re-use excavated subgrade materials in fine grading operations and not export any materials other than pavement from the site. The materials below the pavement contain iron slag pieces and will likely require specific disposal at a facility regulated to accept such materials.** In the event that excess material is generated, the material must be stockpile on site and covered with polyethylene sheeting. The material must be representatively sampled and tested for environmental characterization prior to disposal. All disposal options and associated cost must be discussed and negotiated with the Owner and Engineer prior to disposal. Off-site disposal of excess material generated due to Contractor's negligence shall be paid for by the Contractor.

B. Unstable Material

1. Unstable material shall mean topsoil, clay, cinders, ashes, muck, debris, organic silt, and all wet, soft or loose material which does not remain in position when cut for excavation, or which does not provide sufficient bearing capacity to satisfactorily support pipes or structures placed thereon. Material made unstable by a failure to dewater as required, shall be repaired or removed and replaced at the Contractor's expense.

2. Unstable material in excavations shall be removed and disposed of in accordance with the requirements of this Section and Section 02220. The unstable material shall be removed to the extent and depths as required and as directed by the Engineer, and the excavation refilled and compacted to the proper grade with Select Borrow or crushed stone or as otherwise directed by the Engineer. For structure foundations on rock, any excavation below the foundation subgrade shall be backfilled with concrete of the same class as foundation concrete of the structure, unless otherwise directed by the Engineer. Whenever material is encountered that, in the Contractor's opinion, is incapable of providing adequate support, he shall immediately notify the Engineer and in each such instance, the Engineer will determine if the soil is suitable for support. All such notification shall be verified in writing by the Contractor.

3. Subgrades

a. Subgrades of excavations for pipes and structures shall be observed by the Engineer prior to placing bedding materials. The Contractor shall give timely notice to the Engineer for such inspections. If, in the opinion of the Engineer, additional excavation is required due to the low bearing capacity of the subgrade material, the Contractor shall remove such material to the required width and depth and replace it with thoroughly compacted Select Borrow, crushed stone, or concrete as directed by the Engineer and as specified herein. Subgrades shall be adequately protected against freezing by means of insulated blankets, hay or other approved methods.

4. Overexcavation

a. Excavation other than rock below indicated elevations shall be backfilled to proper lines and grade with compacted Select Borrow or crushed stone, or as otherwise directed by the Engineer, at no additional cost to the City.

5. Trenching for Pipelines

a. Length of Open Trenches: The length of trench to be opened at one time shall be kept within reasonable limits, and unless otherwise

permitted or directed by the Engineer, shall not be longer than 50 ft.

b. Depths of Trenches: Trenches shall be excavated to the subgrade elevations shown on the Drawings or as directed by the Engineer.

c. Widths of Trenches: Trenches shall be excavated to the widths indicated on the Drawings.

6. Excavation Support

a. Where necessary, the sides of the trenches and excavations shall be supported by trench boxes, sheeting and bracing, or other excavation support means to ensure proper construction, protection of adjacent structures and safety of workers. The Contractor is solely responsible for the adequacy of excavation support and for all damages to property or injury to persons resulting from improper quality, strength, installation, and maintenance of the system.

b. Excavation support shall be in accordance with the requirements of Section 02160, Excavation Support.

7. Dewatering

a. Provide and maintain dewatering equipment to remove and dispose all surface water and groundwater entering excavations, trenches, or other parts of the Work in accordance with the requirements of Section 02140, Dewatering.

b. Prevent surface water from entering excavations.

## 3.04 PREPARATION

A. Surfaces shall be firm, dense, and thoroughly compacted and consolidated; free from mud and muck; and stable to remain firm and intact under the feet of workers.

1. Remove all unstable material to limits determined in field by the Engineer and replace with compacted Select Borrow or crushed stone.

2. Prior to placement of bedding materials, compact and densify granular materials (sands and gravels) subgrade by at least four passes of a vibratory walk-behind roller or plate compactor. Compact cohesive subgrade materials (silts and clays) with mechanical tamper or other compaction equipment approved by the Engineer.

## 3.05 BACKFILLING

A. Placement and Compaction of Pipe and Structure Bedding

1. Spread and grade surface of pipe embedment material to provide uniform and continuous support.

2. After each pipe has been graded, aligned, and placed in final position on bedding material, deposit and compact pipe embedment material under and around each side of pipe and end to hold pipe in proper position and alignment.

3. Deposit and compact embedment material on each side of pipe simultaneously to prevent lateral displacement.

4. Place pipe embedment in not more than 9-in. thick layers in uncompacted thickness and compact with at least four passes of a vibratory compactor acceptable to the Engineer. Use a method of compaction and equipment that will not transmit damaging impacts to the new or existing pipes.

5. Embedment material shall be worked under haunches of pipe by vibrating with a mechanical probe vibrator or by “chinking” with a shovel or other method to provide uniform and continuous support.

6. Backfilling

a. Maximum lift thickness, measured prior to compaction, shall be nine (9) in.

b. Final excavation to design bearing levels shall be performed with a smooth-edged bucket.

c. Pipe trenches shall be backfilled as soon a practicable after pipes have been laid and jointed and approved for backfill by the Engineer.

d. To the extent practicable, utilize job excavated material as Common Borrow.

7. Top of Backfill

a. In paved areas, backfill shall be carried up to top of subgrade elevation ready to receive pavement material. In other areas, backfill shall be brought up to adjacent finished grade minus the depth of any required topsoil. Any excavations improperly backfilled, or where settlement occurs, shall be reopened to the depth required for proper compaction and shall then be refilled and compacted with the surface restored to required grade and degree of compaction at no additional cost to the City.

8. Warning Tape

a. All buried pipe and conduit shall have warning marker tapes placed

approximately two (2) ft below top of grade for the entire length of the pipe or conduit. The tape shall be of a noncorrosive material and shall identify the service and approximate depth to the buried pipe or conduit.

## 3.06 COMPACTION REQUIREMENTS

A. Compaction Requirements and Testing

1. All backfill materials shall be thoroughly compacted by rolling, tamping, or vibrating with compaction equipment approved by the Engineer so that pipe, structures, paving, and other construction will not settle at the time of construction or in the future. The Contractor's independent testing laboratory shall perform compaction tests to ensure proper compaction is met for each backfill layer and provide reports to the Engineer.

2. The Contractor shall adjust the moisture content of backfill materials as needed to achieve the minimum required percent compaction. If the moisture content of the backfill is too high to achieve the required compaction, the Contractor shall dry the soil by approved means, or defer compaction of the layer of wet material until the layer has dried such that it can be properly compacted. If the moisture content of the backfill is too low to achieve the specified minimum compaction, the Contractor shall add water, as needed, to achieve the specified compaction.

3. If any of the field density test results fail to meet the density as specified herein, the Contractor shall apply additional compaction, or remove the earthwork in that portion of the work involved, as determined by the Engineer, and replace it in accordance with these specifications to the required density. After the work is replaced, additional field density tests shall be performed by the independent testing laboratory retained by the Contractor.

4. Compaction shall be to the following densities:

| Fill and Backfill Location | Minimum Percent Compaction (ASTM D1557, Modified Proctor) |
|---|---|
| Under structures and pipes | 95 |
| Beside structure foundation walls | 95 |
| Trenches below paved areas | 95 |
| Trenches below unpaved areas | 95 |

5. Methods and equipment proposed for compaction shall be subject to

the approval of the Engineer. Compaction above existing pipes or other utilities shall be at the Contractor's risk. Any pipe or structure damaged during construction shall be replaced or repaired, as directed by the Engineer, and at the expense of the Contractor.

## 3.07 COMPACTION TESTING

A. The independent testing laboratory hired by the Contractor shall perform all sampling and testing on the fill material as directed by the Engineer to assure compliance with the Specifications. Testing shall be performed as frequently as deemed necessary by the Engineer.

1. Tests shall be performed simultaneously with the construction operations in order that the test results can be utilized by the Engineer during the course of the work.

2. All laboratory and field tests shall be recorded neatly and accurately on a standard report form supplied by the testing laboratory and subject to the approval of the Engineer.

3. The results of all test and inspections shall be submitted to the Engineer within one (1) working day after completion of the test or inspection.

4. The Contractor shall plan his operations to allow adequate time for laboratory tests and field density testing during compaction. Any costs of retesting required as a result of failure to meet compaction requirements shall be borne by the Contractor.

B. Field Density Tests

1. At a minimum, field density tests shall be performed in accordance with the following:

a. Backfill under and surrounding structures: One (1) field density test for each layer of compacted fill or backfill for each 1,000 square feet of subgrade.

b. Trenches: One (1) field density test for each 50 linear feet of trench, for each 1.5 ft of backfill, with a minimum of 3 per day.

c. Paved and unpaved areas: One (1) field density test for each 2,000 square feet of subgrade for each layer of compacted fill.

C. Laboratory Compaction Tests

1. Laboratory compaction tests (ASTM D1557) shall be made for each material proposed for use in construction of subgrades for pavements and backfilling for structures.

## 3.08 DUST CONTROL:

A. The Contractor shall furnish and spread calcium chloride for dust control using mechanical spreaders as ordered by the Engineer. In addition the Contractor shall provide a water truck and spread water as needed to minimize dust or as ordered by the Engineer. Water for dust control shall not be separately measured for payment, but is considered incidental to the work.

END OF SECTION

NO TEXT ON THIS PAGE

# SECTION 02210

# HEALTH AND SAFETY

## PART 1 - GENERAL

### 1.01 GENERAL REQUIREMENTS:

A. The Contractor is solely responsible for the health, safety, and protection of all on-site workers including its employees, subcontractors, and material vendors during performance of the Work described herein. Therefore, the Contractor shall provide a Health and Safety Plan (HSP) meeting all applicable Federal, State, and Local requirements.

B. Examine all other sections of the Specifications for requirements that affect work of this Section, whether or not such work is specifically mentioned in this Section.

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

D. Ensure that each subcontractor that may be exposed to contaminated media prepares its own HSP and ensure that subcontractor HSPs comply with the requirements of the Contractor's HSP.

E. The Contractor shall examine all available data regarding site conditions contained including the record drawings “Secondary Wastewater Treatment Plant” by Camp Dresser & McKee, dated 1985, and any other available record information in the area. Dig Safe shall be notified, and all investigations undertaken prior to any excavation on site.

### 1.02 DESCRIPTION OF WORK:

A. Work under this Section includes, but is not limited to, the following items which include all labor, materials, equipment and services necessary and incidental to adhere to the requirements of an HSP during execution of the Work.

1. Preparation of a HSP for all workers engaged in work where exposure to contaminated soil or groundwater is possible. The HSP shall be prepared by a Certified Industrial Hygienist, Certified Safety Professional, or equal environmental health professional who is qualified by training and experience to perform this work. The nature of contaminated and potentially contaminated materials may require use of monitoring equipment, special personal protective clothing and the possible use of respiratory protection.

2. The purpose of the HSP is to establish site specific health and safety requirements for protecting the health and safety of personnel and abutters

during all activities conducted on-site where a potential exists for exposure to contaminated soil, water or air. The HSP shall address Contractor and Subcontractor worker protection and their activities at the contract sites, and protection of public health and safety. The HSP shall, at a minimum, comply with the requirements of the Engineer's HSP and the requirements of the City for the City's employees and contractors.

3. Attendance at a health and safety coordination meeting prior to commencement of excavation work at the project sites. The meeting will address the health and safety issues outlined in the HSP. A representative from the Engineer, Contractor, Subcontractor(s), and the Contractor's Site Safety Officer shall attend.

4. All employees with the potential for exposure to contaminated soil, water or air shall have successfully completed an applicable OSHA Health and Safety training course and be current in OSHA training certifications through annual refresher training in compliance with the OSHA hazardous waste operations and emergency response codified at 29 CFR 1910.120, and specific training for site activities. Submit documentation of training for on-site personnel.

5. Providing health and safety equipment including protective clothing, respiratory equipment and monitoring instruments.

6. Decontamination of heavy construction equipment and tools used in the work prior to removal of such equipment from the site.

1.03 SITE CONDITIONS:

A. The construction work includes excavation, backfilling, and dewatering in connection with rehabilitation and installation of sewer service laterals, installation of new catch basins, rehabilitation of existing manholes and surface work as detailed on the contract drawings.

B. Though it is unlikely that asbestos will be encountered on the waste water treatment facility site, the Contractor is advised that asbestos containing fill is prevalent in the Nashua area and can be encountered randomly throughout the city. Accordingly, the Contractor should be prepared to take appropriate actions should asbestos be encountered during construction.

C. Contaminated soil, urban fill and groundwater may also be encountered. These materials may contain compounds such as heavy metals, arsenic, and asbestos that may present a health hazard for workers and others in the immediate vicinity who become exposed through direct contact and breathing.

D. The purpose of the HSP is to insure that a means for adequate protection of individuals engaged in hazardous work is provided. The nature of the contaminated materials present at the sites may require use of special protective clothing and the

possible use of respiratory protective equipment which is intended to minimize worker exposure to known or suspected hazards.

E. The work will involve handling of urban fill and possibly contaminated soil. The Contractor is required to mitigate dust and emissions of contaminants. The HSP prepared for the site must include a description of the Contractor's methods for control of emissions of dust and methods for monitoring of these emissions for protection of workers and the public.

F. Levels of personal protection are established in reference standards. It is anticipated that most of the work at the sites may be conducted using typical construction health and safety practices as described in OSHA safety and health regulations for construction codified at 29 CFR 1926. Work at the sites is anticipated to be conducted using Level D personal protective equipment with appropriate emissions controls and monitoring. The work to be conducted at the sites is not anticipated to require personal protection above that provided by Level C which requires the use of a respirator.

1.04 NEW MATERIALS AND PRODUCTS:

A. Follow material safety data sheets and the manufacturer's recommendations for worker protection, use, storage and disposal of other products to be used on-site.

1.05 RELATED SECTIONS:

A. Section 02140 – Dewatering

B. Section 02160 – Excavation Support

C. Section 02220 – Soil and Materials Management

D. Section 02229 – Backfill and Compaction

1.06 REFERENCE STANDARDS:

A. NIOSH/OSHA/USCG/EPA: "Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities," October 1985.

B. OSHA: 29 CFR Parts 1910 and 1926

C. EPA: Executive Orders 12223 and 1440.2

D. EPA: Executive Order 3100.1

E. ACED: "Health and Safety Guidelines for Hazardous Waste Site Investigations."

1.07 HEALTH AND SAFETY OVERSIGHT:

A. The Contractor shall have sole responsibility for implementation of the HSP. The Contractor shall also be responsible for implementation of the HSP by all Subcontractors. The Contractor shall provide a Site Safety Officer (SSO) who shall be assigned to the site at all times during the project. The SSO shall be responsible for ensuring that the HSP is properly implemented. The SSO will be charged with: overseeing site health and safety; monitoring and protection of public health and safety as it is related to the Work; instrument monitoring; personnel and equipment decontamination; control of equipment check-out; site traffic control; and emergency response. Other responsibilities include monitoring workers for weather-related exposures or stresses during their use of personal protective clothing and equipment (PPE).

B. The SSO shall have a working knowledge of State and Federal occupational safety and health regulations and formal training in occupational safety and health. Prior to commencement of any site activities, the SSO shall review the HSP and provide training on PPE use to all on-site employees who will be working in or near contaminated soil or groundwater. New employees or visitors to these areas shall be informed of the site conditions by the SSO. If visitors enter those areas, PPE and training required at that time within that area by the Contractor's personnel shall be required.

1.08 SUBMITTALS:

A. Submit the names, qualifications and experience of the following individuals identified by the Contractor for approval by the Engineer, prior to the submittal of the HSP:

1. Certified Industrial Hygienist, Certified Safety Professional or environmental health professional responsible for the preparation of the HSP.

2. Site Safety Officer.

B. Submit the following information to the Engineer and City of Nashua for review:

1. HSP which includes levels of protection and a schedule for training of Contractor's and Subcontractor's workers in the use of respiratory equipment and use of protective clothing. Training will not be provided by the Engineer or City.

2. A list of all personnel who will enter areas of known contamination, copies of certification of training and certification of compliance with medical monitoring requirements. This documentation must be submitted and reviewed by the City/Engineer prior to personnel performing on-site work.

C. The HSP shall be submitted no later than ten (10) calendar days in advance of the site mobilization for review by the Engineer and City.

## PART 2 - PRODUCTS

### 2.01 CLOTHING AND EQUIPMENT:

A. All clothing and equipment shall conform to the OSHA and EPA requirements as indicated in the Reference Standards. Generally, protective clothing is considered disposable, but respiratory equipment is reusable. The items to be furnished by the Contractor under different levels of required protection for their own personnel and Subcontractor's personnel include:

1. Level D Protection

- Coveralls (cotton) or Tyvek
- Safety boots/shoes
- Hard hat with optional face shield
- Safety glasses
- Hearing protection as required

2. Level C Protection

- Full facepiece air-purifying respirator (MSA, Ultra-twin or equal)
- Chemical protective overalls and long-sleeved jacket or Coveralls (Saran or Tyvek)
- Gloves, inner (disposable surgical type)
- Gloves, outer (Neoprene, Nitrile, Viton or Butyl)
- Boots, chemical protective, steel toe and shank (Neoprene or Nitrile)
- Booties, chemical protective (disposable PVC)
- Hard hat
- Face shield (optional)

Levels B and A represent increased levels of protection and are described in the Reference Standards.

B. The Contractor shall provide for PPE disposal during all phases of on-site work at no additional cost to the City.

## PART 3 - EXECUTION

### 3.01 HEALTH AND SAFETY PLANNING AND IMPLEMENTATION:

A. Prepare an HSP that will ensure the health and safety of all workers engaged in work at the site and the public at all times when exposure to contaminated or otherwise hazardous soil or water is possible. The HSP shall be prepared by a Certified Industrial Hygienist or a Certified Safety Professional. Implement the plan throughout the execution of the work. The plan shall include, but not limited to, the following information:

- Compounds/materials of concern and signs/symptoms of exposure.
- Potential for worker exposure to the compounds/materials of concern for each work task.
- Provisions for monitoring weather which would impact wind velocity and direction, and accordingly odor migration.
- Safety issues related to operation of heavy equipment.
- Provisions for work zone security and protection of the public who access the site or the perimeter of the work area.
- Requirements for OSHA training for each work task and a record, or schedule for training, of Contractors workers in the use of personal protective equipment.
- Work task specific levels of protection and a description of health and safety equipment, including protective clothing, respiratory equipment and monitoring instruments.
- Procedures for in-situ monitoring of hazardous particulates, gases or vapors for each work task and action levels for donning personal protective equipment; description of monitoring instruments.
- Procedures for monitoring the perimeter of the work area for potential emissions of dust, particulates, hazardous gases, and vapors that warrant mitigation to protect public health or to avoid nuisance conditions.
- Procedures for mitigating emissions of dusts, odors, hazardous gases, and vapors from the work area and for protecting the public from exposure to dust, vapors, and odors resulting from work at the site.
- Procedures for containing oil and/or hazardous materials.
- Procedures for decontamination of heavy equipment and tools.
- Emergency Response Plan, including the names and phone numbers of individuals or agencies who shall be contacted in the event of on-site injury or release of oil or hazardous material.
- Procedures for defining and securing the "Work zone" when contamination is encountered.
- Identification and qualifications of Contractor's SSO

B. Should Level C protection be required during exposure, excavation, and handling of contaminated soils and/or water, the Contractor will be required to monitor the work area and the perimeter of the site for compounds/materials of concern for which protective equipment is required.

C. Require all workers who will engage in work at the site which might result in exposure contaminated soil or water attend a health and safety coordination meeting.

D. Provide adequate health and safety training for all personnel who will be engaged in work at the site, which might result in exposure to contaminated air, soil or water.

E. Conduct health and safety meetings at the beginning of each work day to review specific hazards associated with the work planned for that day, PPE and operational controls to mitigate those hazards, and contingency plans and emergency procedures to respond to potential problems.

F. Personnel who have not received training, and who are not equipped with the required protective clothing and equipment, shall not be permitted access to the site during execution of work which may result in exposure to contaminated soil or groundwater.

3.02 MINIMUM AIR MONITORING REQUIREMENTS:

A. The Contractor or his Site Safety Officer must perform the following minimum air monitoring requirements:

1. Continuously monitor breathing zone air quality during work within the limits of excavation encountering potentially hazardous materials relative to action levels established in the Contractor's HSP.

2. Maintain daily log of air monitoring results. Record measurements on at least an hourly basis during excavation in potentially hazardous work zones. Tabulated results shall indicate person monitoring, monitoring equipment, results, and work activities being performed at time of measurement.

3. Maintain air monitoring logs on site and accessible to the Engineer. Submit monitoring logs to Engineer at the completion of the work.

3.03 DECONTAMINATION:

A. Decontaminate all equipment and tools which have come in contact with contaminated soil and groundwater to prevent the spread of contamination within the site and outside the site limits.

B. Dispose of all decontamination by-products in accordance with local, state and federal regulations and Section 02220, Soil and Material Management Plan.

C. Decontamination of construction equipment shall include the steam-cleaning of all equipment which comes in contact with contaminated soil or groundwater, prior to leaving the job site. Soap and water decontamination of non-disposable worker protective equipment shall be performed.

D. Provide on-site facilities for Contractor personnel to decontaminate their protective clothing or other equipment.

3.04 ACCIDENT REPORTING REQUIREMENTS:

A. The Contractor shall comply with the following accident and/or incident reporting requirements.

1. Should any unforeseen safety-related factor, hazard, or condition become evident during the performance of the work, the Contractor shall immediately take prudent action to establish, maintain, and secure the site and working conditions. This shall be followed by immediate notice to the Engineer and the City.

2. If a serious injury to a person or damage to property, environment, or natural resources result from an incident, the Contractor shall immediately report the incident to the City and the Engineer. The report shall be followed by a written document describing the incident, what hazards were created by it, and a detailed statement of what actions were taken to correct the problem. The Contractor will also include a description of why the actions taken were prudent.

3. Should any sudden, continuous, or intermittent release of oil or hazardous material occur during the course of work, the Contractor shall notify the Engineer and the City immediately and shall immediately begin actions to contain or abate the release. The Contractor shall immediately arrange for clean-up activities. The Engineer shall make necessary notifications to the New Hampshire Department of Environmental Services.

END OF SECTION

# SECTION 02220

# SOIL AND MATERIAL MANAGEMENT PLAN

## PART 1 - GENERAL

### 1.01 GENERAL:

A. The Contractor shall be experienced and knowledgeable and have trained and qualified personnel need to conduct the work as specified herein.

B. Drawings and general provisions of the Contract apply to this section.

C. Examine all Drawings and all other Sections of the Specifications for requirements affecting the Work of this Section.

D. The Contractor shall examine all available data regarding site conditions contained in Appendix A, which summarize subsurface and environmental conditions within the Contract area. This information is made available to the Contractor for information only and shall not be interpreted as a warranty of subsurface conditions whether interpreted from written text, boring logs, or other data.

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

### 1.02 DESCRIPTION OF WORK:

A. The project includes but is not limited to: rehabilitation and replacement of existing sewer and storm drainage service laterals, installation of new catch basins, rehabilitation of existing manholes and surface work, including new paving, bump outs, sidewalks and other surface features. The Contractor is advised that, although asbestos and contaminated soils were not encountered during field investigations performed for the geotechnical report cited above, the Contractor is advised that asbestos containing fill is prevalent in the Nashua area and can be encountered randomly throughout the City. In addition, it is possible contaminated soils can be encountered during installation of the work.

The work includes potential handling and disposal of both uncontaminated and contaminated soil and urban fill and other waste materials, from excavations for construction of the project. Contaminated soils and waste materials that may be encountered during construction include, but are not limited to, the following:

1. Urban Fill: Urban fill is common in Nashua and may contain asbestos.

2. Petroleum Hydrocarbon Contamination. Although not encountered in the subsurface explorations referenced above, soils impacted by petroleum hydrocarbons may be encountered during the work.

3. Other Non-Hazardous Materials. Other ash fill, and buried non-hazardous debris, if encountered, may require management during construction.

   1. Potential Asbestos Containing Material (PACM): The Contractor should be prepared to take appropriate actions should contaminated soils be encountered during construction. Soil/Fill suspected of containing asbestos as evidenced by the presence of suspect asbestos containing building debris such as cementitious (transite) piping, vinyl floor tiling, paper-like insulation material or any other suspect asbestos containing material observed in the soil/fill shall be segregated and stockpiled pending confirmatory analysis to determine appropriate disposal requirements. In the event that potential asbestos containing material is encountered, the Contractor shall immediately halt work in that area and notify the Engineer. The Contractor's Environmental professional shall collect adequate samples of the suspect material for characterization for asbestos by Polarized Light Microscopy (PLM). Work shall not recommence in that area until the results of the analyses are received and reviewed by the Owner and Engineer. The Contractor shall be responsible for all sampling and analyses. No work in areas determined to contain asbestos shall be conducted until all required notifications to local, state and/or federal agencies have been made and an Asbestos Work Plan has been approved for the site by NHDES. Standby time required from the time work is halted to the time work is allowed to resume will not be grounds for compensation due to the time delay, only a time extension.

      Asbestos-containing material shall be disposed of at appropriately permitted facility. Asbestos containing material shall be segregated and not mixed with soils not impacted by asbestos. Workers handling suspect asbestos containing materials shall be properly trained and equipped to handle asbestos material.

B. Materials Characterization and Off-Site Treatment/Recycling/Disposal

The Contractor will be required to characterize materials for off-site treatment, recycling or disposal. Characterization shall include collection and analysis of samples in accordance with the specific requirements of receiving facilities identified by the Contractor and approved by the City of Nashua and by NHDES, if necessary. Contractor shall submit facility documentation indicating that facility is licensed and permitted to accept materials removed from the site, chemical analysis results for materials classification, and documentation of facility acceptance of the material.

Contractor shall load and transport materials for off-site treatment, recycling or disposal at approved facilities.

C. In the course of the work it may be necessary to excavate and handle potentially contaminated soil/fill. The soil/fill management practices specified herein apply to all soil/fill excavated during the course of this contract. To the extent possible, the Contractor shall reuse geotechnically suitable excavated material prior to using imported backfill to reduce the volume of material to be disposed offsite.

D. Asbestos Removal

1. The Contractor shall be responsible for the proper removal, packaging, transport and disposal of all asbestos containing materials and soils to complete the work as specified herein. The Contractor's Industrial Hygiene Consultant will prepare and submit a work plan to the NHDES that describes the methodology to be used to protect human health and environment during all phases of excavation load-out, transport, and disposal of all debris generated from the site in accordance with Section 02210 Health and Safety. The Contractor shall provide the Engineer the following information one week prior to submitting notification to the NHDES:

    a. Name of Asbestos Contractor or Subcontractor working at the site and a description of their responsibilities.
    b. Name of waste transporter.
    c. Name of landfill.
    d. Anticipated mobilization and estimated completion dates.

2. Asbestos Contractor Qualifications:
    a. Insurance and bonding as stated in the Contract Documents.
    b. Licensing by the State of New Hampshire as an Asbestos Abatement Contractor.
    c. Name and location of at least three projects similar in scope and size to this project completed by the Contractor. Provide a name and phone number for each referenced project.

E. Authority to Stop Work:

1. The Owner has the authority to stop work at any time the Owner determines either personally or through the Engineer that the conditions do not conform with the requirements of the Specifications and/or applicable regulations. The stoppage of work shall continue until the conditions have been corrected and corrective steps have been taken to the satisfaction of the Engineer. Standby time required to resolve violations shall be at the Contractor's expense, and any fines, etc. for hazardous conditions or non-compliance will be at the Contractor's expense and will not be grounds for change orders or time extension.

F. Field Monitoring

Contractor shall monitor field conditions in accordance with its approved Health and Safety Plan and with the provisions of this Section.

G. Permits

Contractor shall obtain all permits required to conduct the Work included in this section. Permits may include, but are not limited to the following:

1. Temporary waste water discharge permit (Industrial Discharge Agreement) from the City of Nashua Wastewater Treatment Plant for discharge of dewatering effluent to the municipal sewer system; and/or

2. NPDES General Permit for Construction Dewatering Activity Discharges or NPDES Remediation General Permit.

H. Documentation

Contractor shall submit all documents required by this specification. Documents include, but are not limited to, waste manifests, bills of lading and materials shipping records for off-site transport of materials, facility documentation of materials receipt, certification of materials processing or destruction, records for monitoring well decommissioning and Contractor reports for on-site monitoring and other activities.

1.03 REFERENCE STANDARDS:

A. New Hampshire Hazardous Waste Rules (Env-Hw 100-1,000) and Federal Hazardous Waste Regulations (40 CFR 261 – 264).

B. New Hampshire Solid Waste Rules (Env-Wm 2603).

C. New Hampshire Rules Governing the Control of Air Pollution (Env-A 100 – 1300).

D. New Hampshire Department of Environmental Services (NHDES) Contaminated Sites Risk Characterization and Management Policy (RCMP).

E. New Hampshire Rules for Reporting and Remediation of Oil Discharges (Env-Orv-600).

F. New Hampshire Rules for Groundwater Management and Release Detection Permits (Env-Or 700).

G. City of Nashua Code of Ordinances.

H. National Pollutant Discharge Elimination System (NPDES) General Permit for Construction Dewatering Activities in New Hampshire (NHG070000) and Remediation General Permit in New Hampshire (NHG910000)

1.04 QUALITY ASSURANCE/ QUALITY CONTROL:

A. The Engineer will monitor the Contractor's activities associated with the Work of this Section. This monitoring will include, but not be limited to:

1. Observing and screening excavated soils as necessary to confirm that their quality;

2. Establishing requirements for stockpiling, segregating, and handling if the quality of the excavated soils as necessary;

3. Verifying Contractor conformance with requirements for on-site management and reuse of excavated materials;

4. Reviewing requests from Contractor for off-site reuse, recycling, treatment, and disposal facilities, associated chemical testing and documentation of materials acceptance by receiving facilities; and

5. Verifying the appropriate Contractor-prepared paperwork accompanies excavated soil and material that is transported from the site and verifying receipt of Contractor's submittal of paperwork for off-site facility receipt and processing of site materials.

1.05 SUBMITTALS:

A. Contractor shall prepare and submit a detailed workplan for excavated materials management and control of dust and other emissions during construction. The Contractor's excavated materials management plan shall be submitted a minimum of fourteen (14) calendar days in advance of the Work and shall include, but not be limited to, the following.

1. Site specific Health and Safety;

2. Proposed locations of materials stockpiles and other containers for solids and liquids if materials are to be stored onsite;

3. Measures for erosion, sedimentation and run-on/runoff controls for materials stockpiles;

4. Plans for excavation dewatering and treatment of dewatering effluent;

5. Measures for control of dust, particulates during construction; and

6. A schedule for off-site disposal of uncontaminated and contaminated media excavated or otherwise generated during construction.

7. Spill and discharge control for potential uncontrolled spills and discharges of contaminated and/or hazardous materials including but not limited to sewage and other on-site waste materials. The spill and discharge control plan shall specifically contain procedures for containing dry and liquid spills, absorbent material available on-site and procedures for protecting wetlands and surrounding public and private property. In the event of an uncontrolled spill or discharge, a written report detailing each uncontrolled spill or discharge shall include at a minimum, the cause and resolution of incident, outside agencies involved and the date of occurrence submitted within 48 hours of the incident to the Engineer. The Contractor shall be responsible for remediating any spills or releases of OHM as a result of the Contractor's activities at no additional cost to the Owner.

B. At least ten (10) calendar days in advance of the Work, submit all documentation, permit applications and permits relative to the handling, management, discharge, treatment, recycling and disposal of soil, wastes, groundwater and other solid and liquids expected to be handled during the Work.

C. Identify off-site treatment, recycling or disposal facilities and submit facility permit documentation for receiving materials expected to be generated from the site, and chemical analysis data from Contractor's characterization of materials a minimum of three (3) days in advance of materials shipment from the site.

D. Documents from treatment, disposal and recycling facilities certifying acceptance of materials excavated during construction a minimum of three (3) days in advance of materials shipment from the site.

E. Manifests for hazardous waste transportation and disposal for review by the Engineer at the time of each shipment of such materials from the site.

F. Bills of Lading and Materials Shipping Records for transportation and off-site treatment/recycling/disposal of non-hazardous materials for review by the Engineer at the time of each shipment of such materials from the site.

G. Documents from disposal and recycling facilities certifying the quantities of materials treated, recycled or otherwise disposed by the facility.

H. Weekly reports containing Contractor's field monitoring records of dust and VOC monitoring and quantities of materials shipped from the site.

PART 2 - PRODUCTS

A. Spill Control: At a minimum, the Contractor shall maintain on-site absorbent pads, booms and absorbent materials in sufficient quantity to address a release of fuel oil, hydraulic oil or other OHM that the Contractor intends to use or store on-site. The quantity of spill containment materials maintained on-site shall be sufficient to respond to a catastrophic release from the equipment or vessel containing the greatest quantity of OHM.

PART 3 - EXECUTION

3.01 ON-SITE CONTAMINATED MATERIALS MANAGEMENT:

A. Screening, Sampling and Testing

1. The Contractor shall monitor ambient air in the area of the excavation in accordance with the Heath & Safety Plan and shall provide the Engineer with monitoring results relevant to the selection of levels of personnel protective equipment.

2. Contractor shall mitigate dusts and odors using water, suppressing agents or other methods approved by the Engineer.

3. Contractor shall be responsible for the collection and analysis of waste characterization samples for the off-site disposal of materials from the Site. The Contractor's sampling and analysis program shall conform the requirements of the receiving facility and all applicable New Hampshire regulations. The Contractor shall notify the Engineer and the City of the proposed sampling schedule and procedures in advance of the collection of any samples from the site.

B. Material Classification and Management: Material generated shall be classified into the following groups and stored separately:

1. Soils:

a. Uncontaminated Materials: These include soils with no visual, olfactory or PID screening evidence of contamination and that do not contain asbestos, ash or impacted material. Uncontaminated material shall be reused on-site to the extent practicable. If reused off-site, uncontaminated materials shall be sampled and analyzed in accordance with New Hampshire regulations to establish that concentrations of chemicals in soils are lower than New Hampshire Method 1 S-1 Soil Standards of the NHDES RCMP and concentrations specified in New Hampshire Solid Waste Rules and to establish the absence of asbestos

in soil samples. Uncontaminated soils proposed for off-site reuse shall be analyzed for VOCs, polynuclear aromatic hydrocarbons (PAHs), total petroleum hydrocarbons (TPH), and RCRA 8 metals. Samples shall be collected in accordance with the requirements of Env-Or 600 and Env-Sw 900 for reuse of soils. Off-site reuse of uncontaminated materials shall be approved by the Engineer, City and NHDES. Uncontaminated materials proposed for off-site disposal at a facility approved by the Engineer and City shall be analyzed in accordance with the requirements of the receiving facility.

b. Urban Fill Soil: Soil containing asbestos, ash, clinkers and debris. Urban Fill Soil shall be reused on-site to the extent practicable. Urban Fill Soil shall be reused either beneath pavement or beneath a minimum 2-foot thick vegetated soil cover at locations approved by the Engineer.

c. Petroleum Hydrocarbon Impacted Soil: Soil and other materials impacted by petroleum shall be analyzed and processed as necessary to meet treatment/recycling/disposal facility requirements.

d. Potential Asbestos Containing Material (PACM): Soil/Fill suspected of containing asbestos as evidenced by the presence of suspect asbestos containing building debris such as cementitious (transite) piping, vinyl floor tiling, paper-like insulation material or any other suspect asbestos containing material observed in the soil/fill. This material shall be segregated and stockpiled pending confirmatory analysis to determine appropriate disposal requirements.

2. Liquids Handling

a. Groundwater: Groundwater recovered during construction dewatering, shall be disposed off-site or discharged in accordance with permits obtained by the Contractor. The Contractor is required to treat the groundwater for contaminants known to exist and also to reduce suspended solids to permit requirements prior to discharge.

b. Decontamination Liquids: Liquids generated and containerized from the decontamination of equipment used during construction. All decontamination liquids shall be disposed of off-site or discharged in accordance with permits obtained by the Contractor.

3. Other Solid Materials

a. Solid Waste: Other solid materials requiring off-site disposal shall be segregated by degree of contamination and analyzed by the Contractor

as necessary to determine disposal requirements and appropriately disposed off-site. These materials may include, but not be limited to, the following: trees, stumps, heavily impacted metal debris, concrete, personal protective equipment, decontamination materials, and polyethylene sheeting. The materials shall be managed and stored in a manner that minimizes the quantity of materials requiring handling and disposal.

b. Metal for Recycling: Metal with limited impacts suitable for recycling shall be segregated and containerized for recycling at a City-approved facility.

3.02 MATERIALS STORAGE:

A. Store excavated material on-site in designated storage areas accepted by the Engineer and in accordance with the Contractor's approved excavated materials management plan. Do not remove regulated material from the site for disposal or treatment without acceptance of the City/Engineer and appropriate Bills of Lading or Hazardous Waste Manifests for off-site disposal or treatment of hazardous waste.

B. Roll-off or other soil storage containers shall be covered to shed precipitation and prevent nuisance odors.

C. Solid waste and metal for recycling shall be temporarily stored on-site in watertight roll-off containers.

D. Maintain project documentation with accurate records of chemical testing, material tracking and disposal transportation manifests, and disposal certification. Documentation shall include daily field reports, estimates of volumes of materials in each stockpile, and minutes of meetings. Submit a complete copy of documentation to the Engineer weekly and at the completion of the project.

E. Suspend work in the area and notify the Engineer if the presence of potentially hazardous conditions is evident. These conditions include, but are not limited to buried containers, drums or tanks, or explosive conditions due to contaminated vapors. Secure the area to protect against worker or public health risk or release into the environment. The Engineer will notify, as necessary, the NHDES, EPA, and the City of Nashua Fire Department.

F. Inspect stockpiles and roll-offs daily, during construction and record inspection observations in a daily logbook for submittal to the Engineer on a weekly basis.

G. Removal of stockpiles shall include approximately 3 inches of underlying soils where polyethylene sheeting was placed on bare soil. Stockpiles over paved areas do not

require extra soil removal if the pavement is intact. Waste polyethylene sheeting may require special disposal.

3.03 STOCKPILE DETAILS:

A. Stockpiles of Urban Fill and contaminated soils shall be constructed as outlined below.

B. Materials shall be stockpiled on two sheets of 6-mil polyethylene plastic and securely covered with 6-mil polyethylene at the end of each working day and when not in active use. Stockpiles shall be located away from construction activity, occupied buildings, water drainage pathways, areas prone to flooding, or other environmentally sensitive areas (i.e. wetlands/flood plain). Prevent access to stockpiles by the public.

C. Shape and grade stockpiles to facilitate surface water drainage. Prevent generation of dust and water from leaving stockpiles. Stockpiles shall be covered and bermed to prevent impacts to storm water. Provide a silt fence at the perimeter of each stockpile. Roll-off containers shall be covered.

D. Label stockpiles and containers as to their group classification and source identification. Place warning signs in the areas in accordance with general practices and regulations.

E. Store material classified as hazardous waste material in containers, tanks, or a containment building, in accordance with NHDES, RCRA and DOT provisions for the less-than-90-day storage permit exemption (40 CFR 262.34). Provide a plan for such storage to the Engineer for approval.

F. Prevent intermixing of soil types or contamination.

3.04 MATERIAL DEWATERING:

A. Saturated material shall be dewatered prior to transportation off-site. Liquids generated by dewatering shall be disposed off-site or discharged in accordance with permits obtained by the Contractor.

B. Materials shall be dewatered/stabilized sufficiently to permit transportation (without the generation of free water during transport) and meet disposal facility requirements at no additional cost to the City.

C. The addition of stabilization materials shall not be permitted without prior written authorization of the City/Engineer. If the use of stabilization material is proposed by the Contractor and acceptable to the City/Engineer, the weight of stabilization material delivered to the site and used shall be accurately tracked by the Contractor with weight slips for each load delivered.

## 3.05 MATERIAL TRANSPORT:

A. Load material within the site work limits, remove soil from trucks within the contamination reduction zone per the Contractor's Health and Safety Plan and Project Work Plan, and sweep off-site streets and other paved areas that contain project debris daily. The Contractor shall provide additional tracking control as needed at the soil loading locations to preclude the off-site tracking of wastes.

B. Transport contaminated material off-site by a licensed hazardous material transporter.

C. Cover all trucks leaving the site and prevent debris from spilling from trucks or being tracked off-site.

D. Transport contaminated material in accordance with requirements for remediation waste or State Solid Waste, State and Federal Hazardous Waste Regulations and all applicable State and US Department of Transportation requirements.

## 3.06 OFF-SITE MATERIAL DISPOSAL:

A. Determine options for off-site treatment, disposal or recycling of contaminated material based on chemical testing results, approval of the City and, if necessary, approval of NHDES.

B. Recycle or dispose of contaminated material only at regulated receiving facilities or specific locations approved by the City. Uncontrolled off-site reuse of contaminated or uncontaminated material is prohibited.

C. Testing of soil and water to be disposed off-site is the responsibility of the Contractor and shall be performed by a state-certified laboratory at a frequency in accordance with NHDES guidance and requirements of the disposal facility.

END OF SECTION

NO TEXT ON THIS PAGE

# SECTION 02229

# BACKFILL AND COMPACTION

## PART 1 - GENERAL

### 1.01 DESCRIPTION:

A) Work Included:

1) Work includes backfilling trenches and/or excavation around structures with suitable material removed in the course of excavating and other suitable materials.

2) Testing soils.

B) Work Specified Elsewhere. This Section is not a stand-alone Section. Other requirements which relate to this Section are noted elsewhere in these documents. The Contractor and all Subcontractors are required to review this entire document along with the Drawings in an effort to identify all requirements.

### 1.02 REFERENCE STANDARDS:

A) Sieve Analysis of Fine and Coarse Aggregates: ASTM C136

B) Sampling Aggregates: ASTM D75

C) Moisture Density Relations of Soils (Modified Proctor): ASTM D1557

D) Density of Soil In-Place by Nuclear Methods: ASTM D2922

E) State of New Hampshire Department of Transportation (NHDOT) Standard Specifications for Road and Bridge Construction (latest edition)

F) Geotextile Specification for Highway Applications: AASHTO M 288-06

### 1.03 QUALITY ASSURANCE:

A) The Contractor shall obtain and pay for all services of a geotechnical testing firm to perform the necessary soil and compaction tests. The independent soils laboratory shall be approved by the Engineer prior to testing.

B) The Contractor shall make necessary arrangements to allow compaction testing to be performed at a time, place and elevation determined by the Engineer.

C) Pre-placement testing.

1) The Contractor shall take one sample of each material proposed to be used on the project. The samples shall be taken in the presence of the Engineer and in accordance with ASTM D75.

2) Subgrade Material: Proctor density tests shall be performed on the existing subgrade in accordance with the following schedule and in accordance with ASTM D1557:

a) At the bottom of excavations where structures or slabs will be placed.

b) One after every 5,000 cubic yards has been relocated on the site.

c) Whenever the material has changed in the opinion of the Engineer.

3) Select and Borrow Materials: Sieve and modified proctor density tests shall be performed on all select and borrow material in accordance with the following schedule and in accordance with ASTM C136 and ASTM D1557:

a) Before any materials are brought to the site.

b) One after every 5,000 cubic yards has been brought to the site.

c) Whenever the source changes.

4) The result shall be submitted to the Engineer for approval prior to placement.

D) Post-placement testing:

1) The trench and/or excavation shall be prepared using the normal backfill technique employed by the Contractor. No special or additional preparation will be allowed.

2) Determine in-place density in accordance with ASTM D2922 or by other methods as approved by the Engineer.

3) Compaction tests shall be made in accordance with the following table:

| | **Material** | **Testing Frequency** | **Percent Compaction** |
|---|---|---|---|
| Under Slabs or Structures: | | | |
| | Native material or borrow material | One for every 500 s.f. of surface area of the slab for every 2 lifts of material placed. | 95%<br>12” lifts |

| | | | |
|---|---|---|---|
| | Structural fill or crushed gravel | One for every 500 s.f. of surface area of the slab for every lift of material placed | 95%<br>6” lifts |
| Around Structures: | | | |
| | Borrow material or other material noted on the drawings | One for every 500 l.f. of wall for every 2 lifts of material placed. | 95%<br>12” lifts |
| In Trenches: | | | |
| | Native material or borrow material | From the blanket material to the underside of the gravel or loam. See Note #1 Below | 95%<br>12” lifts |
| | Gravels or loam | See requirements for Under paved Areas and Grassed Areas for requirements below | See below |
| Under Paved Areas: | | | |
| | Native material or borrow material | One for every 10,000 s.f. of surface area for every 2 lifts of material placed. | 95%<br>12” lifts |
| | Gravel | One for every 10,000 s.f. of surface area for every lift of material placed. | 95%<br>6” lifts |
| | Crushed Gravel | One for every 10,000 s.f. of surface area for every lift of material placed. | 95%<br>6” lifts |
| Under Grassed or Landscaped Areas | | | |
| | Native material or borrow material | One for every 20,000 s.f. of surface area for every 2 lifts of material placed. | 90%<br>12” lifts |

*Notes:*

1. *The Contractor shall propose a method for backfill on the first day of work. This proposed method will be tested and modified as required to meet the compaction requirements noted in the above table. The first day of testing shall include testing of a minimum of 4 lifts. This compaction method shall be used until the soil characteristics have changed in the opinion of the Engineer. At that point new compaction tests shall be performed to determine if the requirements are still being met. If they are, the method shall continue, if they are not, the method shall be modified until the requirements are met. Even if the soil characteristics have not changed, confirmatory compaction tests shall be taken every 3 weeks. Confirmatory testing shall include testing of a minimum of 2 lifts. The Engineer shall determine the location of all tests.*

4) Should compaction tests fail to meet the specified densities, the Contractor shall modify backfill methods as necessary to obtain passing results. The modified method shall be used from that point on.

E) At the option of the Engineer, representative samples of Filter Geotextile shall be obtained and tested by the Engineer to assure that the material properties conform to these specifications. Any geotextile material that does not conform to these specifications shall be rejected.

1.04 SUBMITTALS:

A) The Contractor shall submit at the preconstruction meeting his proposed compaction technique which shall include compaction around field structures (i.e manholes, catch basins, etc.) and valve boxes.

B) The Contractor shall submit sieve and proctor curves to the Engineer for approval 7 days before any material is brought to the site.

C) The Contractor shall submit compaction test result sheets to the Engineer no later than 7 days after the test were performed.

D) The Contractor shall submit product information along with a mill certificate or affidavit from the manufacturer of the filter geotextile attesting that the geotextile meets the chemical, physical, and manufacturing requirements stated in the specifications.

PART 2 - PRODUCTS

2.01 MATERIALS:

A) Excavated Material Suitable for Reuse:

1) Material shall be friable natural material comprised of gravels, sand, silts, or clayey gravel and sands.

2) Material shall be free from peat, muck, other organic matter, frozen material, ice, and/or snow.

3) Material shall be free from stones, ledge/rock fragments, and asphalt over 8” in the largest dimension.

4) The material shall not have a moisture content over 2% of its optimum moisture content.

B) Select and Borrow Materials:

1) Crushed Stone (Bedding Material):

a) Crushed stone shall be well graded in size from 1/4 inch to 3/4 inch and conform to ASTM C33 stone size No. 67.

b) Clean, hard, and durable particles or fragments.

c) Sieve Analysis:

| Sieve Designation | % Passing by Weight Square Opening |
|---|---|
| 1" | 100 |
| 3/4" | 90 - 100 |
| 3/8" | 20 - 55 |
| No. 4 | 0 - 10 |
| No. 8 | 0 - 5 |
| No. 200 | 1% Max. |

2) Sand (Sand Blanket or Bedding):

a) Clean, hard and durable particles or fragments.

b) Sieve Analysis when tested in accordance with ASTM C136:

| Sieve Designation | % Passing by Weight Square Opening |
|---|---|
| 3/8" | 100 |
| No. 4 | 95 - 100 |
| No. 16 | 50 - 85 |
| No. 50 | 10 - 30 |
| No. 100 | 2 - 10 |

3) Crushed Gravel or Structural Fill (Crushed Gravel Base Course):

a) Well graded granular crushed gravel material for use as a crushed gravel base.

b) Material shall be hard and durable, free from frost, organic material, loam, debris and other unsuitable material.

c) At least 50% of material retained on the 1 inch sieve shall have a fractured face.

d) Sieve Analysis as noted in NHDOT standard specification Section 304, when tested in accordance with ASTM C136:

| Sieve Designation | % Passing by Weight Square Opening | |
|---|---|---|
| 3" | 100 | |
| 2" | 95 - 100 | |
| 1" | 55 - 85 | |
| No. 4 | 27 - 52 | |
| No. 200 | 0 – 12 | (of the sand portion) |

4) Bank Run Gravel or Granular Gravel Borrow (Gravel Subbase Course):

a) Well graded granular bank-run gravel material for use as gravel subbase.

b) Material shall be hard and durable, free from frost, organic material, loam, debris and other unsuitable material. Shall not have excess amounts of clay or silt and shall be so sized that the material can be laid out and graded in smooth uniform 8" lifts.

c) Sieve Analysis:

| Sieve Designation | % Passing by Weight Square Opening | |
|---|---|---|
| 6" | 100 | |
| No. 4 | 25 - 70 | |
| No. 200 | 0 - 12 | (of the sand portion) |

5) Common Fill or Borrow (i.e. Sand):

a) Consist of earth suitable for embankment construction; free from frozen material, perishable rubbish, peat and other unsuitable material.

b) Material excavated on site which is friable, compactible, natural soil composed of gravel, sand, or silty or clayey gravel and sand; free from debris, concrete or other rubble, organic matter, muck, peat, excavated rock and boulders over 6 inches in maximum dimension.

c) The moisture content shall be sufficient to provide the required compaction and stable embankment. In no case shall the moisture content exceed 4 percent above optimum.

d) The optimum moisture content shall be determined in accordance with AASHTO T 180, Method C or D.

e) 100% shall pass the 3” sieve and 70-100% shall pass the No. 4 sieve.

6) Gravel Borrow (i.e. Gravel):

a) Well graded granular material suitable for placement in authorized excavations below the bottom of the bedding layer to replace deficient excavated material, for road construction, pipeline construction, and other designate uses.

b) 95-100% shall pass the 3” sieve and 25-70% shall pass the No. 4 sieve.

C) Filter Geotextile:

1) Filter geotextile shall be a minimum 6-ounce per square yard (nominal) nonwoven needle punched synthetic fabric consisting of staple or continuous filament polyester or polypropylene. The geotextile shall be inert and unaffected by long-term exposure to chemicals or liquids with a pH in range from 3 to 10. The geotextile shall have a Survivability Class of Class 1, 2, or 3 in accordance with AASHTO M288, and shall conform to the following minimum properties using the test methods listed below:

a) Mass per Unit Area (Unit Weight) – ASTM D5261: 5.6 oz/sq yd
b) UV Resistance (500 hrs), Avg % Strength Retention – ASTM D4355: 70%
c) Grab Tensile Strength – ASTM D4632: 150 lbs
d) Grab Tensile Elongation – ASTM D4632: 50 %
f) Apparent Opening Size – ASTM D4751: 0.25 mm
g) Permittivity at 50 mm constant head – ASTM D4491: 1.6 $sec^{-1}$
h) Puncture Resistance – ASTM D6241: 430 lbs

## PART 3 - EXECUTION

### 3.01 PERFORMANCE:

A) General:

1) Provide and place all necessary backfill material.

2) Do not allow large masses of backfill to be dropped into the excavation, as from a grab bucket, in such a manner that may endanger pipes and structures.

3) Place material in a manner that will prevent stones and lumps from becoming nested.

4) Completely fill all voids between stones with fine material.

5) Do not place backfill on or against new concrete until it has attained sufficient strength to support loads without distortion, cracking, and other damage.

6) Deposit backfill material evenly on all sides of structures to avoid unequal soil pressures.

7) Place backfill material evenly in the trench in an effort to maximize compaction.

8) Do not backfill with, or on, frozen materials.

9) Remove, or otherwise treat as necessary, previously placed material that has frozen prior to placing backfill.

10) Do not mechanically or hand compact material that is, in the opinion of the Engineer, too wet. Fill material that is too wet to be properly placed back in the trench it its current state shall be dried (disced, harrowed, etc.) to within 2% of optimum moisture content. This material shall not be classified as unsuitable material and ineligible for payment as such.

11) Material made unsuitable by the Contractor's construction methods shall be replace with Gravel Borrow at no additional cost to the Owner.

12) Fill that is too dry shall be uniformly watered. The water shall be placed over a loose lift to allow for the water to migrate through the entire lift before compaction.

13) Do not continue backfilling until the previously placed and/or new materials have dried sufficiently to permit proper compaction.

14) When original excavated material is, in the opinion of the Engineer, unsuitable, use only approved gravel borrow for backfilling.

15) Backfill excavation/trench as early as possible to allow for the maximum time for natural settlement.

16) Slope grade away from structures at a minimum slope of 1.5%.

17) The Contractor shall remove excess fill material from the site.

B) Sheeting:

1) Leave sheeting in place when damage is likely to result from its withdrawal. This shall only be allowed with written approval of the Engineer.

2) Completely fill with suitable material and thoroughly compact all voids left by the removal of sheeting.

3) Sheet shall be left in-place and incrementally moved up to allow for a safe work environment in which to properly compact the excavation/trench.

4) See Section 02160 – Excavation Support.

C) Backfilling Around Trench Obstacles

1) Material must be properly compacted around trench obstacles (i.e. manholes, catch basin, valve boxes, etc.). Uncompacted fill will not be allowed to be placed around these obstacles.

2) The Contractor shall provide adequate excavation supports to allow for a safe work environment in which to properly compact the excavation/trench.

3) The Contractor shall use methods that compensate for the space limitations in the immediate area around these obstacles.

D) Backfilling in Paved Areas:

1) Backfill trenches in streets and other paved areas by maintaining a moisture content within 2% of optimum.

2) In an effort to allow the road to heave uniformly, backfill material that was removed from the top portion of the trench shall be replaced back into the top of the trench. Similarly, the material removed from the middle of the trench shall be replaced back into the middle of the trench. Existing material removed from the bottom of the trench (i.e. where the pipe box is located) shall be stockpiled for later use.

3) Backfill in such a manner as to permit the rolling and compaction of the filled trench with the adjoining material to provide the required bearing value for paving immediately after backfilling is completed.

4) Where required, place excavated material, that is acceptable to the Engineer for surfacing or pavement subbase, at the top of the backfill to the depths as needed to adequately support pavement.

E) Backfilling Trenches in Nonpaved Areas:

1) Grade the ground to a reasonable uniformity.

2) Leave the mounding over the trenches in a uniform and neat condition, satisfactory to the Engineer.

F) Bedding & Backfilling of Pipelines:

1) Install pipe bedding and cushion and primary backfill in accordance with the requirements noted herein, in the specific pipe Specification Section, and on the Drawings.
2) Deposit and thoroughly compact the remainder of the backfill as noted herein.

G) Placing and Compacting Backfill:

1) Water Jetting: Shall not be allowed without the approval of the Engineer.

2) Puddling: Shall not be allowed without the approval of the Engineer.

3) Tamping:

a) Deposit and spread the backfill material in uniform parallel layers not exceeding the lift thicknesses noted herein.

b) Tamp each layer as required to obtain a thoroughly compacted mass.

c) If necessary, furnish and use an adequate number of power driven tampers, each weighing at least 150 lbs.

4) Rolling:

a) Compact material by rolling only when the width and depth of the excavation are sufficient to accommodate the rollers, dozers, mechanical tampers, or other similar powered equipment, as may prove to be acceptable, and when it can be performed without causing damage to pipes and structures installed in the excavation.

b) Deposit and spread the backfill material in uniform parallel layers not exceeding the lift thicknesses noted herein.

c) Roll each layer as required to obtain a thoroughly compacted mass.

5) Other placing and compacting methods may be employed only when approved by the Engineer.

H) Improper Backfill

1) When, in the opinion of the Engineer, excavation and trenches have been improperly backfilled, and when settlement occurs, reopen the excavation to the depth required, as directed by the Engineer.

2) Refill and compact the excavation or trench with suitable material and restore the surface to the required grade and condition.

3) Excavation, backfilling, compacting work and testing performed to correct improper backfilling shall be performed at no additional cost to the Owner.

I) Pipe Bedding & Blanket

| **Location (loose)/Compaction** | **Material/Thickness** | **Lifts** |
|---|---|---|
| **PIPE BLANKET** | | |
| DI & PVC water pipe, DI & PVC gravity pipe, DI & PVC force main and copper tubing | Sand/from springline of pipe to<br>to 12 inches above pipe | 6-inch lifts/<br>95 percent |
| RCP storm drain | Crushed Gravel/from springline of pipe to 12 inches above pipe | 6-inch lifts<br>95 percent |
| **PIPE BEDDING** | | |
| DI water pipe, DI force main, copper tubing and PVC water pipe | Sand/6 inches minimum below pipe to springline of pipe | Existing/<br>95 percent or equal to average density of undisturbed material |
| DI gravity piping, PVC gravity piping, and PVC force main | Crushed Gravel/6 inches min. below pipe to springline of pipe | 6-inch lifts/<br>95 percent |
| RCP storm drain | Crushed Gravel/6 inches min. below pipe to springline of pipe | Existing/<br>95 percent or equal to average density of undisturbed material |

| | | |
|---|---|---|
| All pipe in area of rock excavation | Crushed Gravel/6 inches min. below pipe to springline of pipe | 6-inch lifts/<br>95 percent |
| All pipe in area of unsuitable material excavation | Crushed Gravel/as required, 6-inches min. from excavation limits below pipe to springline of pipe | 6-inch lifts/<br>95 percent |

J) Filter Geotextile

1) During all periods of shipment and storage, geotextile shall be protected from direct sunlight, temperatures greater than 140 degrees F, water, mud, dirt, dust, and debris. The geotextile shall remain wrapped in heavy duty protective covering until use. After the protective covering has been removed, the geotextile shall not be left uncovered for longer than fourteen (14) days.

2) Geotextile shall be placed where shown on the Drawings. Geotextile shall overlap all adjacent geotextiles by a minimum of twelve (12) inches to provide a continuous geotextile layer under the backfill materials to be placed above. Geotextile shall be temporarily secured in a manner accepted by the Engineer prior to placement of overlying backfill materials.

3) Any geotextile that has defects, rips, holes, flaws, evidence of deterioration, or other damage shall be cause for rejection by the Engineer. Any geotextile that is torn or punctured shall be repaired or replaced as directed by the Engineer at no additional cost to the Owner. Repairs shall consist of a patch of the same type of geotextile placed over the failed areas and shall overlap the existing geotextile a minimum twelve (12) inches from any point of the rupture.

END OF SECTION

# SECTION 02276

# EROSION AND SEDIMENTATION CONTROL

## PART 1 – GENERAL

### 1.01 THE REQUIREMENTS:

A. Furnish all labor, equipment and materials required to complete all work associated with providing erosion and sedimentation control, grading, site grading and preparation of pavement and structure subgrade, and other related and incidental work as required to complete the work on the Drawings and specified herein.

B. It is anticipated that erosion control measures shall be set up at the start of construction, and maintained in place throughout the project, per the drawings and specifications.

### 1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. Section 02100 – Clearing and Grubbing

### 1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS:

A. Stormwater Management and Erosion and Sediment Control for Urban and Developing Areas in N.H. Handbook

B. NHDOT Guidelines for Temporary Erosion and Sediment Control and Stormwater Management

C. NPDES - Construction Site Stormwater Discharge Control: An Inventory of Current Practices

D. Guidelines for Erosion and Sediment Control, Planning and Implementation" and "Processes, Procedures and Methods to Control Pollution Resulting from all Construction Activity", published by the United States Environmental Protection Agency.

### 1.04 SUBMITTALS:

A. Two weeks prior to the start of work prepare and submit a plan for applying the temporary and permanent erosion and sedimentation control measures as shown on the Drawings. Construction work shall not commence until the schedule of work and the methods of operations have been reviewed and approved.

B. Submit Shop Drawings and information to show that filter fabric meets requirements.

C. Contractor's Storm Water Pollution Prevention Plan (SWPPP) in accordance with the requirements of EPA NPDES Stormwater Permit Program.

## 1.05 EROSION AND SEDIMENTATION CONTROL DEVICES:

A. All erosion and sedimentation control devices shall be incorporated into the work in accordance with the Stormwater Management and Erosion and Sediment Control for Urban and Developing Areas in N.H. Handbook and shall be constructed at the locations shown on the Drawings and conform to NHDOT Specifications.

B. Other devices and erosion control measures deemed necessary and acceptable to the Engineer shall be installed as required in accordance with the Stormwater Management and Erosion and Sediment Control for Urban and Developing Areas in N.H. Handbook.

C. The Contractor shall plan and execute all operations, particularly those associated with excavation and backfilling, in such a manner as to minimize the amount of excavated and exposed fill or other foreign material that is washed or otherwise carried into waterways. The water quality of waterways shall not be degraded due to construction operations. For the purposes of this Specification Section, the term waterways shall include all conveyance system taking drainage and runoff to an eventual waterway.

D. The Contractor's plan for siltation control shall be submitted to the Engineer for review and authorization to proceed prior to implementation.

E. Baled hay shall be placed to form temporary water stops, dams, diversions, dikes, berms and for other uses connected with water pollution control; bales shall be disposed of by the Contractor upon completion.

F. It is the intent of these Specifications to prevent the unnecessary occurrence of sedimentation or siltation of waterways and private properties. In the event the sedimentation or siltation prevention measures used by the Contractor prove to be inadequate as determined by the Owner and Engineer, the Contractor shall be required to adjust his operations to the extent necessary to prevent any such sedimentation or siltation from occurring.

G. The Contractor shall keep waterways clear of mud, silt, debris and other objectionable materials resulting from his construction operations.

H. Existing natural drainage patterns and vegetative cover shall be preserved to the maximum possible extent.

I. The Contractor shall use temporary vegetation and mulching to protect areas exposed during construction. He shall minimize the amount of bare earth exposed at any one time during construction, and he shall also minimize the length of time bare earth is exposed.

J. On sloping terrain, hay bales may be used to trap sediment until vegetation has become established. The details of their placement shall be as approved by the Engineer.

1.06 GUARANTEE:

A. All restoration and re-vegetation work shall be subject to a one-year guarantee period.

1.07 QUALITY ASSURANCE:

A. Use acceptable procedures, including the use of water diversion structures, ditches, settling basins and sediment traps.

B. Operations restricted to areas of work indicated on the Drawings.

C. If construction materials are washed away during construction, remove materials from fouled areas.

D. Engineer has the authority to limit surface area of erodible earth material exposed by clearing and grubbing, excavation, borrow and fill operations and to direct immediate permanent or temporary pollution control measures to prevent contamination of any stream or wetlands, including construction of temporary berms, dikes, dams, sediment basins and traps, slope drains and use of temporary mulches, mats or other control devices or methods as necessary to control erosion.

PART 2 PRODUCTS

2.01 MATERIALS:

A. Materials for use in erosion and sedimentation control devices shall be incorporated into the work in accordance with the Stormwater Management and Erosion and Sediment Control for Urban and Developing Areas in N.H. Handbook.

2.02 BIODEGRADEABLE SILTATION FENCE:

A. 8 ounce, 20 mesh seine weave burlap composite. Burlap is corn starched stiffened with natural additives for longevity (replaces typical black plastic silt fence). Fiber matting is aspen wood based excelsior fiber (replaces typical hay bale). Seam threads are 100 percent cotton. Reinforcement netting is biodegradable. Wood stakes are 42-inches in length with 1-1/8 inch thickness sewed into fence. A 6 inch flap on the bottom is provided to seal bottom edge to ground via trenching or stapling.

2.03 HAY BALES:

A. Hay bales shall consist of hay from acceptable grasses and legumes, free from weeds, reeds, twigs, chaff, debris, other objectionable material or excessive amounts of seeds and grain. It shall be free from rot or mold and the moisture content shall not exceed fifteen (15) percent by weight at the time of weighing. Individual bales shall be of a longitudinal shape not exceeding one hundred

(100) pounds when weighed. The hay shall be securely baled with biodegradable twine of adequate size to allow for possible rusting while in use and to permit rehandling when the bale is in a saturated condition.

B. Catch Basin Inlet Protection shall be provided during construction to prevent dirt laden runoff from entering and filling catch basins. Filter bags shall be woven geotextile fabric with frames as required to ensure they catch and treat all flow entering the catch basin grate. Filter bags shall be provided with lifting straps and shall be installed per the details on the contract drawings.

PART 3 – EXECUTION

2.04 INSTALLATION AND MAINTENANCE:

A. Installation of erosion and sedimentation control devices shall be accordance with manufacturer's instructions and the Stormwater Management and Erosion and Sediment Control for Urban and Developing Areas in N.H. Handbook.

B. Erosion and sedimentation control devices shall be established prior to or concurrent with the clearing operations in a given area. Where such practice is not feasible, the erosion and sedimentation control device(s) shall be established immediately following completion of the clearing operation.

C. Furnish the labor, materials and equipment required for routine maintenance of all erosion and sedimentation control devices. Maintenance shall be scheduled as required for a particular device to maintain the removal efficiency and intent of the device.

D. Provide temporary or permanent ground cover adequate to restrain erosion on all disturbed areas that will be left unworked for periods exceeding 14 days.

E. Erect biofence and maintain to the satisfaction of the Engineer until a vegetative ground cover has been established. Replacement of the biofence, if required by the Engineer, will be at the Contractor's expense. Upon completion of the work, remove all fencing in areas where a stand of grass has been established and erosion is no longer evident. Removal of the remainder of the fencing shall occur as other areas are established. Removal of any fencing shall be permitted only with the prior approval of the Engineer.

F. All streets around the construction area shall be scraped as necessary to prevent accumulation of dirt and debris.

G. The Contractor shall provide adequate means to prevent any sediment from entering any storm drains, curb inlets (curb inlet filter box), ditches, streams, or bodies of water downstream of any area disturbed by construction. Excavation materials shall be placed upstream of any trench or other excavation to prevent sedimentation at offsite areas. In areas where a natural buffer area exists between the work area and the closest stream or watercourse, this area shall not be disturbed.

END OF SECTION

NO TEXT ON THIS PAGE

# SECTION 02451

# FLAGGERS AND UNIFORMED OFFICERS FOR TRAFFIC CONTROL

## PART 1 - GENERAL

1.01 WORK INCLUDED:

A. This Section covers the provisions for furnishing Flaggers and Uniformed Officers for Traffic Control and Maintenance of to direct traffic through or around work as shown on the plans or as ordered by the Engineer.

1.02 DESCRIPTION:

A. The Contractor shall coordinate with the Engineer to determine the number of Flaggers and Officers deemed necessary to provide for public safety and to maintain a smooth flow of traffic through the construction area(s) affected.

1.03 RELATED WORK:

A. SECTION 01555, TRAFFIC CONTROL AND SIGNAGE

## PART 2 - PRODUCTS

2.01 UNIFORMED OFFICERS:

A. Contractor shall provide the Traffic Control Officer with a minimum of 24 hours notice indicating the time of day, street location and confirm number of officers required for traffic control. This shall be as agreed by the Engineer. The Contractor may furnish additional traffic control personnel at his/her own expenses but only those agreed upon by the Engineer will be measured for payment.

B. Contractor shall give the Traffic Control Officer a minimum of 2 hours prior cancellation notice should Contractor determine that due to weather or conditions beyond his control he would not need the scheduled officers.

C. Contractor shall pay for officer(s) at the prevailing rate established by the local police department should officers not be needed and the Contractor fails to cancel the officers as noted in 2.01.B above.

D. Where the Owner is paying directly for Uniformed Officers, the Contractor shall be responsible for payment of the wages paid to the Uniformed Officers if the Contractor fails to cancel the services of the Uniformed Officers in accordance with 2.01.B and 2.01.C above.

2.02 FLAGGERS:

A. Where allowable, flaggers shall be used for traffic control for the duration of the project.

Uniformed officers will be required for traffic control at the intersection of Allds and Burke Streets. All other traffic control shall be undertaken by flaggers licensed and trained per local, state and federal regulations.

PART 3 - EXECUTION

3.01 OPERATION:

A. Contractor shall provide barricades, barrier fences, traffic signs, and other traffic control devices as required by the Owner's Traffic Control Officer, or as directed by the Engineer, to protect traffic, pedestrians, and animals from the work area.

B. Contractor shall relocate barricades, signs and other devices as necessary as the work progresses as directed by the Owner's Traffic Control Officer or the Engineer.

C. Flaggers shall be provided with the necessary safety equipment.

END OF SECTION

# SECTION 02500

# CURBS AND INCIDENTAL ITEMS

## PART 1 - GENERAL

### 1.01 WORK INCLUDED

A. Furnish all materials and labor to construct or reset curbing, traffic signs, retroflective paint and thermoplastic pavement markings, replacing existing detector loop at Burke/Allds Streets, reset existing guardrail, and incidental items, as shown on the plans, details and as herein specified.

B. Extent of the work under this section includes furnishing and installing granite curb, traffic signs, painted lines, pavement markings and resetting existing guardrail. The extent of this work is shown on the drawings.

### 1.02 RELATED WORK SPECIFIED ELSEWHERE

A. All Division 1 Requirements

B. Section 02300 – EARTHWORK

C. SECTION 02514 - SIDEWALKS AND DRIVEWAY APRONS

D. Section 02745 - PAVING

### 1.03 STANDARD REFERENCE

A. Reference is made to items and paragraphs of the 2010 edition, with amendments of "Standard Specifications for Road and Bridge Construction", State of New Hampshire Department of Transportation. References in this section to these Standard Specifications bear the prefix "NHDOT".

### 1.04 SUBMITTALS

A. Curbing:

Shop drawings and details for vertical granite curbing shall be submitted to the Engineer for review and approval.

## PART 2 - PRODUCTS

### 2.01 MATERIALS

A. Curbing: Straight Granite Curb (Item 609.01) and Curved Granite Curb (Item 609.02) shall conform to NHDOT, Section 609, Curbs.

B. Traffic Signs: The Contractor shall furnish and install traffic signs, breakaway posts and miscellaneous hardware as shown on the plans and as specified in the Standard Specifications. Signs shall conform to the requirements of the "Manual of Uniform Traffic Control Devices" and NHDOT Section 615.

C. Temporary Pavement Markings: Once the asphalt binder pavement course has been installed, temporary pavement markings shall be installed for the winter shutdown as well as during construction segments waiting for the 90 day period before final paving. The temporary pavement markings shall be placed at locations where final pavement markings are shown on the project drawings.

D. Pavement area lines and pavement markings: Final painted pavement lines and markings shall meet the requirements of NHDOT Section 632- Retroreflective Pavement Markings. Retroreflective painted lines shall be NH 4.11 White Traffic paint or NH 4.12 Yellow Traffic paint as designated for traffic use and to conform to NHDOT, Section 708, Paints. School zone crosswalks shall have a red colored paint applied between the thermoplactic borders. Retroreflective thermoplastic pavement markings shall be extruded and shall conform to NHDOT Section 632- Retroreflective Pavement Markings, and shall be white. The specific locations and color are as shown on the project drawings.

E. All existing traffic signs shall remain in place unless directed to be removed by the Engineer. If the Contractor removes a sign to enable a construction activity, the sign shall be replaced as soon as practical to the original location. If during the construction a traffic sign is damaged or lost by the Contractor, the sign shall be replace in kind and shall be **incidental** to the overall project and shall not be paid for as a separate item.

F. Existing guardrail shall be reset using the existing materials.

G. Detector loop replacement materials conforming to NHDOT Section 616.

## PART 3 - EXECUTION

### 3.01 CURBING

A. Granite curbing shall be installed in accordance with NHDOT, Section 609, Curbs. Existing granite curbing shall be removed and reset where shown on the plans or as directed by the Engineer.

B. Surplus granite curb after the needs of the Project have been satisfied shall be delivered to the City at a location designated by the Engineer. Any curb not wanted by the City dhall be disposed of by the Contractor.

3.02 TRAFFIC SIGNS

A. Traffic signs of the type specified to be installed in locations as shown on the plans or as directed by the Engineer. Contractor shall install on posts as detailed on the plans. Traffic signs shall be plumb.

3.03 RETROFLECTIVE PAINT AND THERMOPLASTIC PAVEMENT MARKINGS

A. Apply lining retroreflective paint and thermoplastic pavement markings to paved areas as shown on the plans.

B. Cleaning: Sweep and clean surface to eliminate loose material and dust.

C. Color: White or Yellow (or Red – Cross walk at Arlington Street Only). Do not apply markings until layout and placement have been verified with Engineer.

3.04 GUARDRAIL

A. The existing guardrail shall be reset in place and shall conform to NHDOT Section 606. The height shall conform to NHDOT mounting height standards.

3.05 SIGNAL DETECTOR LOOP

A. The signal detector loop at Burke and Allds Streets shall be installed and connected to the existing loop feed.

3.06 MEASUREMENT AND PAYMENT

All work performed as described in this Section will be paid for under one or more of the payment items listed in Section 01270 - Measurement and Payment, and in the **BID SCHEDULE.** The payment items are intended to provide full payment for the work shown on the Contract drawings and specified herein. Any work called for or implied in the documents but not listed as a payment item shall be considered **incidental** to the overall project.

END OF SECTION

NO TEXT ON THIS PAGE

# SECTION 02514

# SIDEWALKS AND DRIVEWAY APRONS

## PART 1 - GENERAL

### 1.01 WORK INCLUDED:

A. Furnish all materials and labor to construct reinforced concrete and bituminous concrete sidewalks, driveway aprons and detectable warning panels in a concrete base as shown on the plans, details and as herein specified.

### 1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. All Division 1 Requirements

B. Section 02300 – EARTHWORK

C. Section 02745 - PAVING

### 1.03 STANDARD REFERENCE:

A. Reference is made to items and paragraphs of the 2010 edition, with amendments of "Standard Specifications for Road and Bridge Construction", State of New Hampshire Department of Transportation. References in this section to these Standard Specifications bear the prefix "NHDOT".

## PART 2 - PRODUCTS

### 2.01 MATERIALS:

A. All sidewalk materials shall meet the requirements of Section 608 of the Standard Specification for Road and Bridge Construction – NHDOT, latest edition.

B. Detectable Tactile Warning Surface shall be ADA Replaceable (Wet-Set) Composite Tactile (ADAREP) unit, 24” by 48” dimension or 24”x 60” dimension, and Tile color shall be “Federal Yellow”; as manufactured by ADA Solutions, Inc., P.O. Box 3, North Billerica, MA 01862 or approved equal. The concrete base (6” thick) shall be constructed to meet the

requirements for reinforced concrete sidewalks as specified in Section 608 of the Standard Specification for Road and Bridge Construction – NHDOT, latest edition.

PART 3 - EXECUTION

3.01 PERFORMANCE:

A. Bituminous sidewalks and reinforced concrete sidewalks shall be constructed in strict accordance with the details and typical sections of the plans and the construction requirements of Section 608 of the Standard Specification for Road and Bridge Construction – NHDOT, latest edition.

B. Concrete sidewalks and concrete base for Detectable Tactile Warning Surface shall be sealed with a protective coating in accordance with Section 534 and shall be reinforcement in accordance with Section 544.

C. Detectable Tactile Warning System shall be constructed in strict accordance with the manufacturer's recommendations and specifications. The warning surface shall be constructed of a single piece of the size shown on the plans.

3.02 MEASUREMENT AND PAYMENT:

All work performed as described in this Section will be paid for under one or more of the payment items listed in Section 01270 - Measurement and Payment, and in the **BID SCHEDULE.** The payment items are intended to provide full payment for the work shown on the Contract drawings and specified herein. Any work called for or implied in the documents but not listed as a payment item shall be considered **incidental** to the overall project.

END OF SECTION

# SECTION 02604

# UTILITY STRUCTURES

## PART 1 - GENERAL

### 1.01 THE REQUIREMENT:

A. Furnish all materials, labor, equipment, and tools required for the design, fabrication, delivery and installment of utility structures and appurtenances in accordance with the Drawings and as specified herein.

### 1.02 REFERENCE SPECIFICATIONS, CODES AND STANDARDS:

A. Without limiting the generality of the other requirements of the specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. Federal Specification No. SS-5-00210 - Gaskets

2. ASTM C478 - Specification for Precast Reinforced Concrete Manhole Sections

3. NHDOT Section 604 – Catch Basins, Drop Inlets and Manholes

### 1.03 SUBMITTALS:

A. Submit samples and/or Shop Drawings in accordance with Section 01300, Submittals.

B. Shop Drawings shall include, but not be limited to:

1. Complete layout and installation Drawings and schedules with clearly marked dimensions.

2. Material certificates on all piping materials.

3. Structural design calculations sealed by a P.E. registered in the State of New Hampshire. Design calculations for precast manholes and vaults shall include confirmation structures adequately resist flotation when they are totally empty and subjected to groundwater full height of structure.

4. Results of leakage test.

## PART 2 - PRODUCTS

### 2.01 PRECAST MANHOLES AND CATCH BASINS:

A. Precast utility structures shall be furnished with waterstops, sleeves and openings as noted on the Drawings. Box out for wall pipes shall conform accurately to the sizes and elevations of the adjoining pipes. Precast utility structures shall be watertight and conform to the requirements of ASTM C 478 with the following modifications there to:

1. Cement to be used in precast manholes and grout shall be ASTM C 150, Type II.

2. The date and name of manufacturer shall be marked inside each precast sections.

3. Minimum 28-day concrete strength shall be 4000 psi.

4. Manholes shall meet the following:

   a. Manhole section shall have an internal diameter of 4'-0", unless noted otherwise.

   b. Minimum manhole wall thicknesses shall be 5 inches for 4 foot and 5 foot diameter manholes, 6 inches for 6 foot diameter manholes and 7 inches for 7 foot diameter manholes.

   c. Manholes shall include ballast concrete and/or other means necessary to insure manholes resist flotation when empty and subjected to groundwater full height of structure.

   d. Precast manholes shall be as manufactured by CSI Concrete Systems, Oldcastle Precast, or approved equal.

5. No more than two lift holes may be cast or drilled in each section.

6. Dimensions shall be as shown on the Drawings.

7. Covers and frames shall be as specified in paragraph 2.07.

8. Mechanical Details such as piping, and other details shall be as shown on the Drawings.

B. Joints between riser sections and at base slabs shall be groove type.

C. Catch basins shall be of precast concrete, shall be provided with a minimum 4-foot deep sump, and shall meet all standards in NHDOT Standard Specifications.

D. Where shown on the drawings, catch basins shall be provided in the type or dimensions shown. Precast sections shall be used where available.

E. All new catch basins shall be provided with cast iron hoods. Cast iron hoods installed in new shall be Neenah Model R-3700 or approved equal. Hoods installed in existing catch basins shall be Neenah Model R-3705 or approved equal. Hoods installed in existing catch basins shall be per the detail shown on the contract drawings. All hoods shall be sized to suit the outlet pipe size.

F. Precast yard inlet shall be as shown on the contract drawings. Yard inlet shall be 2'x2' field inlet as manufactured by Oldcastle Precast, or approved equal.

2.02 STEPS:

A. None shall be provided.

2.03 JOINT SEALANT:

A. Joint sealant shall be a Preformed Flexible Compound conforming to the requirements of Federal Specifications SS-S-00210, "Sealing Compound, Preformed Plastic for Pipe Joints", Type I, Rope Form.

2.05 FLEXIBLE RUBBER SLEEVE:

A. The spring set type shall have a stainless steel interior power sleeve or expander and shall be the PSX assembly by Press-Seal Gasket Corporation, the Kor-N-Seal assembly by National Pollution Control Systems, or Lock Joint Flexible Manhole Sleeve by Interpace Corp.

B. The cast-in-place type shall conform to ASTM C923 and shall include stainless steel take up clamps.

C. Flexible seal assemblies shall permit at least an eight (8) degree deflection from the center line of the opening in any direction while maintaining a watertight connection.

2.06 RUBBER BLADDER:

A. The rubber bladder seal shall conform to ASTM C923 suitable for pressure testing at 10 psi minimum, with a 3/8 inch minimum wall thickness.

B. The rubber bladder seal shall contain an environmentally safe, anti-bacterial compound which turns into a high viscosity gel when in contact with pressurized water.

C. The rubber bladder seal shall be NPC Contour Seal by Kor-N-Seal, or equal.

2.07 COVERS AND FRAMES:

A. Cast Iron minimum Class 30 conforming to ASTM A48.

B. Manhole covers and frames shall meet the following requirements:

1. Castings to be free from scale, lumps, blisters and sandholes
2. Machine contact surfaces to prevent rocking.
3. Thoroughly clean and hammer inspect.
4. Clear opening shall be a minimum of 30 inches, unless otherwise indicated on the Drawings.
5. Covers for drain manholes shall the word “DRAIN” in 3-inch letters cast into the top surface.
6. Covers for sewer manholes shall the word “SEWER” in 3-inch letters cast into the top surface.
7. Capable of with standing AASHTO H-20 loading unless otherwise indicated or specified.
8. Watertight manhole frames and covers shall be suitable for 20 psi internal pressure and shall be Neenah Model R-1915, Type P or L or equal cast in place.
9. Non-watertight manhole covers shall be perforated and shall be Neenah Model R-1743, or equal.
10. Catch basin frames and grates shall be NHDOT Standard Type B frame and grate.
11. ADA catch basin frames and grates shall be US Foundry and MFG Corp Model 6001 or approved equal.

2.08 CONCRETE BALLAST:

A. Concrete ballast shall be Class B concrete in conformance with Section 03300, Cast-in-Place Concrete. Ballast shall be provided as necessary to insure manhole resists flotation when empty and subjected to full height groundwater conditions.

2.09 FLEXIBLE JOINT SEALER:

A. Flexible joint sealer shall be a rubber ring waterstop as manufactured by Fernco Joint Sealer Co., or equal.

PART 3 - EXECUTION

3.01 DESIGN CRITERIA:

A. Precast items subjected to vehicular traffic shall be designed for H-20 traffic loading. Other precast items shall be designed for a vertical live load of 300 psf.

B. Walls of precast items shall be designed for a vertical surcharge of 100 psf.

C. Precast manholes and vaults shall be designed to resist flotation when totally empty and subjected to groundwater full height of the manhole.

3.02 FABRICATION AND CASTING:

A. All base sections designated to receive concrete ballast and all electrical manholes shall extend monolithically a minimum of 6 inches beyond the outside face of the wall for the entire periphery. All other utility structures shall have a standard base.

B. Utility structures built around existing pipe shall have a cast-in-place base slab.

3.03 INSTALLATION:

A. Precast reinforced concrete sections shall be set so as to be vertical and with sections in true alignment.

B. Frames and covers or grates shall be set so that tops are at elevations indicated on the Drawings or flush with finished grade where no elevation is indicated.

C. Joints between riser sections shall be sealed with joint sealant.

D. All openings in utility structures that ductile iron or PVC pipes be connected to shall have flexible rubber sleeves sized to fit the connecting pipe and installed to provide watertight joints in accordance with the manufacturer's recommendations. The interior of the sleeve shall be filled with Class B concrete.

E. Openings that are too large for flexible rubber sleeves as well as all connections of Reinforced Concrete Pipe shall be made using hydrophilic water stops and non-shrink grout per the Contract Drawings.

F. All units shall be installed plumb and level.

G. All lift holes and joints shall be filled with non-shrink grout conforming to Section 03610, grout inside and out.

H. The manhole frames shall be set to their required elevations with two or three courses of brick masonry laid around the top of the upper wall section. Such brick work shall be given a 1-inch mortar coat on the inside and out.

I. Concrete ballast shall be placed so that it bears directly on the utility structure base against the outer wall monolithically encircling the structure for the full height indicated on the Drawings. Additional ballast may be required where the depth or elevation of the structure varies from the Drawings.

J. Connection to Existing Pipe

1. Verify the diameter and invert elevation of existing pipe to be connected to new utility structures prior to beginning work on the structures.

2. Provide adequate protection to prevent damage to the existing pipe.

3. Provide adequate means for plugging and/or transferring the existing flow in the pipe to allow for the construction of inverts and grouting.

4. Cut off the existing pipe sufficiently for connection to the new structure and remove.

5. Thoroughly clean all foreign matter and coat the pipe surface with epoxy adhesive where the pipe joins the new structure.

6. Install a flexible joint sealer around the pipe (or hydrophilic water stop and non-shrink grout as needed).

7. Grout inside and outside of wall penetration with nonshrink grout.

K. Backfill structures in accordance with Section 02200, Earthwork.

L. Clean all structures of any accumulation of silt, debris, or foreign matter and keep clean until final acceptance of the work.

M. Excavation shall conform to Section 02200, Earthwork.

N. Structure bases shall bear on a minimum of 8 inches of compacted stone unless otherwise indicated on the Drawings.

O. Channel Inverts

1. Inverts shall be placed using Class B concrete with forms sufficient to provide a smooth half-round shape as shown on the Drawings. Manhole bases employing full depth precast inverts are acceptable.

2. Where the slope of the line does not change through a manhole, a constant slope shall be maintained in the invert. Where slope changes occur within a given manhole, the transition shall be smooth and shall occur at the approximate center of the manhole.

3. Inverts shown on the Drawings are taken at the center of the manhole unless otherwise noted.

3.04 ADJUSTMENTS TO EXISTING UTILITY STRUCTURES:

A. Adjust structures as indicated on the Drawings using concrete or cast iron adjustment rings by approved methods.

3.05 ADJUSTING COLLARS AND FINAL ADJUSTMENTS:

A. Adjusting collars shall be as shown on the Drawings. Final adjustments shall be made so that the manhole ring and cover will be smooth and flush with the finished grade of the adjacent surface, or as otherwise indicated on the Drawings for manholes shown above grade.

3.06 ACCEPTANCE TESTING:

A. An Acceptance Test shall be conducted as specified below for all gravity sewer lines and their associated manholes. The test may be a water test, and air test, or a vacuum test.

B. Flushing – Refer to Section 15000 – Basic Mechanical Requirements for Flushing Testing.

C. Visual Inspection - Sewer lines shall be visually inspected from every manhole by use of mirrors, television cameras, or other devices for visual inspection, and the lines shall all exhibit a fully circular pattern when viewed from one manhole to the next. Lines which do not exhibit a true line and grade or have structural defects shall be corrected to meet these qualifications.

After all utilities, including curb and gutter have been installed; the DPW will request the Contractor to make a TV inspection of the sewer. Minimum preparation for TV inspection of outfall sewer requires that:

a) Suitable access shall be provided for TV equipment to be driven to each manhole.
b) All manholes and lines shall be cleaned prior to TV inspection.
c) All bulkheads in the area to be TV inspected shall be removed 48 hr prior to TV inspection, and replaced 48 hr following the inspection.

D. Leakage - Sewers shall be tested for leakage. The program of testing shall fit the conditions as mutually determined by the Engineer and the Contractor. The Contractor shall take all necessary precautions to prevent any joints from drawing while the sewers or their appurtenances are being tested. The Contractor shall, at his own expense, correct any excess leakage and repair any damage to the pipe and their appurtenances, or to any structures resulting from or caused by these tests.

E. Leakage Test Procedure - Each section of sewer shall be tested by closing the lower end of the sewer to be tested and the inlet sewer of the upper manhole with stoppers and filling the pipe and manhole with water to a point 6 feet above the crown of the open sewer in the upper manhole, or, if ground water is present, 6 feet above the sections average adjacent ground water level as indicated by a monitor well installed adjacent to each manhole. The line shall be filled with water prior to testing and allowed to stand until the pipe has reached its maximum absorption, but not less than two (2) hours. After maximum absorption has been reached, the head shall be re-established and tested for at least six (6) hours maintaining the head specified above by measured additions of water. The sum of these additions shall be the leakage for the test period.

If ground water is present to a height of at least 6 feet above the crown of the sewer at the upper end of the pipe section to be tested, the leakage test may be made by measuring the rate of infiltration using a suitable weir or other measuring device approved by the Engineer. Whether the test is made by infiltration or exfiltration, the allowable leakage shall not exceed 100 gallons per day per inch of diameter per mile of sewer being tested.

Where the actual leakage exceeds the allowable, the Contractor shall discover the cause and correct it before the sewer will be accepted. For the purpose of this subsection, a section of sewer is defined as that length of sewer between successive manholes or special structures or stubouts for future connections.

F. Low Pressure Compressed Air Test - If the leakage cannot be located by infiltration or exfiltration testing, this type test may be used. The pipeline shall be considered acceptable, when tested at an average pressure of 3.0 psi greater than the average back pressure of any groundwater that may submerge the pipe, if the section under test does not lose air at a rate greater than 0.0030 cfm per sq. ft. of internal pipe surface.

G. Deflection Test - No sooner than thirty (30) days after final backfill installation, each section of PVC pipe shall be checked for vertical deflection using an electronic deflecto-meter or a rigid "Go-No-Go" device. The method of testing procedure shall be as per ASTM D3034-856..

In Place PVC Pipe Deflection Testing – where soil conditions, installation procedures, or TV inspections warrant, manhole to manhole deflection testing may be required at the request of the County. Maximum allowable pipe deflection shall be 7 ½%.

Where the actual deflection exceeds the allowable, the Contractor shall discover the cause and correct it before the pipe will be acceptable. For the purpose of this subsection, a section of sewer is defined as that length of sewer between successive manholes or special structures or stubouts for future connections.

H. Cost of Testing and Repairs - Any and all work necessary to bring the line into conformance with the infiltration and deflection specifications shall be performed by the Contractor at no extra cost to the Owner. All apparent sources of infiltration and excessive deflection shall be repaired by the Contractor.

I. The Contractor shall provide all water, plugs, hoses, pumps, equipment, etc. necessary for the proper flushing and testing of the sewers.

END OF SECTION

# SECTION 02622

# POLYVINYL CHLORIDE GRAVITY

# SANITARY SEWER AND STORM DRAIN PIPE

## PART 1 - GENERAL

### 1.01 DESCRIPTION:

A. Furnish, install, and test PVC pipe and fittings for sanitary and storm gravity sewer piping as indicated and specified.

B. Where the word "pipe" is used it shall refer to pipe, fittings, connections, or appurtenances unless otherwise note.

### 1.02 RELATED WORK:

A. Section 02200 - EARTHWORK

### 1.03 SUBMITTALS:

A. Shop Drawings: Submit the following in accordance with Section 01300 - SUBMITTALS:

1. Submit shop drawings, product data sheets, and laying diagrams of all pipe, joints, bends, special fittings, and piping appurtenances.

2. Submit anticipated production and delivery schedule.

3. Submit manufacturer's certificates for all materials indicating conformance to the Contract Documents.

4. For informational purposes only, submit manufacturer's printed installation instructions.

5. Submit detailed testing procedures as specified.

### 1.04 QUALITY ASSURANCE:

A. Testing: All materials testing will be based upon applicable ASTM Test Methods and AWWA Standards referenced herein for the materials specified.

B. All costs of such inspection and tests shall be at no additional cost to the Owner.

C. Certificates: Manufacturer's notarized certificates of compliance shall be furnished by the Contractor.

D. The pipe shall be subjected to the specified hydrostatic strength tests, flexure tests, and crushing tests. The crushing tests shall be made on samples taken from the center of full-length sections of pipe.

PART 2- PRODUCTS

2.01 MATERIALS:

A. General

1. All PVC pipe shall be continuously and permanently marked with the manufacturer's name, pipe size, and pressure rating or stiffness in psi (kpa).

2. The Contractor shall also require the manufacturer to mark the date of extrusion on the pipe. This dating shall be done in conjunction with records to be held by the manufacturer for 2 years, covering quality control tests, raw material batch number, and other information deemed necessary by the manufacturer,

B. Pipe

1. All PVC pipe shall be joined by compression joints unless otherwise shown or specified, and shall conform to the following requirements:

a. Polyvinyl chloride pipe (PVC) shall conform to the requirements of ASTM D 3034, Class SDR 35. Material for PVC pipe shall conform to the requirements of ASTM D 1784 for Class 12454-B or 12454-C as defined therein. All diameters shall be as specified on the Contract Drawings.

3. Elastomeric seals for compression type joints for PVC pipe and fittings shall conform to the requirements of ASTM D 3212.

4. Service pipes for storm services shall be minimum of 8-inches and shall match diameter of existing services for reconnections. Service pipes for sanitary services shall be minimum of 6-inches and shall match diameter of existing, services for reconnections.

C. Fittings

1. All fittings shall conform to the requirements of ASTM D 3034 or ASTM F 679. The ring groove and gasket ring shall be compatible with PVC pipe ends. The flanged fittings shall be compatible with cast-iron or ductile iron pipe fittings.

2. The strength class of the fittings shall be not less than the strength class of any adjoining pipe.

3. PVC pipe fittings shall be full-bodied, either injection molded or factory fabricated. Saddle-type tee or wye fittings are not acceptable.

D. Connections

1. Sanitary services shall be connected to new, parallel or replacement sanitary sewer lines with full bodied tees or wye fittings.

2. Storm services shall be connected to new, parallel, or replacement storm sewer lines with full bodied tees or wye fittings for all pipes up to 18-inches in diameter. Connections to pipes larger than 18-inches in diameter or odd sizes shall be made with saddle tap connections, as approved by Engineer.

3. Connections of storm and sanitary service lines to existing storm and sanitary main lines shall be made with full bodied tees or wye fittings wherever possible for existing lines less than 18-inches in diameter and with tapping saddles as approved by Engineer for existing lines greater than 18-inches in diameter and in odd sizes.

4. Fernco type couplings shall be used to connect PVC pipe to existing clay, concrete, or pipes of types other than PVC.

E. Wall Penetration Seal

1. Shall be a modular mechanical type, consisting of interlocking sealing links of an elastomer such as ethylene propylene and diene monomer (EPDM) shaped to continuously fill the annular space between the pipe and wall sleeve. Links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and nut. After the seal assembly is positioned in the sleeve, tightening of the bolts shall cause the rubber sealing elements to expand and provide a watertight seal between the pipe and sleeve. The watertight seal shall be effective against a hydrostatic head of at least 40 feet. The seal shall also be constructed so as to provide electrical insulation between the pipe and wall, thus reducing chances of cathodic reaction between these two members. Metal hardware shall be 18-8 stainless steel. The seal shall be similar to the Link-Seal modular wall and casing seal manufactured by Thunderline Corporation or the equivalent by other manufacturers.

2. The Contractor shall be responsible for the selection of the required inside diameter of each wall opening or sleeve for each pipe and

the correct sizing of seal and shall provide to the Engineer schedule of proposed uses indicating pipe material, type of services, pipe size, sleeve size and appropriate link seal, model, type and location. The Contractor is to coordinate pipe and sleeve sizes with the appropriate link seal model.

F. Bedding Materials

1. Unless otherwise specified or shown, all material used for pipe bedding shall conform to the requirements in Section 02200 - EARTHWORK

G. Gaskets

1. Gaskets shall be flexible elastomeric rings conforming with ASTM F477.

H. Acceptance of Pipe

1. Acceptance will be on the basis of tests specified hereinbefore, The quality of all materials used in the pipe, the process of manufacture, and the finished pipe shall be subject to review by the Engineer. Inspection may be made at the place of manufacture, or on the work site after delivery or at both places and the pipe shall be subject to rejection at any time on account of failure to meet any of the specification requirements, even though sample pipe units may have been accepted as satisfactory at the place of manufacture. All pipe which is rejected shall be immediately removed from the project site by the Contractor.

2.02 DELIVERY AND STORAGE:

A. Arrange for the delivery of the pipe sections at approved locations in the vicinity of the location in which the pipe sections are to be laid. Pipe shall be stored in an approved orderly manner so that there will be a minimum of handling from the storage area into the final position in the work, and so that there is a minimum of obstruction and inconvenience to any kind of traffic. Deliveries shall be scheduled so that the progress of the work is at no time delayed, and also so that large quantities of pipe shall not be stored on area's over structures of utilities which might be damaged by the superimposed load, and storage of pipe will be restricted to approved or permitted areas. Pipe shall be strutted, if necessary, for proper protection of the pipe during storage or handling. When unit packages of PVC pipe are stacked, ensure that the weight of upper units does not cause deformation to pipe in lower units. Pipe shall be handled and stored in such a manner and by such means as recommended by the pipe manufacturer, and so that the pipe, including the interior pipe, will not be damaged.

PART 3 - EXECUTION

3.01 GENERAL:

A. Installation

1. Each pipe unit shall be inspected before being installed. No single piece of pipe shall be laid unless it is generally straight. The centerline of the pipe shall not deviate from a straight line drawn between the centers of the openings at the ends of the pipe by more than 1/16-inch per foot of length. If a piece of pipe fails to meet this requirement for straightness, it shall be rejected and removed from the site. Any pipe unit or fitting discovered to be defective either before or after installation shall be removed and replaced with a sound unit.

2. No pipe or fitting shall be permanently supported on saddles, blocking, or stones. Crushed stone shall be as specified in Section 02200 - EARTHWORK.

3. Suitable bell holes shall be provided, so that after placement, only the barrel of the pipe receives bearing pressure from the supporting material. Special care shall be taken to hold the trench width at the crown of the pipe to the maximum indicated on the Trench Detail included in the Details Section of these specifications.

4. All pipe and fittings shall be cleared of all debris, dirt, etc., before being installed and shall be kept clean until accepted in the completed work.

5. Pipe and fittings shall be installed to the lines and grades indicated on the Drawings. Care shall be taken to ensure true alignments and gradients.

6. Before any joint is made, the previously installed unit shall be checked to assure that a close joint with the adjoining unit has been maintained and that the inverts are matched and conform to the required grade. The pipe shall not be driven down to the required grade by striking it with a shovel handle, timber or other unyielding object.

7. All joint surfaces shall be cleaned. Immediately before joining the pipe, the bell or groove shall be checked to see that the rubber ring is properly seated. Apply lubricant to the spigot end only, paying particular attention to the bevel, in accordance with the manufacturer's recommendation. Each pipe unit shall then be carefully pushed into place without damage to pipe or gasket. Suitable devices shall be used to force the pipe units together so

that they will fit with minimum open recess inside and outside and have tightly sealed joints. Care shall be taken not to use such force as to wedge apart and split the bell or groove ends. Joints shall not be "pulled" or "cramped" unless permitted by the Engineer.

8. Where any two pipe units do not fit each other closely enough to enable them to be properly jointed, they shall be removed and replaced with suitable units and new gaskets.

9. Details of gasket installation and joint assembly shall follow the directions of the manufacturers of the joint materials and of the pipe, all subject to review by the Engineer. The resulting joints shall be watertight and flexible.

10. All pre-molded gasket joint polyvinyl chloride pipe of a particular manufacturer may be rejected if there are more than five unsatisfactory joint .assembly operations or "bell breaks" in 100 consecutive joints, even though the pipe and joint conform to the appropriate ASTM Specifications as hereinbefore specified. If the pipe is unsatisfactory, as determined above, the Contractor shall, if required, remove all pipe of that manufacturer of the same shipment from the work and shall furnish pipe from another manufacturer which will conform to all of the requirements of these specifications.

11. Open ends of pipe and branches shall be closed with polyvinyl chloride stoppers secured in place in an acceptable manner.

12. After each pipe has been properly bedded, enough crushed stone shall be placed between the pipe and the sides of the trench, and thoroughly compacted, to hold the pipe in correct alignment. Bell holes, provided for jointing, shall be filled with crushed stone and compacted, and then crushed stone shall be placed and compacted to complete the pipe bedding.

13. The Contractor shall take all necessary precautions to prevent flotation of the pipe in the trench, At all times pipe installation is not in progress, the open ends of the pipe shall be closed with temporary watertight plugs, or by other acceptable means,

14. If water is in the trench when work is to be resumed, the plug shall not be removed until suitable provisions have been made to prevent water, earth, or other substances from entering the pipe, Pipelines shall not be used as conductors for trench drainage during construction. Install PVC pipe and fittings in accordance with manufacturer’s printed instructions.

B. Allowable Pipe Deflection

1. Pipe provided under this Specification shall be so installed as to not exceed a maximum deflection of 5.0 percent. Such deflection shall be computed by multiplying the amount of deflection (nominal diameter less minimum diameter when measured) by 100 and dividing by the nominal diameter of the pipe.

2. Upon completion of a section of pipe, including placement and compaction of backfill, the Contractor shall measure the amount of deflection by pulling a specially designed gage assembly through the completed section. The gage assembly shall be in accordance with the recommendations of the pipe manufacturer, and be reviewed by the Engineer. The section of pipe must be placed and backfilled for a minimum of 90 days before the deflection can be measured.

3. Should the installed pipe fail to meet this requirement, the Contractor shall do all work to correct the problem without additional compensation.

C. Cleaning

1. Care shall be taken to prevent earth, water and other materials from entering the pipeline. As soon as possible after the pipe and manholes are completed, the Contractor shall clean out the pipeline and manholes being careful to prevent soil, water and debris from entering any existing pipe.

D. Testing of Pipe

1. If the visual inspection of the completed pipe or any part thereof shows any pipe, manhole or joint which allows infiltration of water in a noticeable stream or jet, the defective work or material shall be replaced or repaired as required.

2. After completing installation and backfill of pipe, the Contractor shall, at his expense, conduct a line acceptance test using low pressure air.

3. Equipment used shall meet the following minimum requirements: Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be inspected; Pneumatic plugs shall resist internal test pressures without requiring external bracing or blocking; All air used shall pass through a single control panel.

4. Three individual hoses shall be used for the following connections.

   a. From control panel to pneumatic plugs for inflation.

b. From control panel to sealed line for introducing the low pressure air.

c. From sealed line to control panel for continually monitoring the air pressure rise in the sealed line.

5. All pneumatic plugs shall be seal tested before being used in the actual test installation. One 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 per plug manufacturer's requirements, The sealed pipe shall be pressurized to 5 psig. The plugs shall hold against this pressure without bracing and without movement of the plugs out of the pipe.

6 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 installed in the line at each manhole and in accordance with the plug manufacturer's requirements. Low pressure air shall be introduced into this sealed line until the internal air pressure reaches 4 psig greater than the average back pressure of any groundwater that may be over the pipe. At least two minutes shall be allowed for the air pressure to stabilize.

7. 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 the average back pressure of any groundwater that may be over the pipe) is not less than the time shown for the given diameter in the following table:

| Pipe Diameter | Specification Time for Length Shown (min:sec) | | | |
|---|---|---|---|---|
| Inches | 100 ft. | 200 ft. | 300 ft. | 400 ft. |
| 6 | 5:40 | 5:40 | 5:40 | 5:42 |
| 8 | 7:34 | 7:34 | 7:36 | 10:08 |
| 10 | 9:26 | 9:26 | 11:52 | 15:49 |
| 12 | 11:20 | 11:24 | 17:05 | 22:47 |
| 15 | 14:10 | 17:48 | 26:42 | 35:36 |
| 18 | 17:00 | 25:38 | 38:27 | 51:16 |
| 21 | 19:50 | 34:54 | 52:21 | 69:48 |
| 24 | 22:47 | 45:34 | 68:22 | 91:10 |

8. In areas where groundwater is known to exist, the Contractor shall install a 1/2-inch diameter capped pipe nipple, approximately 10-inches long, through the manhole wall adjacent to one of the sewer lines entering the manhole. This shall be done at the time the 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 of water over the invert of the pipe shall be taken after the water has stopped rising in this plastic tube. 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 water is 11-1/2 feet, then the added pressure will be 5 psig. This increases the 3.5 psig to 8.5 psig, and the 2.5 psig to 7.5 psig. The allowable drop of one pound and the timing remain the same). In no case shall the starting pressure exceed 9.0 psig.

9. If the Contractor is unable to pass a pressure test because lines are "live", the Contractor shall perform closed circuit television inspections of the lines at no additional cost to the Owner. The Engineer must be able to witness the tests and must be provided with a video recording of each test for further inspection.

E. Test Failure

1. If the section of pipe fails to pass the leakage and pressure test, or if there is any visible leakage, the Contractor shall locate, uncover and repair or replace the defective pipe fitting or joint and retest all at his own expense. Pipe will be considered passing only when the leakage does not exceed the above standard. Passing the test does not absolve the Contractor from his responsibility if leaks develop later within the period of warranty.

END OF SECTION

NO TEXT ON THIS PAGE

# SECTION 02629

# RESETTING OF SEWER OR DRAINAGE CASTINGS

## PART 1 - GENERAL

### 1.01 WORK INCLUDED:

This Section covers raising, lowering and/or resetting of manhole frames and covers or catch basin frames and grates. The work includes raising, lowering, resetting, and/or adjusting of structures to line and grade of finished pavement surface. New manhole frames and covers, or catch basin frames and grates are to be provided by the Contractor as detailed on the Project plans.

### 1.02 RELATED WORK

A. All Division 1 Requirements

B. Section 02745, Paving

C. Section 02800, Manhole Rehabilitation

## PART 2 - PRODUCT

### 2.01 SEWER OR DRAIN FRAME AND COVER OR CATCH BASIN FRAME AND GRATE:

A. All existing and proposed frames and covers, and frames and grates shall be reset. The plans have identified where new frames and covers, or frames and grates are to be provided by the Contractor for sewers and drain structures on the project.

B. Catch basin frames and grates shall be NHDOT Type B cast iron as detailed on the plans.

C. Drain and sewer manhole frames and covers shall be 30” diameter conforming to the requirements of the “Standard Specifications for Sewers and Drains” latest revisions.

D. Masonry work shall conform to the latest edition of the Standard Specifications for Sewers and Drains, City of Nashua.

## PART 3 - EXECUTION

### 3.01 RAISING AND OR RESETTING OF SEWER OR MANHOLE FRAME AND COVER OR CATCH BASIN FRAME AND GRATE:

A. In all new or overlay bituminous pavement areas, all sewer and drainage manhole castings shall be raised to the proper finish grade where indicated on the contract drawings or as directed by the Engineer.

B. Cut around manhole castings a minimum of 8-inches from casting. Excavate and remove old masonry to such a depth as directed by the Engineer and rebuild masonry below the bottom of the casting. Backfill excavation with crushed gravel and compact. Place high, early strength concrete or bituminous concrete collar, as directed, to approximately 1-1 /2 inches below the raised casting grade, or in accordance with the details on the plans..

C. The Contractor shall provide a top course approximately 1-1/2-inches thick and shall match existing surrounding grades and pavement materials. The Contractor shall provide a watertight seal between the masonry work and the casting.

3.02 MEASUREMENT AND PAYMENT:

A. All work performed as described in this Section will be paid for under one or more of the payment items listed in Section 01270 - Measurement and Payment, and in the **BID SCHEDULE.** The payment items are intended to provide full payment for the work shown on the Contract drawings and specified herein. Any work called for or implied in the documents but not listed as a payment item shall be considered **incidental** to the overall project.

END OF SECTION

# SECTION 02650

# SEWER LINE CLEANING

## PART 1 – GENERAL

### 1.01 SCOPE OF WORK:

A. Furnish all labor, materials, equipment and incidentals required to clean all sewer pipe and fittings installed and/or rehabilitated, as specified herein.

B. Cleaning shall include the proper high pressure water jetting, rodding, snaking, bucketing, brushing and flushing of sewers, and manholes prior to inspection by closed circuit television, pipeline rehabilitation or replacement, point repairs, manhole preparation, and testing operations.

C. Cleaning shall dislodge, transport and remove all sludge, mud, sand, gravel, rocks, bricks, grease, roots, sticks, and all other debris from the interior of the sewer pipe and manholes as required for pipeline rehabilitation.

## PART 2 – PRODUCTS

### 2.01 MATERIALS:

A. Hydraulically Propelled Sewer Cleaning Equipment

1. Hydraulically propelled sewer cleaning equipment shall be the movable dam type constructed such that a portion of the dam may be collapsed during cleaning to prevent flooding of the sewer.

2. The movable dam shall be the same diameter as the pipe being cleaned and shall provide a flexible scraper around the outer periphery to ensure total removal of grease.

3. Contractor shall take precautions against flooding prior to using sewer cleaning balls or other such equipment that cannot be collapsed instantly.

B. High Velocity Hydro-Cleaning Equipment shall have the following:

1. A minimum of 500-ft of high pressure hose.

2. Two or more high velocity nozzles capable of producing a scouring action from 15 to 45 degrees in all size lines to be cleaned.

3. A high velocity gun for washing and scouring manhole walls and floor.

4. Capability of producing flows from a fine spray to a long distance solid stream.

5. A water tank, auxiliary engines and pumps and a hydraulically driven hose reel.

6. Equipment operating controls located above ground.

C. Mechanical cleaning equipment for sewer mains shall be either power buckets or power rodders by the Sewer Equipment Company of America or equal.

1. Bucket machines

    a. Be furnished with buckets in pairs

    b. Use V-belts for power transmission or have an overload device. No direct drive machines will be permitted.

    c. Be equipped with a take up drum and a minimum of 500-ft of cable.

    d. Have sufficient dragging power to perform the work efficiently.

2. Power rodding machine

    a. Either sectional or continuous.

    b. Hold a minimum of 750-ft of rod.

    c. The machine shall have a positive rod drive to produce 2000 pounds of rod pull.

D. Root Cutting

    a. The contractor will be required to cut root intrusions throughout the interceptor at various locations, specifically between manholes 1375 and 1375 and manholes 1380 and 1237.

    b. Root cutting equipment shall be provided. Cutting shall be undertaken such that no structural damage to the existing interceptor results.

    c. The contractor shall ensure that cut roots are not allowed to travel down the interceptor. Roots shall be removed from the interceptor and properly disposed of.

## PART 3 - EXECUTION

### 3.01 PERFORMANCE:

A. Selection of cleaning equipment shall be based on the conditions of the manholes and lines at the time the work commences based on the pre-construction CCTV inspection to be conducted by the Contractor under this

Contract.

B. Use properly selected equipment to remove all dirt, grease, rock and other deleterious materials and obstructions.

C. Protect existing sewer lines from damage caused by improper use of cleaning equipment.

D. Take precautions to avoid damage or flooding to public or private property being served by the line being cleaned.

E. Use sewage flow in the sewer lines to provide necessary pressures for hydraulic cleaning devices whenever possible.

F. Removal of Materials

1. Remove all solids and semi-solids at the downstream manhole of the section being cleaned.

2. Passing material from one section of a line to another will not be permitted.

G. Remove from the site and properly dispose of all solids or semi-solids recovered during the cleaning operation.

H. No sewer cleaning shall take place in a particular sewer segment until all upstream pipe segments have been cleaned. If cleaning is done in a downstream pipe segment in order to facilitate overall cleaning operations, the segment shall be re-cleaned at no additional cost, after all pipes upstream of that segment have been cleaned.

3.02 FIELD QUALITY CONTROL:

A. Acceptance of this portion of the work shall be dependent upon the results of the television inspection. Lines not acceptably clean as to permit television inspection and rehabilitation shall be re-cleaned and re-inspected at no additional cost to the Owner.

3.03 FINAL SEWER CLEANING:

A. Prior to final inspection and acceptance of each manhole-to-manhole section of the sewer system by the Engineer, the sewer shall be cleaned. Remove all accumulated construction debris, rocks, gravel, sand, silt and other foreign material from the sewer system. Once the large debris is removed, the sewer shall be flushed.

B. Following final cleaning, the Contractor shall inspect each manhole-to-manhole section in accordance with Specifications Section 2651 – Television Inspection.

C. Upon the Engineer's final manhole-to-manhole inspection of the sewer system, if any foreign matter is still present in the system, clean the sections and portions of the lines as required.

D. Place the new line in service as soon as is practical after acceptance by the Engineer.

END OF SECTION

# SECTION 02651

# TELEVISION INSPECTION

## PART 1 – GENERAL

### 1.01 SCOPE OF WORK:

A. Furnish all necessary labor, materials, equipment, services and incidentals required to visually inspect by means of closed-circuit television (CCTV) designated sewer line sections, including, but not limited to, recording and playback equipment, materials and supplies.

B. The inspection shall be performed on one sewer line section (i.e. manhole to manhole) at a time. The section being inspected shall be suitably isolated from the remainder of the sewer system.

C. Video recordings shall be made of the television inspections and copies of both the recordings and printed inspection logs shall be supplied to the Owner.

D. Contractor may have to perform point repairs, remove obstructions or remove protruding service connections to complete pre-rehabilitation TV inspection.

E. Each new sanitary sewer segment installed by open cut shall be inspected by CCTV conducted by FSD as part of the acceptance process, following backfill and compaction. If the Contractor elects to perform CCTV inspection prior to FSD inspection it shall be at his own cost.

## PART 2 – PRODUCTS

### 2.01 EQUIPMENT:

A. The television camera used for sewer main inspection shall be one specifically designed and constructed for such inspection. Lighting for the camera shall be suitable to allow a clear picture for the entire periphery of the pipe. The camera shall be operative in 100 percent humidity conditions. The camera, television monitor and other components of the video system shall be capable of producing a minimum 500-line resolution color video picture. Picture quality and definition shall be to the satisfaction of the Engineer and if unsatisfactory, inspection shall be performed again with the appropriate changes made as designated by the Engineer at no additional cost to the Owner. The television inspection equipment shall have an accurate footage counter that shall display on the monitor, the exact distance of the camera from the centerline of the starting manhole.

## PART 3 – EXECUTION

### 3.01 PROCEDURE:

A. The camera shall be moved through the sewer main in either direction at a uniform rate, stopping when necessary to ensure proper documentation of the sewer's condition but in no case will the television camera be pulled at a speed greater than 30 fpm. Manual winches, power winches, TV cable and powered rewinds or other devices that do not obstruct the camera view or interfere with proper documentation of the sewer conditions shall be used to move the camera through the sewer line. If, during the inspection operation, the television camera will not pass through the entire sewer line section, the equipment shall be removed and repositioned in a manner so that the inspection can be performed from the opposite manhole. All set-up costs for the inspection shall be included in the unit prices bid. If, again, the camera fails to pass through the entire section, the Contractor shall perform point repairs as required on the Drawings, remove or cut protruding service connections, or re-clean or further remove roots or blockage at no additional cost to the Owner.

B. Whenever non-remote powered and controlled winches are used to pull the television camera through the line, telephones, radios, or other suitable means of communication shall be set up between the two manholes of the sewer line being inspected to ensure that good communications exist between members of the crew.

C. Measurement for location of defects shall be above ground by means of a meter device. Marking on cable, or the like, which would require interpolation for depth of manhole, shall not be allowed. Measurement meters shall be accurate to two-tenths of a foot over the length of the sewer line section being inspected. Accuracy of the measurement meters shall be checked daily by use of a walking meter, roll-a-tape, or other suitable device, and the accuracy shall be satisfactory to the Owner's representative.

D. The camera height shall be adjusted such that the camera lens is always centered (1/2 □I.D. or higher) in the pipe being televised. Flow shall be controlled such that depth of flow shall not exceed 20% of pipe's diameter.

E. Lighting system shall be adequate for quality pictures.

3.02 RECORDING OF FIELD OBSERVATIONS:

A. Television Inspection logs

B. Printed location records shall be kept which shall clearly show the location, in relation to adjacent manholes, of each source of infiltration discovered. In addition, other data of significance including the locations of building and house service connections, along with an estimation of infiltration from such services, joints, unusual conditions, roots, storm sewer connections, cracked or collapsed sections, presence of scale and corrosion, sewer line sections that the camera failed to pass through and reasons for the failure and other discernible features shall be recorded and annotated using the PACP system and a copy of such records shall be supplied to both the Owner and the Engineer.

C. Recordings shall be made after cleaning of the pipe, noting all lateral connections within the interceptor, and demonstrating that the cleaning process has been successful. A full recording shall be made after lining demonstrating that the liner has been installed in a satisfactory manner, and that all existing lateral connections have been re-established.

D. The pre-lining inspection of the cleaned pipe shall serve as the contractor's baseline for lateral information. Previous video inspection recordings may be used for contractor's information, but shall not be considered by the contractor to be current and/or accurate.

E. Digital Recordings

1. The purpose of digital recording shall be to supply a visual and audio record of areas of interests of the pipe segments that may be replayed by the Owner. Digital recording playback shall be at the same speed that it was recorded and shall be made in color. The Contractor shall be required to have all digital media and necessary playback equipment readily accessible for review by the Owner/Engineer during the project.

2. The Contractor shall perform CCTV inspection of each newly installed or rehabilitated pipe segment (manhole to manhole) after testing and before re-introducing any sewage flow into the pipe. Each test shall be witnessed by the Engineer and/or Owner.

3. The Contractor shall record each CCTV inspection on a DVD and submit such recordings to the Engineer as a prerequisite for Partial Utilization/Substantial Completion.

4. CCTV inspections shall be performed after all backfill has been placed and final grades have been established, and after all manhole and pipe testing has been performed and approved by the Engineer.

5. CCTV inspections shall be performed by a PACP certified and trained person.

6. Inspections shall include narration that notes the location and type of defects, if any.

7. At the completion of the project, the Contractor shall furnish all of the original digital recordings to the Owner. Each disc shall be labeled as to its contents. Labels shall include the disc number, date televised, sewer segment reach designation, street location, and manhole numbers on the disc. The Contractor shall keep a copy of the discs for 30 days after the final payment for the project, at which time the discs may be erased at the Contractor’s option.

END OF SECTION

NO TEXT ON THIS PAGE

# SECTION 02730

# SECTIONAL CURED-IN-PLACE PIPE LINING

## PART 1 - GENERAL

### 1.01 SCOPE OF WORK:

A. Provide all labor, materials, accessories, equipment, and tools required for the rehabilitation of sections of existing pipelines by the installation and testing of a resin-impregnated flexible tube which shall be formed to the original pipeline and cured to produce a continuous and tight-fitting sectional Cured-In-Place Pipe (CIPP) lining as shown on the Drawings and as specified herein. The CIPP liner shall be designed for a gravity wastewater application.

B. The finished sectional pipe liner shall be fabricated from materials which, when installed, shall be chemically-resistant to withstand exposure to domestic sewage and shall restore the structural integrity of the pipe section.

### 1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. Section 01300 – Submittals

B. Section 02600 – Wastewater Flow Control

C. Section 02650 – Sewer Line Cleaning

D. Section 02720 – Excavated Point Repair (Pipe and Tap Connections)

E. Section 02731 – Sanitary Sewer Television Inspection

### 1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS:

A. Without limiting the generality of the other requirements of the Specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. ASTM D790 — Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials

2. ASTM F1216 Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube

1.04 DELIVERY, STORAGE, AND HANDLING:

A. Care shall be taken in shipping, storage, and handling to avoid damaging the liner.

B. All material shall be shipped, stored, and handled in conformance with the manufacturer's requirements and recommendations.

1.05 WARRANTY:

A. All lining work shall be warranted by the applicator and/or manufacturer against failure for a minimum of two (2) years after acceptance by the Owner; in no case shall the warranty be less than the manufacturer's published standard warranty period. If any such failure occurs within the warranty period, the damage shall be repaired by the Contractor in a manner satisfactory to the Owner at no cost to the Owner within 60 days after written notification of the failure.

1.06 SUBMITTALS:

A. Shop Drawings: The Contractor shall submit the following in accordance with the requirements set forth in Section 01300 – Submittals:

1. Design calculations

2. Resin physical and chemical properties

3. Manufacturer's installation instructions

4. MSDS sheets

1.07 QUALIFICATIONS:

A. The qualifications of the Contractor shall be submitted with the Bid Proposal. These qualifications shall include detailed descriptions of the following:

1. Name, business address, and telephone number of the Contractor

2. Name(s) of all supervisory personnel that will be directly involved in the Project

3. Proposed product information showing compliance with the specified requirements listed herein, including liner material and resin

4. Documentation of certification of specialty technicians by the equipment

manufacturer and/or its authorized representative

5. A reference list of previous projects on which the Contractor and/or installer has installed sectional CIPP linings over the last four (4) years, including project name, project number, customer name, owner's contact information (name and phone number), and the number of sectional liners installed

6. To be acceptable, the Contractor/installer must have had a minimum of 400 sectional liner installations and a minimum of two (2) years of active experience in the commercial installation of the product.

7. The Contractor shall sign and date the information provided and certify that, to the extent of his knowledge, the information is true and accurate and that the supervisory personnel will be directly involved with and used on the Project. Substitutions of personnel and/or methods will not be allowed without prior written authorization by the Owner and/or Engineer.

## PART 2 - PRODUCTS

### 2.01 GENERAL:

A. The finished liner shall be fabricated from material as specified herein which, when cured, shall be chemically-resistant to the corrosive effects of the raw sewage and hydrogen sulfide. The sectional CIPP lining shall be the Sectional Point Repair system as manufactured by LMK Technologies, Perma-Liner Industries, or Engineer-approved equal.

B. See Sectional Liner detail and Sectional Liner at Manhole Interface detail on Drawing D01.

### 2.02 LINER SIZING:

A. The liner shall be fabricated to a size that, when installed, shall neatly fit the internal diameter of the pipeline to be repaired.

B. The Contractor shall verify the lengths in the field before cutting liner to length.

C. The minimum length shall be 8 feet for 8-inch to 12-inch diameter pipe. For 15-inch to 21-inch diameter pipe, a longer sectional liner may be required.

D. The sectional liner shall extend a minimum of 18 inches past the first non-defective joints and a minimum of 6 inches past any lateral cut reinstatements.

E. For rehabilitation of pipe sections at terminal points of pipe located adjacent to a manhole or other access structure, care shall be taken to ensure that the liner extends past the

opening of the pipe and into the manhole or access structure. This extended section of liner shall be removed by the use of appropriate cutting tools once the liner has cured. The end of the liner shall be ground down such that it extends approximately 3 inches into the manhole, and non-shrink grout shall be used to create a fillet between the liner and the wall of the manhole.

2.03 LINER MATERIAL:

A. The liner shall be one-piece and shall consist of one or more layers of flexible needled felt or an equivalent non-woven material. The liner shall be continuous in length, and the wall thickness shall be uniform. No overlapping sections shall be allowed in the circumference or the length of the lateral liner. The tube shall be capable of conforming to offset joints, bells, and disfigured pipe sections. The liner shall be flat with one end overlapping the second end and shall be sized accordingly to create a circular lining equal to the diameter of the mainline pipe. The resin shall be selected with proper consideration for the specific application. The sectional CIPP liner shall result in a smooth bore interior after installation. A report documenting the design criteria for a fully deteriorated pipe section, relative to the hydrostatic pressures, depth of soil cover, and type of soil, shall be submitted to the Engineer for each installation. The cured pipe repair system shall be watertight, shall conform to the existing pipe, and shall eliminate any leakage or connection to the outside of the host pipe/service.

B. The composite of the previously-listed materials shall, upon installation inside the host pipe, exceed the following ASTM test standards at a minimum:

| Item | Test Value | Reference Standard |
|---|---|---|
| Flexural Strength | 5,000 psi | ASTM D790 |
| Flexural Modulus | 400,000 psi | ASTM D790 |

2.04 LINER DESIGN:

A. The minimum required structural CIPP wall thickness shall be based on the physical properties previously described and shall be in accordance with the design equations in the appendix of ASTM F1216 and the following design parameters:

| | |
|---|---|
| Design Safety Factor | 2.0 |
| Retention Factor for Long-Term Flexural Modulus for Design | 50 percent |
| Ovality* | 2 percent |
| Groundwater Depth = Pipe Depth (above invert)* | ____ feet |
| Soil Depth (above crown)* | ____ feet |
| Soil Modulus | 1,000 psi |
| Soil Load | 120 pcf |
| Live Load | One AASHTO H-20 Truck |

| | |
|---|---|
| Design Condition | Fully-Deteriorated |

**Denotes information which can be provided here or in inspection video tapes or project construction drawings. Multiple line segments may require a table of values.*

B. The lining manufacturer shall submit complete design calculations for the liner, signed and sealed by a Professional Engineer registered in the State of Alabama and certified by the manufacturer as to the compliance of his materials to the values used in the calculations, to the Engineer for review.

C. Liner shall be neither accepted nor installed until design calculations are acceptable to the Owner and Engineer.

## PART 3 – EXECUTION

### 3.01 GENERAL:

A. The sectional lining procedure shall be performed in strict accordance with the manufacturer's current guidelines. If any deviations from the guidelines are proposed, Contractor shall submit explanation and approval from liner manufacturer.

B. If chemical or structural grouting is shown on the Drawings or required by the Owner or Engineer in addition to the sectional liner, grouting shall be completed and accepted by Owner and Engineer prior to installation of the sectional liner.

### 3.02 CLEANING SEWER LINES:

A. Prior to applying a sectional CIPP liner to a pipeline, the Contractor shall remove internal deposits from the pipeline in accordance with Section 02650 – Sewer Line Cleaning.

### 3.03 TELEVISION SURVEY:

A. Prior to application of the liner and again after application of the liner, a television survey of each sectional CIPP-lined pipeline shall be performed in accordance with Section 02731 – Sanitary Sewer Television Inspection.

B. The interior of the pipeline shall be carefully surveyed to determine the location(s) and extent(s) of any structural failures. The location(s) of any conditions which may prevent proper installation of lining materials in the pipeline shall be noted so that these conditions can be corrected. A videotape and suitable log shall be maintained and submitted to the Engineer.

### 3.04 FLOW BYPASSING:

A. When required, the Contractor shall provide for the transfer of flow around a section or sections of pipe to be lined. The proposed bypassing system shall be approved in

advance by the Owner and Engineer. The approval of the bypassing system shall in no way relieve the Contractor of his responsibility and/or public liability. The flow bypassing shall be performed in accordance with Section 02600 – Wastewater Flow Control.

1. If the installation of the lining can be completed in a few hours, bypass pumping may not be required. The placement carriage shall be equipped with a bypass section to allow flow once liner is pressed into place.

3.05 LINE OBSTRUCTIONS:

A. The Contractor shall clear each pipeline of obstructions prior to lining. If the survey reveals an obstruction that cannot be removed by conventional cleaning equipment, the Contractor shall make a point repair excavation in accordance with Section 02720 – Excavated Point Repair (Pipe and Tap Connections) to uncover and remove or repair the obstruction. All excavations shall be approved by the Owner and Engineer in writing prior to the commencement of the work.

3.06 LINER INSTALLATION:

A. Prior to liner installation, all active leaks which are severe enough to affect the success of liner installation shall be stopped using chemical grout. Contractor shall impregnate the liner with the 100 percent solids resin. Drop cloths, tarpaulins, etc. shall be used to prevent resin material from contacting the adjacent ground. Contractor shall place the liner on the placement carriage and maneuver the carriage and liner into position with the use of a video camera. Contractor shall then force the liner against the inside wall of the damaged host pipe, allowing the resin to permeate into any cracks in the host pipe. Lines shall be allowed to cure in accordance with the manufacturer's recommendations. Heat may be introduced to speed up curing time. Contractor shall then retract the placement carriage and remove from pipe.

B. After the sectional liner has been cured in place, Contractor shall reconnect the service connections. Cutting of the liner pipe shall be performed from the interior of the pipeline using a robotic cutter. Where holes are cut through the liner, they shall be neat and smooth in order to prevent blockage at the service connections. Cut-in service connections shall be opened to a minimum of 95 percent of the flow capacity of the building sewer. Cuts shall be wire-brushed to remove jagged edges. All coupons shall be recovered at the downstream manhole and removed.

3.07 ACCEPTANCE:

A. The finished sectional liner shall be continuous over the entire length of the installation. The liner shall be free from visual defects, damage, deflection, holes, delamination, uncured resin, etc.. There shall be no visible infiltration through the liner or from behind the liner.

B. CCTV inspection after liner installation shall be performed in accordance with Section 02731 – Sanitary Sewer Television Inspection. Owner and Engineer shall confirm visible acceptance of sectional liner.

3.08 SITE RESTORATION:

A. After the liner installation has been completed and accepted, the Contractor shall clean up the entire Project area and return the ground cover to grade. All excess material and debris not incorporated into the permanent installation shall be disposed of by the Contractor.

- END OF SECTION –

NO TEXT ON THIS PAGE

# SECTION 02740

# CURED-IN-PLACE PIPE LINING

## PART 1 - GENERAL

### 1.01 SCOPE OF WORK:

A. Provide all labor, materials, accessories, equipment, tools, and incidentals required for the reconstruction of pipelines by the installation and testing of a resin-impregnated flexible tube which is formed to the original pipeline and cured to produce a continuous and tight-fitting Cured-in-Place Pipe (CIPP) lining as shown on the Drawings and as specified herein. The CIPP liner shall be designed for a gravity wastewater application.

B. CIPP lining is an acceptable product for lining all sewers shown on the Drawings.

### 1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. Section 01300 – Submittals

B. Section 01510 – Temporary Utilities

C. Section 02600 – Wastewater Flow Control

D. Section 02650 – Sewer Line Cleaning

E. Section 02731 – Sanitary Sewer Television Inspection

F. Section 02750 – Chemical Grouting

G. Section 02770 – Full-Circle Main to Lateral Connection Lining

### 1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS:

A. Without limiting the generality of the other requirements of the Specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. ASTM D790 — Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials

2. ASTM D2290 — Standard Test Method for Apparent Hoop Tensile Strength of Plastic or Reinforced Plastic Pipe

3. ASTM D2412 — Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading

4. ASTM D5813 — Standard Specification for Cured-In-Place Thermosetting Resin Sewer Piping Systems

5. ASTM F1216 — Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube

6. ASTM F1743 — Standard Practice for Rehabilitation of Existing Pipelines and Conduits by Pulled-in-Place Installation of Cured-in-Place Thermosetting Resin Pipe (CIPP)

7. ASTM F2019 — Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Pulled in Place Installation of Glass Reinforced Plastic (GRP) Cured-in-Place Thermosetting Resin Pipe (CIPP)

## 1.04 SUBMITTALS:

A. Shop Drawings: The Contractor shall submit the following in accordance with the requirements set forth in Section 01300 – Submittals:

1. Performance Work Statement (PWS) summarizing the work to be completed. PWS shall include verification of conformance to these Specifications and a detailed description of the work plan including product delivery, installation schedule, cleaning operations, CCTV inspection, bypass pumping, traffic control, provisions for pipes with sags too large for lining, curing method, repair methods, service reconnections, third party testing laboratory, as-built procedures, warranty, Quality Control Plan (QCP), etc. The QCP shall define the Contractor's, Owner's, Engineer's, and testing labs' role in quality control.

2. CIPP design data and manufacturer's data sheets listing all parameters used in the CIPP design and thickness calculations based on ASTM F1216 or ASTM F2019 and ASTM D2412 for "fully deteriorated gravity pipe conditions" as specified in Part 2 herein. All CIPP liner design calculations shall be signed and sealed by a Professional Engineer registered in the State of Alabama and certified by the manufacturer as to the compliance of his materials to the values used in the calculations. The buckling analysis shall account for the combination of dead load, live load, hydrostatic pressure, and grout pressure (if any). The liner side support shall be considered as if provided by soil pressure against the liner. Modulus of soil reaction shall be as specified in Part 2 herein, corresponding to a moderate degree of compaction of bedding and a fine-grained soil as shown in AWWA Manual M45, Fiberglass Pipe Design.

3. Detailed installation procedures; lining production schedule and location; testing procedures and schedule; quality control procedures; liner curing procedures including heat-up and cool-down rates, curing temperature and duration; and shipping and storage requirements, schedule, and procedures

4. Product data including cured color of fabric tube, fiberglass laminate, flexible membrane, resin, etc.

5. Technical data sheets showing the physical and chemical properties of the resin

6. Product data on cementitious patching material including manufacturer's installation guidelines

7. Product data on hydrophilic end seal, including chemical and physical properties such as swelling capacity, and manufacturer's intended application

8. Product data on water stopping (chemical seal) grout (if used)

9. Product data on mechanical coupling for joining dissimilar-sized pipes

B. After installation of the liner, the Contractor shall submit the following in accordance with the requirements set forth in Section 01300 – Submittals and in Part 3 herein:

1. Cure Report, including the following documentation:

a. Curing log, including temperatures, pressures, and times during the curing process to document that a proper cure has been achieved. Curing log shall be submitted immediately after the curing is complete for each line segment that is rehabilitated.

2. Television survey documentation

3. All required test results

1.05 QUALIFICATIONS:

A. The Contractor performing the CIPP lining work shall be fully qualified, experienced, and equipped to complete this work expeditiously and in a satisfactory manner and shall be certified and/or licensed as an installer by the CIPP manufacturer. Only commercially proven products and installers with substantial track records will be approved.

B. The qualifications of the Contractor shall be submitted with the Bid Proposal. These qualifications shall include detailed descriptions and verification of the following requirements:

1. The Contractor shall have successfully installed a minimum of 100,000 linear feet of CIPP lining in pipelines measuring 12 inches in diameter and smaller using the specified method of installation and curing.

2. The Contractor shall have successfully installed a minimum of 5,000 linear feet of CIPP lining in pipelines measuring greater than 12 inches in diameter using the specified method of installation and curing.

3. The Contractor's superintendent who will perform the work specified herein shall have at least 3 years of experience and shall have successfully installed at least 150,000 linear feet of the proposed CIPP lining using the proposed curing method.

4. The Contractor shall submit a certified statement from the manufacturer that the Contractor is a certified and/or licensed installer of the CIPP lining.

5. A installation reference list of a minimum of three municipal clients that the Contractor has performed this type of work for, including contact names, phone numbers, pipeline diameter, linear footage of pipeline rehabilitated, and a description of the actual work performed.

C. The Contractor shall be capable of providing crews as needed to complete the work without undue delay.

D. The Owner and Engineer shall approve or disapprove the Contractor and/or lining manufacturer based on the submitted information and a follow up interview, if warranted.

E. Inspection of the liner may be made by the Owner and/or Engineer after delivery. The liner shall be subject to rejection at any time on account of failure to meet any of the requirements specified herein, even though sample liner may have been accepted as satisfactory at the place of manufacture. Liner rejected after delivery shall be marked for identification and shall be immediately removed from the job site.

F. Sewer rehabilitation products submitted for approval shall include third party test results supporting the long-term performance and structural strength of the product. Contractor shall acquire test results. Test samples shall be prepared so as to simulate installation methods and trauma of the product. No product will be approved by the Owner and Engineer without satisfactory independent third party testing verification.

1.06 DELIVERY, STORAGE, AND HANDLING:

A. Care shall be taken in shipping, storage, and handling to avoid damaging the liner. Extra care shall be taken during cold weather construction. Any liner damaged in shipment shall be replaced at no cost to the Owner and as directed by the Owner and/or Engineer.

B. All material shall be shipped, stored, and handled in conformance with the manufacturer’s requirements and recommendations.

C. Any liner showing a split or tear, or which has otherwise received damage, shall be marked as rejected and immediately removed from the site.

D. The liner shall be maintained at a proper temperature in refrigerated facilities to prevent premature curing at all times prior to installation. The liner shall be protected from UV light prior to installation. Any liner showing evidence of premature curing shall be rejected for use and shall be immediately removed from the site.

1.07 WARRANTY:

A. The materials used for this Project shall be certified by the manufacturer for the specified purpose. The Contractor shall warrant the liner material and its installation for one (1) year from the date of acceptance. During the warranty period, any defects which affect the integrity, strength, function, and/or operation of the pipe shall be repaired at the Contractor's expense in a manner mutually agreed upon by the Owner, Engineer, and the Contractor. All repairs shall also be warranted by the Contractor for one (1) year from the date of repair acceptance. The Owner or Engineer may conduct an independent

television inspection, at the Owner's expense, of the lining work prior to the completion of the one-year guarantee period.

## PART 2 - PRODUCTS

### 2.01 MATERIALS:

A. CIPP lining shall be Insituform by Insituform Technologies, Inliner by Layne/Inliner Technologies, AM-Liner by Premier-Pipe USA, Blue-Tek by Reline America, or Engineer-approved equal.

B. Inversion: The sewed tube shall consist of one or more layers of absorbent non-woven felt fabric in accordance with the requirements of ASTM F1216.

C. Pulled-in-Place: The tube shall consist of one or more layers of fiberglass laminate in accordance with the requirements of ASTM F2019.

D. The tube shall be constructed to withstand installation pressures, have sufficient strength to bridge breaks and missing sections of the existing pipe, and stretch to fit irregular pipe sections. The new jointless pipe-within-a-pipe shall fit tightly against the existing pipe wall and shall consolidate all disconnected sections into a single continuous pipeline, eliminating infiltration or exfiltration.

E. The wet-out tube shall have a uniform thickness that, when compressed at installation pressures, shall meet or exceed the design thickness.

F. The tube shall be sewn to a size that, when installed, shall tightly fit the internal circumference and length of the original pipe with minimal shrinkage, in such a way as to minimize water migration (tracking) between the liner and the host pipe. Allowance shall be made for circumferential stretching during inversion and longitudinal stretching during pull-in. Overlapped layers of felt in longitudinal seams that cause lumps in the final product shall not be acceptable.

G. The minimum tube length shall be that deemed necessary by the Contractor to effectively span the distance between the access points and to facilitate a good seal without water migration. The Contractor shall verify the lengths in the field before cutting liner to length and otherwise preparing it for installation.

H. The outside layer of the tube (before wet-out) shall be coated with an impermeable, flexible membrane that shall contain the resin and facilitate monitoring of resin saturation during the resin impregnation (wet-out) procedure.

I. The tube shall be homogeneous across the entire wall thickness containing no intermediate or encapsulated elastomeric layers. No material shall be included in the tube that may cause delamination in the cured CIPP. No dry or unsaturated layers shall be evident.

J. The wall color of the interior pipe surface of CIPP after installation shall be a light reflective color so that a clear detailed examination with closed circuit television inspection equipment may be made.

K. Seams in the tube shall be stronger than the seamless felt and shall meet the requirements of ASTM D5813.

L. The outside of the tube shall be marked for distance at regular intervals, not exceeding five (5) feet, along its entire length. Such markings shall include the manufacturer's name or identifying symbol. The tubes shall be manufactured in the USA.

M. The resin system shall be a corrosion-resistant polyester, vinyl ester, or epoxy and catalyst system that, when properly cured within the tube composite, meets the requirements of ASTM F1216 or ASTM F2019 and ASTM F1743, the physical properties specified herein, and any additional physical properties that are utilized in the design of the CIPP for this Project. The resin shall produce CIPP which shall comply with the structural and chemical resistance requirements specified herein.

N. The finished CIPP shall be fabricated from materials which, when cured, shall be chemically-resistant to withstand internal exposure to domestic sewage. All constituent materials shall be suitable for service in the environment intended. The final product shall not deteriorate, corrode, or lose structural strength resulting in reduction of the projected product life.

O. The CIPP shall be designed in accordance with the requirements of ASTM F1216 or ASTM F2019, Appendix X1. The CIPP design shall assume no bonding to the original pipe wall. The structural performance of the finished pipe shall be adequate to accommodate all anticipated loads throughout its design life.

P. The CIPP shall have a minimum design life of fifty (50) years. The minimum design life shall be documented by submitting life estimates by national and/or international authorities or specifying agencies.

Q. The Contractor shall have performed long-term testing for flexural creep of the CIPP material installed by his company. These testing results shall be used to determine the

long-term, time-dependent flexural modulus to be utilized in the product design. This testing shall include demonstration of performance of the materials (tube and resin) and general workmanship of the installation and curing. A percentage of the instantaneous flexural modulus value (as measured by ASTM D790 testing) shall be used in design calculations for external buckling. The percentage, or the long-term creep retention value, utilized shall be verified by this testing. Values in excess of 50 percent shall not be applied unless substantiated by qualified third party test data. The materials utilized for this Project shall be of a quality equal to or better than the materials used in the long-term test with respect to the initial flexural modulus used in design.

R. The minimum required structural CIPP wall thickness shall be based on the physical and structural properties described herein and shall be in accordance with the design equations in the Appendicies of ASTM F1216 or F2019 and the following design parameters:

| | |
|---|---|
| Design Safety Factor | 2.0 |
| Retention Factor for Long-Term Flexural Modulus for Design | 50 percent |
| Ovality* | 2 percent |
| Groundwater Depth = Grade Elevation | Refer to Drawings |
| Soil Depth (above crown) | Refer to Drawings |
| Soil Modulus | 1,000 psi |
| Soil Load | 120 pcf |
| Live Load | One AASHTO H-20 Truck |
| Design Condition | Fully-Deteriorated |

* Value listed is based on the best available information. Ovality shall be calculated by Contractor from ASTM F1216, Appendix X1.1 based on information from sewer inspection.

S. The layers of the cured CIPP shall be uniformly-bonded. It shall not be possible to separate any two layers with a probe or point of a knife blade so that the layers cleanly separate or the probe or knife blade freely moves between the layers. If separation of the layers occurs during testing of field samples, new samples shall be cut from the work. Any reoccurrence of separation shall be cause for rejection of the work.

T. Any layers of the tube that are not saturated with resin prior to insertion into the existing pipe shall not be included in the structural CIPP wall thickness computation.

U. A chloroprene, hydrophilic waterstop end seal shall be installed at both of the manhole interfaces. End seals shall be full-circle and shall swell when in contact with water.

V. A cementitous patching material shall be used in the manholes to reconstruct a proper flow channel around the end of the cured liner. Patching material shall be Hyperform by Quadex or Engineer-approved equal.

2.02 STRUCTURAL REQUIREMENTS FOR MAIN LINES:

A. Resin shall be impregnated by vacuum application, resin bath, or Engineer-approved equal method. If reinforcing materials (fiberglass, etc.) are used, the reinforcing material shall be fully-encapsulated within the resin to ensure that the reinforcement is not exposed, either to the inside of the pipe or at the interface of the CIPP and the existing pipe.

B. The design for the CIPP wall thickness shall be based on the following strengths, unless otherwise approved by the Owner and Engineer in advance.

| Property | Test Method | Cured Composite per ASTM F1216 | Cured Composite per ASTM F2019 |
|---|---|---|---|
| Flexural Modulus of Elasticity | ASTM D790 | 250,000 psi | 725,000 psi |
| Flexural Stress | ASTM D790 | 4,500 psi | 6,500 psi |

PART 3 - EXECUTION

3.01 GENERAL:

A. Contractor shall clean the pipeline with a high-pressure water jet and hydraulically-powered root cutting equipment to remove all internal debris from the pipeline in accordance with Section 02650 – Sewer Line Cleaning.

B. Hydraulic cementitous patching material used for flow channel construction shall be installed as directed by the manufacturer.

3.02 SEWER REPAIRS:

A. Any protruding pieces of concrete, dropped joints, or broken pipe shall be subjected to point repairs so that the pipe is left in a clean, smooth condition in all respects ready for lining, unless otherwise jointly determined by the Contractor, Engineer, and the Owner that the defect will not compromise the integrity of the liner.

B. If conditions such as broken pipe and major blockages are found that will prevent proper cleaning, or where additional damage would result if cleaning is attempted or continued, the Contractor, with the advance approval of the Owner and Engineer, shall perform the necessary point repair(s) and then complete the cleaning. Known instances of blockages such as protruding taps are listed in the Pipe Rehabilitation Schedules on the Drawings, but the Contractor shall ensure the pipe is suitable for CIPP lining.

C. The Contractor shall not line through pipe sagging more than 30 percent without written permission from the Engineer.

3.03 JOINT, CRACK, ANNULAR SPACE, AND LINER END CHEMICAL SEALING:

A. Prior to CIPP liner installation, all active leaks of a magnitude that will compromise the integrity of the liner shall be stopped at least one hour prior to installation of the liner using chemical seal grout, at no additional cost to the Owner.

B. Chemical seal grout shall have the following properties:

1. Chemical seal grout shall react quickly to form a permanent watertight seal.

2. Resultant seal shall be flexible and immune to the effects of wet/dry cycles.

3. Chemical seal grout shall be non-biodegradable and immune to the effects of acids, alkalis, and organics in sewage.

4. Component packaging and mixing shall be compatible with field conditions and worker safety.

5. Extraneous sealant left inside pipe shall be readily removable.

6. Chemical seal grout shall be compatible with the CIPP liner resin system utilized.

The chemical sealing materials shall be acrylic resin-type and shall be furnished with activators, initiators, inhibitors, and any other materials recommended by the manufacturer for a complete grout system. Sealing grout shall be furnished in liquid form in manufacturer's standard containers. Sealing grout shall be AV-100 by Avanti International or Engineer-approved equal.

C. The Contractor shall modify his equipment as necessary to seal the leaks. The Contractor’s equipment and sealing method shall be approved by the Owner and Engineer prior to use. Extreme caution shall be utilized during leak sealing (pressure)

operations in order to avoid damaging the already-weakened sewer pipe. If any damage occurs, it shall be repaired at the Contractor's expense and to the satisfaction of the Owner and Engineer. Excessive pumping of grout which might plug a service lateral shall be avoided. Any service laterals blocked by the grouting operation shall be immediately cleared by the Contractor.

3.04 FLOW CONTROL:

A. Flow control shall be exercised as required to ensure that no flowing sewage comes into contact with sections of the sewer under repair in accordance with Section 02600 – Wastewater Flow Control for additional information.

3.05 LINER INSTALLATION:

A. In presence of the Engineer, perform a pre-lining CCTV inspection immediately prior to CIPP lining to demonstrate that the pipe is clean and free of roots, grease, sand, rocks, sludge, PACP runners or gushers, pockets of water, or structural impediments that would affect long-term viability of the pipe liner. Obtain Owner's and/or Engineer's approval of the acceptability of the existing pipe condition prior to installation of CIPP.

B. Prior to the Preconstruction Meeting, the Contractor shall submit to the Owner and Engineer for review and approval a description of the proposed methods for avoiding liner stoppage due to conflict and friction with such points as the manhole entrance and the bend into the pipe entrance. Contractor shall also submit plans for dealing with a liner stopped by snagging within the pipe.

C. The Contractor shall immediately notify the Owner and Engineer of any construction delays during the insertion operation. Such delays may require sampling and testing of portions of the cured liner by an independent laboratory at the Owner's discretion. The cost of such testing shall be borne by the Contractor, and no extra compensation will be allowed. Any failure of sample tests or a lack of immediate notification of delay shall be automatic cause for rejection of that part of the work at the Owner's discretion.

D. The Contractor shall submit construction schedules for review and approval by the Owner and Engineer. At no time shall any service lateral remain inoperative for more than an eight (8) hour period. Any service that will be out of service for more than eight (8) hours shall be temporarily bypassed into a mainline sanitary sewer at the Contractor's expense.

E. The materials and processes shall be reasonably available and accessible for pre-installation, installation and post-installation inspections. Areas which require inspection shall include, but not be limited to, the following:

1. Product materials shall exhibit sufficient transparency to visually verify the quality of resin impregnation.

2. Temperature sensing devices, such as thermocouples, shall be located between the existing pipe and the CIPP to ensure the quality of the cure of the wall laminate.

F. Curing shall be accomplished by utilizing the appropriate medium in accordance with the manufacturer's recommended cure schedule. The curing source or input and output temperatures shall be monitored and logged during the cure cycles if applicable. The manufacturer's recommended cure method and schedule shall be used for each line segment installed, and the liner wall thickness and the existing ground conditions with regard to temperature, moisture level, and thermal conductivity of soil, per applicable ASTM standards, shall be taken into account by the Contractor.

G. Initial cure shall be deemed complete when the exposed portions of the tube appear to be hard and sound and the temperature sensor indicates that the temperature is of a magnitude to realize an exotherm. The cure period shall be of a duration recommended by the resin manufacturer and may require continuous recirculation of water to maintain the temperature. The Contractor shall have on hand at all times, for use by his personnel, the Owner, and the Engineer, a digital thermometer or other means of accurately and quickly checking the temperature of exposed portions of the liner.

H. CIPP installation shall be in accordance with Section 7 of ASTM F1216, Section 6 of ASTM F1743, or ASTM F2019, with modifications as listed herein.

I. Resin Impregnation: The quantity of resin used for tube impregnation shall be sufficient to fill the volume of air voids in the tube with additional allowances for polymerization shrinkage and the loss of resin through cracks and irregularities in the original pipe wall. A vacuum impregnation, resin bath, or Engineer-approved equal method shall be used. To ensure thorough resin saturation throughout the length of the felt tube, the point of vacuum shall be no further than 25 feet from the point of initial resin introduction. After vacuum in the tube is established, a vacuum point shall be no further than 75 feet from the leading edge of the resin. The leading edge of the resin slug shall be as near to perpendicular as possible. A roller system shall be used to uniformly distribute the resin throughout the tube. If the installer uses an alternate method of resin impregnation, the method shall produce the same results. Any alternate resin impregnation method shall be proven and subject to the approval of the Owner and Engineer.

J. Tube Insertion: The wet-out tube shall be positioned in the pipeline using either inversion or a pull-in method. If pulled into place, a power winch shall be utilized and care shall be exercised not to damage the tube as a result of pull-in friction. The tube shall be pulled-in or inverted through an existing manhole or approved access point and shall fully extend to the next designated manhole or termination point. Water for inversion and cure shall be provided in accordance with Section 01510 – Temporary Utilities.

K. Temperature gauges shall be placed inside the tube at the invert level of each end, or throughout its length, to monitor the temperatures during the cure cycle.

L. Curing shall be performed in accordance with the manufacturer's recommended cure schedule.

M. Cool Down: The Contractor shall cool the hardened pipe to a temperature below 100 degrees Fahrenheit before relieving the hydrostatic head. Cool down shall be accomplished by the introduction of cool water into the inversion standpipe to replace water being pumped out of the manhole. Care shall be taken in release of static head so that vacuum will not be developed that could damage the newly-installed liner.

N. Finish: The new pipe shall be cut off in the manhole at a suitable location. The finished product shall be continuous over the length of pipe reconstructed and shall be free from dry spots, delamination, and lifts. Pipe entries and exits shall be smooth, free of irregularities, and watertight. Visible leaks shall not be present, and the Contractor shall perform grouting to remove leaks or fill voids between the host pipe and the liner. During the warranty period, any defects which will affect the integrity or strength of the product shall be repaired at the Contractor's expense, in a manner mutually agreed upon by the Owner, Engineer, and the Contractor.

O. Reconstructing Inverts: A proper flow channel shall be reconstructed around the cured liner using a cementitous patching material. Flow channel shall not leave any voids under the liner which will become clogged with debris.

P. Reinstatement of Services: The exact location and number of service connections to be reinstated shall be determined from CCTV footage and/or by the Owner and/or Engineer in the field. Contractor shall accurately field-locate all existing service connections. The Contractor shall reconnect all active service connections to the lined pipe. All services shall be internally reinstated to a minimum of 90 percent of the original opening shape and capacity, resulting in a smooth opening with no jagged edges. Services shall not be reconnected from unoccupied, abandoned, or vacant lots, unless directed otherwise by

Owner or Engineer. In case of oversized cuts to service connections, Contractor shall install a full-circle tap connection in accordance with Section 02770 – Full-Circle Main to Lateral Connection Lining at no cost to Owner. Contractor shall also restore/correct, without any delay, all missed or faulty reconnections and any damage caused to property owners for not reconnecting the services soon enough or for not giving adequate notice to the property owners.

Q. Grouting of Reinstated Services: After service connections are internally reinstated, all lateral connections that are not designated on the Drawings or directed by the Owner and/or Engineer to be replaced via excavation or rehabilitated with a full-circle lateral liner or structural grout shall be chemically grouted as applicable and feasible in accordance with Section 02750 – Chemical Grouting.

3.06 FIELD QUALITY CONTROL:

A. For all runs of CIPP liner and where the thickness of the liner changes, the Contractor shall take samples and shall test them in accordance with Article 3.11 herein.

B. Where the pipe diameter is less than or equal to 15 inches, the samples shall be restrained-type samples made by extending the liner through a form with a diameter as close as possible to the existing pipeline. The formed sample shall be provided with insulation to contain cure heat as well as a heat sink, such as sandbags, for cool down. The length of the tube shall be large enough to provide at least five samples.

C. Where the pipe diameter is greater than 15 inches, a plate sample shall be prepared. The test sample shall be fabricated from the material taken from the liner and cured in a clamped mold with the resin used in the liner construction placed in the down tube.

D. Test specimens shall be clearly marked in indelible ink to identify the name of the Project, location, appropriate lateral or main section, work order number, date of installation, and orientation to the top of the pipe (direction of up) so the results can be correlated to the work performed. All test results shall use this designated labeling as a reference.

E. The extraction and labeling of test specimens shall be performed by the Contractor in the presence of the Owner and/or Engineer. The Owner, Engineer, and Contractor shall, upon completion of sample extraction and labeling, all sign a chain-of-custody form that shall subsequently accompany the sample at all times and shall ultimately be received and signed at the testing laboratory. Test reports shall include a copy of the chain-of-custody form with all signatures to ensure that reported test results are for the correct sample.

F. Each sample shall be large enough to provide at least five total specimens for testing. One test for thickness, flexural strength, and flexural modulus shall be conducted in accordance with ASTM F1216 or ASTM F2019, ASTM D790, and ASTM D2290 for each run of lines. The material shall meet the initial strength requirements of Table 1 of ASTM F1216 or ASTM F2019 (UV cured).

3.07 WET-OUT AND CURE REPORT:

A. The Contractor shall submit wet-out and cure reports documenting the specific details of the liner's vacuum impregnation and saturation with resin and the CIPP installation of the liner. A report shall be generated for each liner installation. Copies of all wet-out and cure records shall be submitted to the Owner and Engineer on a weekly basis and prior to submitting an Application for Payment on which payment for the specific liner(s) included in the wet-out and cure records is requested. If the wet-out and cure reports are not submitted prior to the associated Application for Payment, payment for the work will not be made and the Application for Payment will be rejected. At a minimum, the report shall include:

1. Contractor name

2. Owner’s Contract number

3. Line identification and location

4. Date of wet-out

5. Identification of sample(s) and name of technician(s)

6. Date of installation in sewer

7. Inside diameter of host sewer pipe

8. Liner thickness

9. Liner length

10. Liner and resin batch numbers

11. Resin type

12. Wet-out length

13. Roller spacing

14. Vacuum setting

15. Quantity of resin and catalyst utilized

16. Name of wet-out technician(s)

17. Time wet-out started and completed

18. Applicable remarks

19. Heat Cure: Boiler and liner heating fluid (water or steam) pressure and temperature versus time log during cure period

20. UV Cure: Pressure and temperature versus time log and light train speed during cure period

21. Cool down report

3.08 SITE RESTORATION:

A. After the liner installation has been completed and accepted by the Owner, the Contractor shall restore the entire Project area and shall return the ground cover to its original or better condition. All excess material and debris not incorporated into the permanent installation shall be disposed of by the Contractor.

3.09 TELEVISION SURVEY:

A. Prior to application of the liner and again after application of the liner, a television survey of each CIPP-lined pipeline shall be performed in accordance with Section 02731 – Sanitary Sewer Television Inspection. Television survey shall be performed for all CIPP lining, and post-installation inspection shall be completed within 2 weeks of liner installation.

3.10 PUBLIC NOTIFICATION:

A. The Contractor shall maintain sewer service usage for adjacent property owners throughout the duration of the Project. In the event that sewer service to any single

property must be temporarily stopped for CIPP lining, the service shall be restored within 8 hours or less. A public notification program shall be implemented, and, at a minimum, Contractor shall contact each home or business connected to the sanitary sewer to inform them of the work to be performed and when the sewer will be offline. The Contractor shall also provide the following:

1. Whether or not an interruption in service is expected, a written notice delivered to each home or business the day prior to the beginning of work being conducted on the sewer section to which their services are connected. Written notice shall include a local telephone number for the Contractor that the property owner can call to discuss the Project or any problems which could arise.

2. Personal contact with any home or business which cannot be reconnected within the time stated in the written notice

3.11 TESTING REQUIREMENTS:

A. Testing on physical samples from a random 10 percent of cured lines shall be performed, unless a pattern of failure occurs, at which point the Owner or Engineer can request additional testing at no cost to the Owner. At a minimum, one sample shall be tested for each 1,000 linear feet of liner installed. All of the costs for sample collection and testing shall be included in the amount bid for the applicable Bid Item for CIPP lining, and no separate payment shall be made.

B. The Contractor shall submit a method to the Owner and Engineer for review and approval for obtaining representative samples from the installed liners in accordance with Article 3.06 herein. These samples shall be tested by an ASTM-certified testing laboratory at the Contractor's expense to verify compliance with the installed material specifications. The Contractor shall produce these test samples when directed by the Owner and/or Engineer.

C. The CIPP shall meet the chemical resistance requirements of ASTM F1216 or ASTM F2019. CIPP samples for testing shall be of a tube and resin system similar to that proposed for actual construction. CIPP samples, both with and without plastic coating, shall meet these chemical testing requirements. The CIPP samples shall be prepared and the samples' physical properties tested in accordance with ASTM F1216, ASTM F2019, or Section 8 of ASTM F1743 using either proposed method. Wall thickness of samples shall be in accordance with paragraph 8.1.6 of ASTM F1743.

D. When post-installation thickness measurements and/or physical property testing is performed, installed liners which do not pass these material tests will be accepted at reduced payment or rejected as follows:

1. Full Payment: If the thickness, flexural strength, and flexural modulus of elasticity of installed liner are all equal or greater than 95 percent of specified values, full payment will be made.

2. Reduced Payment: If the thickness, flexural strength, or flexural modulus of elasticity of installed liner is between 90 and 94.9 percent of specified value, payment will be made based on an adjusted amount, which shall equal the appropriate unit price bid multiplied by a Value Factor calculated as follows:

   *Value Factor = Thickness x Flexural Strength x Flexural Modulus of Elasticity (all percentages expressed as decimals)*

3. Rejected: If the thickness, flexural strength, or flexural modulus of elasticity of installed liner is 89.9 percent or less of specified value, product may be rejected.

3.12 ACCEPTANCE:

A. The finished liner shall be continuous over the entire length of the installation. The liner shall be free from visual defects, damage, deflection, holes, delaminations, uncured resin, etc. No pinholes, splits, cracks, thin spots, dry spots, lifts, ridges, or other defects in the CIPP liner shall be permitted. There shall be no visible infiltration through the liner or from behind the liner at manholes and service connections. Wrinkles in the finished liner that cause backwater, reduce the pipe's hydraulic capacity or structural stability, or create voids between the liner and pipe wall are unacceptable.

B. Cut-ins and attachments at service connections shall be neat and smooth. All service connections shall be open, clear, and watertight. The liner opening shall neatly conform to the opening in the host pipe and shall be free of burrs or debris.

C. Following installation of the liner and reopening of the service connections, the Contractor shall conduct a final digitally-recorded color CCTV inspection of the completed work. Copies of these post-installation digital recordings and the digital recordings made prior to the liner installation shall be submitted to the Engineer for approval. Payment will not be made for any CIPP lining until the Engineer has reviewed and approved these digital recordings. The Contractor shall submit the CDs or DVDs of this inspection footage a minimum of two weeks in advance of submitting an Application for Payment on which payment for the CIPP lining shown in the footage is requested.

D. Defective lining shall be removed and the pipe re-lined at no additional cost to the Owner. If the host pipe is damaged during the removal process, Contractor shall perform a point repair at Contractor's expense.

E. Preliminary field acceptance of the liner shall be based on the Owner's and/or Engineer's evaluation of the installation and curing data, results of air testing where required, and review of the digital CCTV recordings.

1. Groundwater infiltration shall not be observed through the liner.

2. There shall be no evidence of splits, cracks, breaks, lifts, kinks, delaminations, or crazing in the liner.

3. If any defective liner is discovered after it has been installed, it shall be removed and replaced with either a sound liner or a new pipe at no additional cost to the Owner.

F. Final acceptance of the liner shall be based on the preliminary field acceptance of the liner by the Owner and/or Engineer as previously listed <u>and</u> on the results of the certified laboratory tests on the liner specimens as previously listed.

G. Liners meeting or exceeding the certified thicknesses and specified strengths, as evidenced by the certified laboratory testing results, shall be paid for per Paragraph D of Article 3.11 herein.

- END OF SECTION -

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# SECTION 02745

# PAVING

## PART 1 - GENERAL

### 1.01 WORK INCLUDED:

Furnish all labor, equipment and materials required to furnish and install bituminous concrete pavement courses, including roadways, shoulders, driveways, temporary and permanent trench paving, pavement overlays and pavement saw cutting as shown on the Drawings and as specified herein.

### 1.02 RELATED WORK:

A. All Division 1 Requirements

B. Section 02050, SWPPP

C. Section 02276, Erosion and Sedimentation Control

D. Section 02300, Earthwork

E. Section 02514, Sidewalks and Driveway Aprons

F. Section 02629, Resetting Sewer or Drainage Castings

### 1.03 STANDARD REFERENCE:

A. Reference is made to items and paragraphs of the 2010 edition, with amendments of "Standard Specifications for Road and Bridge Construction", State of New Hampshire Department of Transportation. References in this section to these Standard Specifications bear the prefix "NHDOT

### 1.04 SYSTEM DESCRIPTION:

A. GENERAL

The type of bituminous pavement courses to be utilized on this project shall be:

| Roadway Pavement Section | |
|---|---|
| Layer Description | Thickness (inches) |
| NHDOT 9.5 mm Superpave Wearing Course (50 Gyration Design) | 1.5 |
| NHDOT 19 mm Superpave Binder Course (50 Gyration Design) | 3.0 |

| Driveway Patch Pavement Section | |
|---|---|
| Layer Description | Thickness (inches) |
| NHDOT 9.5 mm Superpave Wearing Course (50 Gyration Design) | 1.5 |
| NHDOT 19 mm Superpave Binder Course (50 Gyration Design) | 2.25 |

The work should be undertaken in segments of about 1,500 linear feet maximum for a total of 3 segments. The work to be done hereunder shall include the removal of the existing pavement, re-grading the existing subgrade, shimming with crushed gravel base as needed, and the placement of new bituminous pavements to the relevant provisions under Section 306 and Division 400 of the New Hampshire Department of Transportation Standard Specification for Roads and Bridges (NHDOT Standard Specifications) and as shown on the Plans and as specified in the Contract Documents.

Prior to removing the existing pavement, the Contractor shall locate and protect existing drainage and utility structures and underground pipes, culverts, conduits and other appurtenances. The Contractor shall be held responsible for the protection of the casting. The Contractor, at his expense, shall replace any frames, grates or covers, damaged in any manner during the process of the Construction with new castings. The Contractor shall make adjustment of the structures and castings to match proposed finish grade.

Except in areas where roadway closure and detours will be allowed, the Contractor shall remove only that area of pavement that can be removed and the subgrade compacted by the end of the same working day, at which time it must be open to traffic, with the Engineer's approval. One-way traffic will be allowed only during working hours with proper traffic controls. Two-way traffic shall be maintained at all other times. Suitable ramping shall be in place at the beginning and end of each work zone to allow for smooth and safe travel. This shall be considered incidental to the work for this item.

After removal of the existing pavement, the Contractor shall re-grade the existing

subgrade and shim with crushed gravel as necessary to the lines and grades as detailed on the Project plans. Grade control must meet a maximum tolerance of ¼" from the proposed grades as detailed on the plans, unless revisions are approved in writing by the Engineer. The Contractor shall compact existing subgrade and crushed gravel shim to not less than 95 percent of the maximum dry density of the material as determined by ASTM Specification D-1557 at optimum moisture content without additional cost to the Owner. The required density of the subgrade shall be maintained until the bituminous concrete pavement has been placed.

The objective of the project is to re-use excavated materials in fine grading operations and not export any materials from the site. The materials below the pavement contain iron slag pieces and will likely require specific disposal at facility regulated to accept such materials. In the event that excess material is generated, the material must be stockpile on site and covered with polyethylene sheeting. The material must be representatively sampled and tested for environmental characterization prior to disposal. All disposal options and associated cost must be discussed and negotiated with the Owner and Engineer prior to disposal.

The Contractor is responsible for placing all new bituminous concrete in a manner as to follow the Project Plans. All bituminous pavements shall be constructed in accordance with Division 400 of the Latest Edition of the State of New Hampshire Department of Transportation "Standard Specifications for Road and Bridge Construction". Cold Planing of Bituminous Surfaces at locations shown on the Project Plans should be performed in accordance with Section 417 of the NHDOT Standard Specifications.

All existing driveways shall be saw cut as determined by the Engineer and all bituminous concrete shall be excavated up to the face of the saw cut. The Contractor is responsible for placing all new bituminous concrete in a manner to provide a smooth transition to existing driveway grades.

The Contractor shall be responsible for maintaining proper drainage of street runoff during construction.

The Contractor shall be responsible for removing and resetting all curbing that is disturbed during construction to existing grades at no additional cost to the Owner. All bituminous concrete berms, if any, disturbed during construction operations shall be replaced at no additional cost to the Owner and shall be set to existing grades and shall maintain proper drainage.

All signs, sign posts, mail boxes, fences and gates, etc. disturbed during construction operations shall be removed and reset. Any signs that have been damaged shall be replaced and set at existing grades and locations at no additional cost to the owner.

No trees within the project limits shall be under cut or destroyed. The Contractor is responsible for protecting all trees and their root systems from all adjacent construction operations. Any trees damaged or destroyed shall be replaced with no additional compensation. All existing landscaped surface areas outside the paved roadway surface area that are disturbed during construction shall be repaired with 6-inches of loam with seed at no additional cost to the Owner.

1.05 REFERENCES

The following standards form a part of these specifications and indicate the minimum standards required:

American Society for Testing and Materials (ASTM):

| | |
|---|---|
| ASTM D1557 | Test for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 Pound Rammer and 18-Inch Drop |
| ASTM C-117 | Standard Test Method for Materials Finer than the No. 200 sieve in Mineral Aggregates by Washing |
| ASTM C-136 | Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates |
| AASHTO T 164 | Quantitative Extraction of Asphalt Binder from Hot Mix Asphalt |
| AASHTO T 166 | Bulk Specific Gravity of Compacted Hot Mix Asphalt using Saturated Surface Dry Specimens |
| AASHTO T 209 | Theoretical Maximum Gravity and Density of Hot Mix Asphalt |

State of New Hampshire Department of Transportation (NHDOT) Standard Specifications for Road and Bridge Construction, latest edition:

| | |
|---|---|
| Section 304 | Gravel Subbase Course, Crushed Gravel, Crushed Stone (fine) |
| Section 401 | Bituminous Concrete Pavement - Table 2 Design Control Points |
| Section 632 | Reflectorized Pavement Markings |
| Section 410 | Tack Coats |
| Section 417 | Cold Planing Bituminous Surfaces |

Federal Specifications:

| | |
|---|---|
| SS-S-164 | Sealing Compound, Hot Poured Type, for Joints in Concrete |
| SS-S-1401C | Sealants, Joint, Non-Jet-Fuel-Resistant, Hot Applied, for Portland Cement and Asphalt Concrete Pavement |

1.06 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

A. Six sets of complete job mix formula shall be submitted to the Engineer at least two weeks before any of the work of this section is to begin.

B. Delivery slips shall be furnished with each load of mix delivered to the project. Information shall include:

1. Vehicle identification.
2. Date.
3. Project.
4. Identification of material.
5. Gross, tare and net weights.
6. Signed by the bituminous concrete producer.
7. Stamped by a licensed public weighmaster.

1.07 PRE-PAVING CONFERENCE

The general contractor shall schedule a pre-paving conference for attendance by the Owner, Engineer, testing firm, geotechnical engineer, and paving contractor. The meeting shall be scheduled at least 5 days prior to the start of paving and the attendees shall be given a minimum 72 hour notice.

PART 2 - PRODUCTS

2.01 CRUSHED GRAVEL, or CRUSHED STONE (fine) BASE COURSE

A. Crushed Gravel or Crushed Stone (fine) Base Course shall consist of inert material that is hard durable stone and coarse sand, free from loam and clay, surface coatings and deleterious materials.

B. Gradation requirements for Crushed Gravel or Crushed Stone (fine) Base Course shall be as specified herein Section 02300, EARTHWORK for Crushed Gravel, or Crushed Stone (fine).

2.02 BITUMINOUS CONCRETE PAVEMENT:

A. Bituminous concrete mixtures shall be within the composition limits of base courses, binder courses, top courses and surface treatment, in accordance with NHDOT Standard Specifications Section 401, that conform to Table 2.

B. The joint sealant shall be a hot poured rubberized emulsified asphalt sealant meeting the requirements of Federal Specifications SS-S-1401 or SS-S-164.

C. The joint sealant shall not be separately measured and paid for, but shall be considered subsidiary to each layer of pavement.

2.03 TACK COAT:

A. The tack coat shall be an asphalt emulsion, RS-1, CRS-1, HFMS-1 CSS-1 if required.

B. The Tack Coat shall be applied to all vertical seams and joints, and between the

bituminous binder and wearing course layers.

C. The surface to which the Tack Coat will be applied shall be prepared as detailed in the NHDOT, Standard Specifications 410.3.3.2.

D. The Tack Coat shall be applied as detailed in the NHDOT Standard Specifications 410.3.4.2

E. The Tack Coat shall be applied at a rate as detailed in the NHDOT Standard Specifications 410.3.4.2.1, and as approved by the Engineer.

F. The Tack Coat shall not be separately measured and paid for, but shall be considered subsidiary to the Wearing Course of pavement.

PART 3 - EXECUTION

3.01 GENERAL:

A. Paving courses required for the project shall be as shown on the drawings and as specified herein. Pavement thicknesses specified are measured in compacted inches. If a pavement course thickness exceeds 3 compacted inches, the course shall be installed in multiple lifts with each lift not exceeding 3 compacted inches in thickness.

3.02 CRUSHED GRAVEL or CRUSHED STONE (fine) BASE COURSE:

A. The base course(s) to be placed under pavement shall be evenly spread and thoroughly compacted.

B. The base course(s) shall be spread in loose layers not more than 12-inches thick. All layers shall be compacted to not less than 95 percent of the maximum dry density of the material as determined by ASTM Specification D-1557 at a suitable moisture content to achieve the required compaction.

3.03 PERMANENT BITUMINOUS PAVEMENT:

A. The bituminous paving mixture, equipment, methods of mixing and placing, and the precautions to be observed as to weather, condition of base, etc., shall be in accordance with NHDOT Standard Specifications Section 401.

B. BASE COURSE AND BINDER COURSE PAVEMENT:

1. Immediately prior to installing the base and/or binder course, the trimmed edges shall be made stable and unyielding, free of loose or broken pieces and all edges shall be thoroughly broomed clean. Contact surfaces of trench sides, curbing, manholes, catch basins, or other appurtenant structures in the pavement shall be painted thoroughly with a uniform coating of asphalt emulsion (tack coat), just before any mixture is placed against them.

2. The binder course shall be repaired as necessary to maintain the surface of the

pavement until placement of the permanent overlay. The wearing course shall not be placed sooner than 90 days from the placement of the binder course

C. TOP COURSE OR SURFACE TREATMENT PAVEMENT (PERMANENT OVERLAY):

1. Top course or surface treatment shall be placed over the full width as shown on the drawings or as specified. In Project areas where Cold Planing will occur as detailed on the Project Plans, this operation shall be performed in accordance with Section 417 - Cold Planing Bituminous Surfaces of the NHDOT Standard Specifications.

2. Prior to placement of the top course or surface treatment, the entire surface over which the top course or surface treatment is to be placed shall be broom cleaned and tack coated. Cleaning and tack coat are considered subsidiary and incidental to this item of work, and no separate payment will be made.

3. Top course or surface treatment pavement placed over trenches may be feathered to meet existing paved surfaces, if approved by the Engineer.

4. Prior to placing full width top course or surface treatment pavements, cold planning shall be used as detailed in the Contract Drawings to achieve a smooth transition.

5. Existing pavement around castings shall be removed with hand cold planning equipment, or by the use of hand tools if necessary, prior to placement of pavement overlay.

3.04 PAVEMENT PLACEMENT:

A. Unless otherwise permitted by the Engineer for particular conditions, only machine methods of placing the pavement shall be used. The equipment for spreading and finishing shall be mechanical, self-powered pavers, capable of spreading and finishing the mixture true to line, grade, width and crown. The mixtures shall be placed and compacted only at such times as to permit proper inspection and checking by the Engineer.

B. After the paving mixtures have been properly spread, initial and intermediate compaction shall be obtained by the use of steel wheel rollers having a weight of not less than 240 pounds per inch width of tread.

C. Final rolling of the top course or surface treatment pavement shall be performed by a steel wheel roller weighing not less than 285 pounds per inch width of tread at a mix temperature and time sufficient to allow for final smoothing of the surface and thorough compaction.

D. Immediately after placement of top course or surface treatment pavement, all joints between the existing and new top course or surface treatment pavements shall be sealed

with hot poured rubberized asphalt sealant meeting the requirements of Federal Specification SS-S-1401 or SS-S-164.

E. Where there is no backing for the edges of the curb-to-curb pavement, the Contractor shall provide a gravel transition. The gravel transition shall be installed immediately after the pavement is placed, shall be feathered and extend a minimum of 18 inches, and shall be compacted using the same equipment as for pavement compaction. The gravel shall be uniformly graded material with a maximum size of 3/8 to 1/2 inch.

F. When directed by the Engineer, the Contractor shall furnish and install additional paving to provide satisfactory transition for driveways and walkways impacted by a new curb-to-curb pavement installation. The transition pavement installation will be paid for under the item for Hot Bituminous Pavement, Hand Method.

G. Each pavement layer should be compacted to 92% of its Theoretical Maximum Density as determined by AASHTO T 209.

H. Pavement acceptance shall be determined based on comparison to the submittal for gradation and asphalt binder content in accordance with AASHTO T 164 and comparison to 92% compaction as determined by AASHTO T 166 and AASHTO T 209.

3.09 RAISING AND ADJUSTING CASTINGS:

A. For sewer and drainage castings see Section 02629, Resetting Sewer or Drainage Castings.

B. Valve box castings owned by private utilities shall be raised or lowered to proper final grade by the Contractor, unless the private utility will perform this work with their own forces. The Contractor shall be responsible for coordinating this work.

D. The method of raising or lowering valve boxes shall be as follows: Cut around valve box a minimum of 8-inches from valve box. Excavate as required and raise the valve box. Pour high early strength cement or bituminous concrete collar, as directed, to approximately 1-1/2-inches below the top of the valve box.

E. Castings which need to be raised, lowered or adjusted to complete permanent curb to curb paving shall be done immediately prior to paving.

3.10 PAVEMENT MARKINGS:

A. See Section 02500, Curbs and Incidental Items. The Contractor shall replace all pavement markings (temporary or permanent) removed or covered-over in carrying out the work, and as directed by the Engineer, no sooner than 48 hours after completion of the binder pavement (for temporary markings) or permanent final pavement (for permanent markings).

3.11 PAVEMENT REPAIR:

A. If required in the contract or if permanent pavement becomes rough or uneven, permanent pavement patches and trenches shall be repaired and brought to grade utilizing "infrared" paving methods following completion of the construction.

B. The Contractor performing the work shall use care to avoid overheating the pavement being repaired.

C. Pavement repair shall extend a minimum of 6-inches beyond all edges of the pavement patch to assure adequate bonding at the pavement joints.

3.12 SAW CUTTING PAVEMENT:

A. The pavement shall be saw cut at driveways and intersecting roadway tie in locations as shown on the Project Plans. Work shall conform to NHDOT Section 628 – Sawed Pavement.

3.13 COLD PLANING BITUMINOUS SURFACE

A. The pavement shall be cold planed (milled) in the areas shown on the plans to 1-1/2" depth to receive a tack coat and 1-1/2" finish course of pavement.

3.14 MEASUREMENT AND PAYMENT:

A. All work performed as described in this Section will be paid for under one or more of the payment items listed in Section 01270 - Measurement and Payment, and in the **BID SCHEDULE.** The payment items are intended to provide full payment for the work shown on the drawings and specified herein. Any work called for or implied in the documents but not listed as a payment item shall be considered **incidental** to the overall project.

B. **Liquid Asphalt Adjustment:** All work performed as described in this Section 02745, Paving will be subject to a liquid asphalt price adjustment as described below, **except bituminous pavement for sidewalks**. The liquid asphalt adjustment is used when the "NE Average" monthly price for asphalt cement as furnished by the NHDOT Bureau of Materials and Research differs from the base price contained in the proposal. The monthly price posted by NHDOT is available in the following web page:

http://www.nh.gov/dot/org/projectdevelopment/construction/documents/MonthlyFuelPricesImperial.pdf

The price adjustment will be based on the percent of asphalt cement in the approved mix formula(s) in the materials incorporated in the work.

The base price of asphalt cement for this Contract is: $ **580.00** per ton.

The **monthly price** of asphalt cement will be furnished by the NHDOT Bureau of Materials and Research on the first business day following the 14th calendar day of each month.

The contract prices of Hot Bituminous Pavement will be paid under the item in the contract. The price adjustment, as provided herein, upwards or downwards, will be made at the end of each month in which the work was accomplished as follows:

[monthly price less the base price] X [approved job mix formula percent of asphalt cement] X [tons of pavement used].

END OF SECTION

# SECTION 02760

# STRUCTURAL GROUTING

## PART 1 - GENERAL

### 1.01 SCOPE OF WORK:

A. Provide all labor, materials, accessories, equipment, and tools required for the structural rehabilitation of pipe and lateral defects, such as holes and voids, by injection of a silicate-based resin (i.e. structural grout) as shown on the Drawings and as specified herein.

### 1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. Section 01300 – Submittals

B. Section 02600 – Wastewater Flow Control

C. Section 02650 – Sewer Line Cleaning

D. Section 02720 – Excavated Point Repair (Pipe and Tap Connections)

E. Section 02731 – Sanitary Sewer Television Inspection

### 1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS:

A. Without limiting the generality of the other requirements of the Specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. NASSCO Specification Guidelines – Specification for Sewer Line Cleaning

2. NASSCO Specification Guidelines – Specification for Television Inspection Main Sewer

### 1.04 SUBMITTALS:

A. Shop Drawings: The Contractor shall submit the following in accordance with the requirements set forth in Section 01300 – Submittals:

1. Structural grout product data showing physical and chemical properties

2. Manufacturer's installation instructions

3. MSDS sheets

B. After the structural grout is injected, Contractor shall submit the following for each main line or lateral repair completed using structural grout:

1. CCTV footage of the repair on a DVD or CD

2. A log containing the following information, at a minimum:

a. Date and location of main line or lateral grouting

b. Weather and groundwater conditions at time of grouting

c. Quantity (gallons) of resin injected

d. Resin batch number

e. Any additional cutting requirement(s) other than the standard stated herein

1.05 QUALIFICATIONS:

A. The qualifications of the Contractor shall be submitted with the Bid Proposal. These qualifications shall include detailed descriptions of the following:

1. Name, business address, and telephone number of the Contractor

2. Name(s) of all supervisory personnel that will be directly involved in the Project

3. Proposed product information showing compliance with the specified requirements listed herein, including structural grouts, packers, and suitability for penetrating soil/bedding

4. Documentation of certification of Contractor/installer by the structural grout and resin injector manufacturer and/or its authorized representative

5. A reference list of previous projects on which the Contractor and/or installer has provided structural grouting over the last five years, including project name, project number, customer name, and owner's contact information (name and phone number

6. To be acceptable, the Contractor/installer must have had a minimum of five (5) years of active experience in structural grouting.

7. The structural grout shall have documented service of successful performance in similar usage, with a minimum of 1,000 applications in the United States.

8. The Contractor shall sign and date the information provided and certify that, to the extent of his knowledge, the information is true and accurate and that the supervisory personnel will be directly involved with and used on the Project. Substitutions of personnel and/or methods will not be allowed without written authorization by the Owner and Engineer.

## PART 2 - PRODUCTS

### 2.01 STRUCTURAL GROUT:

A. A silicate based-resin (i.e. structural grout) shall be injected into the soils/bedding surrounding the pipe interface to reestablish bedding and spring line support and provide a structural repair with a proven 50-year lifespan that prevents the passage of water via infiltration and root intrusion through the sealed void.

B. Mixing and handling of the structural grout material shall be in accordance with the manufacturer's and supplier's recommendations.

C. Structural grout shall have a viscosity between 200 to 250 centipoise to allow it to easily penetrate cracks, holes, and areas where pipe is broken or missing.

D. Structural grout shall be capable of injection into voids and subsequent curing in the presence of high groundwater infiltration.

E. Structural grout shall have a cure time of approximately 20 minutes to permit formation of exterior reinforcement grout-soil mass. Structural grout shall cure via ambient temperatures in the pipe and soil environment.

F. Structural grout shall be continuously supplied through hoses to the injection point to properly build grout reconstruction in the soils/bedding/voids surrounding the pipe interface.

G. Structural grout shall have bonding characteristics to withstand the movement of pipe and interface area during periods of hydrostatic lift without cracking, breaking, or tearing. Grout shall meet the following minimum physical properties:

1. Minimum Tensile Strength: 2,100 psi

2. Minimum Compressive Strength: 5,100 psi

3. Minimum Adhesive Strength: 340 psi for clay pipe and 350 psi for concrete pipe

H. The cured structural grout shall be chemically-stable and shall be resistant to the concentrations of acids, alkalis, and organics found in normal wastewater.

I. Residual structural grout sealing materials shall be easily removable from the sewer to prevent reduction or blockage of the flow.

J. Structural grout process shall be the Janssen Process or Engineer-approval equal.

## PART 3 -- EXECUTION

### 3.01 CLEANING SEWER LINES:

A. Prior to any structural grouting of a pipe, the Contractor shall remove internal deposits, protrusions, and anything that prevents proper packer seating from the pipeline in accordance with Section 02650 – Sewer Line Cleaning.

### 3.02 TELEVISION SURVEY:

A. Prior to application of the structural grout and again after application of the structural grout, a television survey of each grouted pipeline shall be performed in accordance with Section 02731 – Sanitary Sewer Television Inspection.

B. The interior of the pipeline shall be carefully surveyed to determine the location(s) and extent(s) of any structural failures. The location(s) of any conditions which may prevent proper application of grouting materials in the pipeline shall be noted so that these conditions can be corrected. A videotape and suitable log shall be maintained and submitted to the Engineer.

### 3.03 FLOW BYPASSING:

A. When required, the Contractor shall provide for the transfer of flow around a section or sections of pipe to be grouted. The proposed bypassing system shall be approved in advance by the Owner and Engineer. The approval of the bypassing system shall in no way relieve the Contractor of his responsibility and/or public liability. The flow bypassing shall be performed in accordance with Section 02600 – Wastewater Flow Control.

1. If the grouting can be completed in a few hours, bypass pumping may not be required. The placement carriage shall be equipped with a bypass section to allow flow once grouting is completed.

### 3.04 LINE OBSTRUCTIONS:

A. The Contractor shall clear each pipeline of obstructions prior to grouting. If the survey reveals an obstruction that cannot be removed by conventional cleaning equipment, the Contractor shall make a point repair excavation in accordance with Section 02720 – Excavated Point Repair (Pipe and Tap Connections) to uncover and remove or repair the obstruction. All excavations shall be approved by the Owner and Engineer in writing prior to the commencement of the work.

## 3.05 STRUCTURAL GROUT APPLICATION:

A. The entire structural grouting process shall be performed in strict accordance with the manufacturer's current guidelines. If any deviations from the guidelines are proposed, Contractor shall submit explanation and approval from resin and/or injector manufacturer(s).

B. Repairs shall take place at defects (holes and voids) or similar points of infiltration as listed in the Pipe Rehabilitation Schedules on the Drawings. The repair shall not permanently reduce or change the original cross-sectional area and shape of the interior of the sewer pipeline.

C. If either the Drawings show or the Owner or Engineer requests structural grouting in addition to a sectional liner, grouting shall be completed and accepted by the Owner and Engineer prior to installation of the sectional liner.

D. Sewer Pipe Defects:

1. Contractor shall position the sealing packer over the area to be repaired using a metering device at the surface and CCTV camera in the line.

2. Accurate measurement of the location of the defect to be sealed shall be made using the portion of sealing packer as the datum (i.e. measurement point or target).

3. A similar measurement to the target shall also be used to obtain the necessary measurement for positioning the injection area of the sealing packer over the area to be sealed.

4. Contractor shall expand the sealing packer sleeves using controlled pressures.

5. Expanded sleeve shall seal against the inside periphery of the pipeline to form a void area at the point of infiltration that is completely isolated from the rest of the pipeline.

6. Contractor shall pump sealant materials into the isolated area through those systems at controlled pressures that are in excess of groundwater pressures.

7. Contractor shall pump as much grout as is required to seal any leaks and fill the voids.

8. Structural grout shall break away from the packer and stay in place when the packer is deflated and moved from the point of infiltration.

9. Upon completion of injection, Contractor shall test the point of repair. If testing shows the seal was not completely effective, Contractor shall repeat the sealing process until the defect successfully passes the pressure test.

10. After sealing each sewer section, Contractor shall remove surplus grouting material from the section at the manhole immediately downstream of the grouting location.

11. If surplus grouting materials left in a sewer section by the Contractor result in sewer surcharging and subsequent damage to public or private property, Contractor shall be responsible for damage to property and payment of any related expenses incurred by Owner.

12. For sealing main line sewer pipe defects and laterals connected to manholes by packer injection grouting, gel times shall be plus or minus 30 seconds unless otherwise approved by Engineer.

E. Lateral Connections:

1. A section of approximately 2 inches of the entire circumference of the lateral pipe wall at the connection to the main shall be cut or milled to provide an egress path for grout injection.

2. An ambient-cure grout shall be injected into the interface isolated by the inflated main line packer and lateral bladder. Cured grout shall:

   a. Provide a continuous band throughout the circumference of the lateral-to-main line connection.

   b. Be smooth at the interface and not impede flow from the lateral.

   c. Create a grout and grout/soil reinforcement mass surrounding the interface to reestablish spring line support for the lateral.

3. Contractor shall fill any offset gaps in the first joint that are within 18 inches of the main line with structural grout.

4. Contractor shall fill any holes or cracks in the lateral between the main line connection and first joint that are within 18 inches of the main line with structural grout.

5. If annulus exists in lined pipe, Contractor shall fill it with structural grout.

## 3.06 ACCEPTANCE AND TESTING:

A. Owner or Engineer shall confirm completion of structural grouting and its compliance with the Specifications.

B. CCTV inspection after installation of the structural grout shall be performed in accordance with Section 02731 – Sanitary Sewer Television Inspection, and footage shall be submitted as stated herein. If CCTV inspection reveals breaches, such as holes, tears or cracks, in the circular resin band, the lateral repair process shall be repeated beginning with the cutting phase outlined in Article 3.05.

3.07 SITE RESTORATION:

A. After the grouting has been completed and accepted by the Owner, the Contractor shall restore the entire Project area and shall return the ground cover to its original or better condition. All excess material and debris not incorporated into the permanent installation shall be disposed of by the Contractor.

B. A container shall be furnished for the collection of solvents used in the cleaning of the grouting equipment. Contractor shall use an approved solvent recovery process to dispose of the collected solvents. Disposal of cleaning solvents into the sewer system or into natural watercourses is strictly prohibited.

- END OF SECTION –

NO TEXT ON THIS PAGE

# SECTION 02770

# FULL-CIRCLE MAIN TO LATERAL CONNECTION LINING

## PART 1 - GENERAL

### 1.01 SCOPE OF WORK:

A. Provide all labor, materials, accessories, equipment, tools, and incidentals required for the rehabilitation and testing of main line sewer sections and the adjacent laterals without excavation by providing a one-piece, leak-free connection at the interface of the main line and lateral using Cured-in-Place Pipe (CIPP) as shown on the Drawings and as specified herein. The CIPP liner shall be designed for a gravity wastewater application.

B. The finished main-to-lateral connection pipe liner shall be fabricated from materials which, when installed, shall be chemically-resistant to withstand exposure to domestic sewage and shall restore the structural integrity of the main line section and lateral.

### 1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. Section 01300 – Submittals

B. Section 02600 – Wastewater Flow Control

C. Section 02650 – Sewer Line Cleaning

D. Section 02720 – Excavated Point Repair (Pipe and Tap Connections)

E. Section 02731 – Sanitary Sewer Television Inspection

### 1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS:

A. Without limiting the generality of the other requirements of the Specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

| | | |
|---|---|---|
| 1. | ASTM D790 | Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials |
| 2. | ASTM F1216 | Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube |

1.04 DELIVERY, STORAGE, AND HANDLING:

A. Care shall be taken in shipping, storage, and handling to avoid damaging the liner.

B. All material shall be shipped, stored, and handled in conformance with the manufacturer's requirements and recommendations.

1.05 WARRANTY:

A. All lining work shall be warranted by the applicator and/or manufacturer against failure for a minimum of two (2) years after acceptance by the Owner; in no case shall the warranty be less than the manufacturer's published standard warranty period. If any such failure occurs within the warranty period, the damage shall be repaired by the Contractor in a manner satisfactory to the Owner at no cost to the Owner within 60 days after written notification of the failure.

1.06 SUBMITTALS:

A. Shop Drawings: The Contractor shall submit the following in accordance with the requirements set forth in Section 01300 – Submittals:

1. Design calculations

2. Resin physical and chemical properties

3. Manufacturer's installation instructions

4. MSDS sheets

1.07 QUALIFICATIONS:

A. The qualifications of the Contractor shall be submitted with the Bid Proposal. These qualifications shall include detailed descriptions of the following:

1. Name, business address, and telephone number of the Contractor

2. Name(s) of all supervisory personnel that will be directly involved in the Project

3. Proposed product information showing compliance with the specified requirements listed herein, including liner material, resin, and hydrophilic material

4. Documentation of certification of specialty technicians by the equipment manufacturer and/or its authorized representative

5. A reference list of previous projects on which the Contractor and/or installer has installed CIPP linings at main-to-lateral connections over the last two years,

including project name, project number, customer name, owner's contact information (name and phone number), and the number of CIPP linings at main-to-lateral connections installed

6. To be acceptable, The Contractor/installer must have had a minimum of 400 main-to-lateral connection liner installations and a minimum of two (2) years of active experience in the commercial installation of the product.

7. The Contractor shall sign and date the information provided and certify that, to the extent of his knowledge, the information is true and accurate and that the supervisory personnel will be directly involved with and used on the Project. Substitutions of personnel and/or methods will not be allowed without prior written authorization by the Owner and Engineer.

## PART 2 - PRODUCTS

### 2.01 GENERAL:

A. The finished liner shall be fabricated from material as specified herein which, when cured, shall be chemically-resistant to the corrosive effects of the raw sewage and hydrogen sulfide. The main-to-lateral connection CIPP lining shall be as manufactured by LMK Technologies, Perma-Liner Industries, BLD Services, or Engineer-approved equal.

B. See Full-Circle Tap Connection Repair detail on Drawing D01.

### 2.02 LINER SIZING:

A. The liner shall be fabricated to a size that, when installed, shall neatly fit the internal circumference of the main line pipe and lateral connection to be repaired.

B. The minimum length of the main line liner shall be 16 inches.

C. The length projected into the lateral shall be a minimum of 6 inches past the first joint on the connection fitting and a minimum of 12 inches total.

### 2.03 LINER MATERIAL:

A. The liner shall be one-piece, shall consist of a main line portion and a lateral portion, and shall consist of one or more layers of flexible needled felt or an equivalent non-woven material. The liner shall be continuous in length, and the wall thickness shall be uniform. No overlapping sections shall be allowed in the circumference or the length of the lateral liner. The tube shall be capable of conforming to offset joints, bells, and disfigured pipe sections. The main line liner shall be flat with one end overlapping the second end and shall be sized accordingly to create a circular lining equal to the diameter of the main line pipe. The resin shall be selected with proper consideration for the specific application.

The main-to-lateral connection CIPP liner shall result in a smooth bore interior after installation. A report documenting the design criteria for a fully deteriorated pipe section, relative to the hydrostatic pressures, depth of soil cover, and type of soil, shall be submitted to the Engineer for each installation. The main line liner shall be a full-circle, 18-inch long CIPP liner integrally manufactured to the lateral liner to provide a seamless connection between the main line liner and the lateral liner. Installation shall be remotely accomplished using air or water for inversion and curing. The cured pipe repair system shall be watertight, shall conform to the existing pipe, and shall eliminate any leakage or connection to the outside of the host pipe/service.

B. The composite of the previously-listed materials shall, upon installation inside the host pipe, exceed the following ASTM test standards at a minimum:

| Item | Test Value | Reference Standard |
|---|---|---|
| Flexural Strength | 4,500 psi | ASTM D790 |
| Flexural Modulus | 250,000 psi | ASTM D790 |

2.04 LINER DESIGN:

A. The minimum required structural CIPP wall thickness shall be based on the physical properties previously described and shall be in accordance with the design equations in the appendix of ASTM F1216 and the following design parameters:

| | |
|---|---|
| Design Safety Factor | 2.0 |
| Retention Factor for Long-Term Flexural Modulus for Design | 50 percent |
| Ovality* | 2 percent |
| Groundwater Depth = Pipe Depth (above invert)* | ____ feet |
| Soil Depth (above crown)* | ____ feet |
| Soil Modulus | 700 psi |
| Soil Load | 120 pcf |
| Live Load | One AASHTO H-20 Truck |
| Design Condition | Fully-Deteriorated |

**Denotes information which can be provided here or in inspection video tapes or project construction drawings. Multiple line segments may require a table of values.*

B. The lining manufacturer shall submit complete design calculations for the liner, signed and sealed by a Professional Engineer registered in the State of Alabama and certified by the manufacturer as to the compliance of his materials to the values used in the calculations, to the Engineer for review.

C. Liner shall be neither accepted nor installed until design calculations are acceptable to the Owner and Engineer.

2.05 HYDROPHILIC SEALING MATERIAL:

A. The liner shall be inverted into place with a continuous hydrophilic gasket or hydrophilic sealing material along the entire interface between the main line and the lateral and the terminal ends of the main line and lateral.

B. Hydrophilic gasket or sealing paste shall be a material specifically designed to expand in the presence of water. Expansion by volume shall be a minimum of 100 percent. Material shall be resistant to chemical contaminants, such as hydrogen sulfide, at the concentrations typically found in domestic wastewater.

PART 3 - EXECUTION

3.01 CLEANING SEWER LINES:

A. Prior to applying a CIPP liner to a main-to-lateral connection, the Contractor shall remove internal deposits from the main and lateral in accordance with Section 02650 – Sewer Line Cleaning.

3.02 TELEVISION SURVEY:

A. Prior to application of the liner and again after application of the liner, a television survey of each CIPP-lined main-to-lateral connection shall be performed in accordance with Section 02731 – Sanitary Sewer Television Inspection.

B. The interior of the main line and lateral shall be carefully surveyed to determine the location(s) and extent(s) of any structural failures. The location(s) of any conditions which may prevent proper installation of lining materials in the main line and lateral shall be noted so that these conditions can be corrected. A videotape and suitable log shall be maintained and submitted to the Engineer.

3.03 FLOW BYPASSING:

A. When required, the Contractor shall provide for the transfer of flow around a section or sections of pipe to be lined. The proposed bypassing system shall be approved in advance by the Owner and Engineer. The approval of the bypassing system shall in no way relieve the Contractor of his responsibility and/or public liability. The flow bypassing shall be performed in accordance with Section 02600 – Wastewater Flow Control.

1. If the installation of the lining can be completed in a few hours, bypass pumping may not be required. The placement carriage shall be equipped with a bypass section to allow flow once liner is pressed into place.

3.04 LINE OBSTRUCTIONS:

A. The Contractor shall clear each main line and lateral of obstructions prior to lining. If the survey reveals an obstruction that cannot be removed by conventional cleaning equipment, the Contractor shall make a point repair excavation in accordance with Section 02720 – Excavated Point Repair (Pipe and Tap Connections) to uncover and remove or repair the obstruction. All excavations shall be approved by the Owner and Engineer in writing prior to the commencement of the work.

3.05 LINER INSTALLATION:

A. The tube shall be inspected for tears and frayed sections. The tube, after it is verified to be in good condition, shall be vacuum-impregnated with the thermosetting resin. The resin shall be introduced into the tube by creating a slug of resin at the beginning of the tube. A calibration roller shall be used to assist the movement of the resin slug throughout the tube. All air in the tube shall be removed using a vacuum, which will allow the resin to thoroughly impregnate the tube. All resin shall be contained to ensure that public properties or persons are not exposed to the liquid resin. The main line liner shall be saturated on a wet-out platform. The resin-impregnated sample (wick) shall be retained by the installer to provide verification of the curing process taking place in the host pipe.

B. The saturated tube shall be inserted into the carrying device along with the inversion bladder. The main line liner shall be affixed on the "T" launching device. Both the launching device and carrying device shall be pulled into the pipe using a cable winch. The pull shall be complete when the open port of the "T" launching device is aligned with the interface between the main line and lateral. The resin-saturated lateral tube shall be completely protected during the pull. Resin shall not be lost by contact with manhole walls or the pipe during the pull. The resin-saturated main line liner shall be supported on the rigid "T" launcher that is elevated above the pipe invert using a rotating skid system. The main line liner shall not be contaminated or diluted by exposure to dirt, debris, or water during the pull.

C. The installer shall document the placement of the "T" Liner by internal CCTV inspection. The camera shall be inserted from the lateral down to the main line pipe.

D. The main line liner shall be expanded against the main line, and the lateral tube shall be inverted out of the "T" launcher/carrying device using controlled air or water pressure. The installer shall be able to view the lateral liner contacting the lateral from the beginning to the end of the repair. The main line liner and the lateral tube shall be held tightly in place against the wall of the host pipe by controlled pressure until the cure is complete.

E. When the curing process is complete, the pressure shall be released. The inversion bladder and launching device shall be removed from the host pipe using the winch. No barriers, coatings, or any material other than the cured tube/resin composite shall be left

in the host pipe. Any materials used in the installation other than the cured tube/resin composite shall be removed from the pipe by the installer.

3.06 ACCEPTANCE AND TESTING:

A. The finished liner shall be continuous over the entire length of the installation. The liner shall be free from visual defects, damage, deflection, holes, delamination, uncured resin, etc.. There shall be no visible infiltration through the liner or from behind the liner.

B. CCTV inspection after liner installation shall be performed in accordance with Section 02731 – Sanitary Sewer Television Inspection. Owner and/or Engineer shall confirm visible acceptance of sectional liner. If main line is also specified to be CIPP lined, CCTV inspection after the lateral liner is applied can be the same inspection as the CCTV inspection after CIPP lining.

C. An air test shall be performed by the Contractor to verify that the lateral liner and service connection are not leaking. Testing shall be performed at the Owner's and/or Engineer's discretion and at a frequency not to exceed one test for every ten T-liners installed. All of the costs for testing shall be included in the amount bid for the Bid Item for Tap Connection Repair (Full-Circle Liner), and no separate payment shall be made.

1. A camera shall be inserted into the lateral via a clean-out located upstream of the uppermost portion of the CIPP lateral liner. The camera shall then be moved through the lateral until it is positioned at the lateral/main connection. The camera shall be utilized to assist in positioning and placing a plug in the main line on each side of the lateral opening. A pair of test plugs, separated by a minimum of 10 inches, shall be centered on the lateral opening and shall span the brim of the lined connection.

2. Next, an air test plug shall be installed in the lateral via the clean-out opening. The test plug shall be placed not more than 5 inches inside of the CIPP lateral liner at its uppermost portion. The test plug shall then be inflated and sealed against the uppermost portion of the CIPP lateral liner.

3. The pair of plugs within the main line shall then be inflated and sealed across the service connection.

4. Air pressure at not less than 4 psi shall be introduced through the test plug. The void area between the three plugs shall be pressurized at 4 psi and held for 3 minutes, and during this time, the pressure shall not drop below 3.5 psi.

5. If an installed CIPP lateral liner fails the air test, the following corrective measures shall be taken:

   a. The CIPP lateral liner shall be re-inspected using a CCTV camera to attempt to identify the defect.

b. Any repairs made shall consist of materials that are structural and meet or exceed the same criteria as the CIPP lateral liner is required to meet in a domestic sewer collection system. Such materials shall have a minimum life expectancy of 50 years in accordance with Appendix X1 and Appendix X2 of ASTM F1216.

c. Once the defect has been corrected, the renewed lateral pipe shall be re-tested in accordance with the air test procedure as previously described.

d. Any corrective measures shall be performed at the Contractor's expense.

6. If any of the air tests fail, the Owner and/or Engineer may require the Contractor to test an additional lateral at no additional charge to the Owner. If a second air test fails, the Owner and/or Engineer may require the Contractor to test additional or all of the installed CIPP lateral linings at no additional charge to the Owner.

3.07 SITE RESTORATION:

A. After the liner installation has been completed and accepted, the Contractor shall clean up the entire Project area and return the ground cover to grade. All excess material and debris not incorporated into the permanent installation shall be disposed of by the Contractor.

- END OF SECTION -

# SECTION 02800

# MANHOLE REHABILITATION

## PART 1 - GENERAL

### 1.01 SCOPE OF WORK:

A. Provide all labor, materials, accessories, equipment, tools, and incidentals required to rehabilitate and test manholes as shown on the Drawings and as specified herein, including surface preparation, flow diversion, inflow control, invert and channel reconstruction, internal lining, chimney seals, and pipe connections.

B. The manhole rehabilitation products shall be fabricated from materials which, when installed, shall mitigate or terminate infiltration and shall be chemically-resistant to withstand exposure to domestic sewage.

### 1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. Section 01300 – Submittals

B. Section 02750 – Chemical Grouting

### 1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS:

A. Without limiting the generality of the other requirements of the Specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

| | | |
|---|---|---|
| 1. | ASTM C109 | Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens) |
| 2. | ASTM C273 | Standard Test Method for Shear Properties of Sandwich Core Materials |
| 3. | ASTM C293 | Standard Test Method for Flexural Strength of Concrete (Using Simple Beam With Center-Point Loading) |
| 4. | ASTM C496 | Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens |

| | | |
|---|---|---|
| 5. | ASTM C882 | Standard Test Method for Bond Strength of Epoxy-Resin Systems Used With Concrete By Slant Shear |
| 6. | ASTM C1244 | Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill |
| 7. | ASTM D412 | Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers – Tension |
| 8. | ASTM D624 | Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers |
| 9. | ASTM D638 | Standard Test Method for Tensile Properties of Plastics |
| 10. | ASTM D695 | Standard Test Method for Compressive Properties of Rigid Plastics |
| 11. | ASTM D790 | Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials |
| 12. | ASTM D2240 | Standard Test Method for Rubber Property – Durometer Hardness |
| 13. | ASTM D4787 | Standard Practice for Continuity Verification of Liquid or Sheet Linings Applied to Concrete Substrates |
| 14. | ASTM D7234 | Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers |

1.04 SUBMITTALS:

A. Shop Drawings: The Contractor shall submit the following for the manhole rehabilitation products in accordance with the requirements set forth in Section 01300 – Submittals:

1. Physical and chemical properties

2. Material composition

3. Confirmation of conformance to applicable reference standards

4. MSDSs

5. Warranty information

6. Instructions for installation and repair

7. Manufacturer's statement of compatibility between epoxy or polyurethane coating and cementitious base coat

1.05 QUALIFICATIONS:

A. The qualifications of the apparent low bidder shall be submitted no later than seven (7) calendar days after the bid opening to the Engineer for evaluation prior to making a recommendation for award. These qualifications shall include detailed descriptions of the following:

1. Name, business address, and telephone number of the Contractor

2. Name(s) of all supervisory personnel that will be directly involved in the Project

3. Proposed product information showing compliance with the specified requirements listed herein, including chimney seal, grout, and internal liner material, and the respective manufacturer's installation instructions.

4. Documentation of certification of the Contractor, specialty technician, and/or installer by the product manufacturer and/or its authorized representative

5. A reference list of previous projects on which the Contractor and/or installer has rehabilitated manholes over the last two years, including project name, project number, customer name, owner's contact information (name and phone number), and the number of manholes rehabilitated

6. To be acceptable, the Contractor/installer must have had a minimum of 500 manhole rehabilitation product installations and a minimum of two (2) years of active experience in the commercial installation of the products.

7. The Contractor shall sign and date the information provided and certify that, to the extent of his knowledge, the information is true and accurate and that the supervisory personnel will be directly involved with and used on the Project. Substitutions of personnel and/or methods will not be allowed without prior written authorization by the Owner and Engineer.

1.06 WARRANTY:

A. All rehabilitation systems, shall be warranted by the applicator and/or manufacturer against failure for a minimum of two (2) years after acceptance by the Owner; in no case shall the

warranty be less than the manufacturer's published standard warranty period.

B. Failure will be deemed to have occurred if they fail to prevent groundwater infiltration or prevent the internal deterioration or corrosion of the manhole. If any such failure occurs within the warranty period, the damage shall be repaired by the Contractor in a manner satisfactory to the Owner at no cost to the Owner within 60 days after written notification of the failure.

PART 2 - PRODUCTS

2.01 GENERAL:

A. The materials to be utilized in the rehabilitation of manholes shall be designed and manufactured to withstand the corrosive effects of hydrogen sulfide in a wastewater environment, prevent infiltration, and withstand constant and direct contact with flowing wastewater.

2.04 INTERNAL-LINER SYSTEM:

A. The internal liner system shall be specifically designed for a minimum service life of 50 years, to continuously bond to the substrate, to withstand a temperature range of 0 degrees to 100 degrees Fahrenheit, to restore the interior of the manhole, to withstand the corrosive gases of domestic wastewater (especially hydrogen sulfide), to eliminate the infiltration of groundwater through the manhole walls and mortar joints, and to be structurally capable of withstanding the pressure of groundwater based on the depth of the specific manhole being lined.

B. The internal liner system shall be a multilayered polyurethane/polymeric stress skin panel system, a 100 percent solids epoxy or polyurethane coating, or a composite system consisting of an epoxy or polyurethane top coat over a cementitious base coat. Infiltration control, patching material, and/or a cementitious base coat may be necessary depending on the extent of the manhole corrosion, damage, substrate profile, loss of material, and infiltration. All materials used shall be completely compatible with all other manhole rehabilitation products being used. Contractor shall ensure compatibility of all products with the individual material manufacturers.

C. Where necessary, infiltration control and patching materials shall be installed in accordance with the lining manufacturer's requirements prior to installing the lining system to control active infiltration and repair voids in the existing manhole walls or damaged inverts. Infiltration control and patching materials shall be rapid-setting, high early

strength, hand-applied cementitious materials for stopping infiltrating water and making repairs to concrete, brick, or other masonry-constructed manholes. The materials shall be non-shrinking, nonmetallic, and non-corrosive. The materials shall be compatible with the lining material used. Infiltration control and patching materials shall be as manufactured by The Strong Company, Inc., Raven Lining Systems, Madewell Products Corporation, Quadex, Inc., or Engineer-approved equal.

D. Multilayered polyurethane/polymeric stress skin panel system shall consist of a moisture barrier, surfacer, and final corrosion barrier. Multilayered panel system shall be SpectraShield by CCI Spectrum, Inc. or Engineer-approved equal. Multilayered panel system shall meet the following requirements at a minimum:

1. Shore A Hardness: 95 (per ASTM D2240)

2. Elongation: 300 percent (per ASTM D412)

3. Tensile Strength: 2,400 psi (per ASTM D412)

4. Tear Strength: 500 pounds/linear inch (per ASTM D624)

5. Shear Strength: 225 psi (per ASTM C273)

6. Finished Dry Thickness: 500 mils

7. Adhesion to Concrete: Substrate failure (per ASTM D7234)

E. Epoxy or polyurethane coating shall be high-build, shall be 100 percent solids, and shall contain no volatile organic compounds. Coating shall be suitable for use as a trowel-applied or spray-applied monolithic surfacing at the minimum dry film thickness specified herein. Epoxy or polyurethane coating shall be Raven 405 by Raven Lining Systems, Mainstay DS-5 by Madewell Products Corporation, SprayWall by Sprayroq, S-301 Epoxy Spray System by Warren Environmental, Inc., or Engineer-approved equal. Epoxy or polyurethane coating shall meet the following requirements at a minimum:

1. Shore D Hardness: 85 (per ASTM D2240)

2. Compressive Strength: 12,000 psi (per ASTM D695)

3. Tensile Strength: 6,800 psi (per ASTM D638)

4. Flexural Strength: 11,000 psi (per ASTM D790)

5. Finished Dry Thickness: 125 mils

6. Adhesion to Concrete: Substrate failure (per ASTM D7234)

F. Cementitious base coat shall be a pumpable, Portland-based microsilica cement or calcium aluminate cement. If the epoxy or polyurethane coating manufacturer also manufactures a cementitious base coat, the cementitious base coat product shall be by the same manufacturer as the epoxy or polyurethane top coat product. If the epoxy or polyurethane coating manufacturer does not manufacture a cementitious base coat, the cementitious base coat product shall be compatible with the epoxy or polyurethane top coat product. Contractor shall ensure compatibility between the top coat product and cementitious base coat product. Cementitious base coat shall be Raven 705CA by Raven Lining Systems, Mainstay ML-72 by Madewell Products Corporation, or Engineer-approved equal. Cementitious base coat, when cured, shall meet the following requirements at 28 days at a minimum:

1. Compressive Strength: 9,200 psi (per ASTM C109)

2. Tensile Strength: 685 psi (per ASTM C496)

3. Flexural Strength: 1,200 psi (per ASTM C293)

4. Finished Dry Thickness: See Article 3.04, Paragraph H herein

5. Bond Strength: 2,000 psi (per ASTM C882)

## PART 3 - EXECUTION

### 3.01 GENERAL:

A. Contractor shall accurately field-measure and size the rehabilitation products for each individual manhole. Each existing sewer manhole to be rehabilitated may have a different configuration and varying field dimensions. All field measurements shall conform to the requirements of the manufacturers of the rehabilitation products.

### 3.02 CHIMNEY SEAL:

A. All loose and protruding mortar, bricks, roots, and anything else that might prevent proper application of the chimney seal shall be removed prior to application.

B. Active leaks shall be stopped with chemical or hydraulic sealants or cements prior to installation.

C. All areas to be sealed shall be dry, clean, and free of dust, dirt, sand, and other contaminants prior to installation. A torch may be required to ensure a dry surface.

D. Chimney seal shall be installed in strict accordance with the manufacturer's installation instructions over the entire chimney area and onto the frame and cone as shown on the Rehabilitation of Existing Manhole detail on Drawing D02. A primer shall be used if recommended by the manufacturer.

3.03 CHEMICAL GROUT:

A. Install chemical grout in accordance with Section 02750 – Chemical Grouting.

B. Chemical grouting shall be completed and accepted prior to performing internal lining if both methods are specified or directed by the Owner and/or Engineer for a specific manhole.

3.04 INTERNAL LINER SYSTEM:

A. All loose and protruding mortar, bricks, roots, and anything else that might prevent proper application of the liner shall be removed prior to application. Manhole steps, protruding pipes, and exposed rebar shall be removed and ground back 1/2 inch into the manhole wall. Manhole steps and protruding pipe shall not be replaced after installation of the liner.

B. High pressure water shall be used during surface preparation to produce a clean, abraded, and sound surface with no evidence of laitance, loose material, or other contaminants. Surface shall have a suitable profile for application of liner in accordance with the manufacturer's requirements.

C. Active leaks shall be stopped with chemical or hydraulic sealants or cements prior to installation.

D. All areas to be lined shall be dry, clean, and free of dust, dirt, sand, and other contaminants prior to installation. A torch or heat lamp may be required to ensure a dry surface.

E. Any spray equipment used for application shall be specifically designed to accurately ratio and apply the liner system. Liner system shall be installed in strict accordance with the manufacturer's installation instructions over the entire interior of the manhole and 2 inches

up onto the frame and 6 inches down onto the bench as shown on the Rehabilitation of Existing Manhole detail on Drawing D02.

F. Multilayered polyurethane/polymeric stress skin panel system shall be installed in strict accordance with the manufacturer's installation instructions, including those for materials handling, mixing, environmental controls, working time, working temperature, pot life, allowable time between coats (recoat time), safety, and spray equipment. A permanent identification and date of work performed shall be affixed to the structure in a readily-visible location, and a final written report shall be provided to Owner and Engineer detailing the location, date of report, and description of liner installation.

G. Epoxy or polyurethane coating shall be installed in strict accordance with the manufacturer's installation instructions, including those for materials handling, primers, mixing, environmental controls, working time, working temperature, pot life, allowable time between coats (recoat time), safety, and spray equipment. Installation of epoxy or polyurethane coating over cementitious base coat shall not occur until the cementitious base coat has cured to the extent and time required by the manufacturer. A permanent identification and date of work performed shall be affixed to the structure in a readily-visible location, and a final written report shall be provided to Owner and Engineer detailing the location, date of report, and description of liner installation.

H. Cementitious base coat shall be installed in strict accordance with the manufacturer's installation instructions, including those for materials handling, on-site mixing, environmental controls, working time, working temperature, safety, and spray equipment. Water shall only be added to the materials during the mixing process and prior to material pumping or spray application; water shall not be added at the nozzle. Cementitious base coat shall only be installed via low-pressure application. The cured base coat surface shall be troweled smooth and continuous with proper sealing connections to all unsurfaced areas. The total thickness of the cementitious base coat shall be in accordance with the epoxy or polyurethane lining manufacturer's recommendations and the following minimum requirements:

1. For all brick manholes and for block or cast concrete manholes in poor condition with notable loss of surface material or exposed reinforcing, apply to a minimum thickness of 1 inch.

2. For block or cast concrete manholes in fair condition, apply to a minimum thickness of 0.5 inch.

3. For block or cast concrete manholes in good condition with no loss of

surface material, it may be acceptable to apply the epoxy or polyurethane top coat directly to the manhole surface without applying a cementitious base coat if the Contractor confirms that the existing manhole surface meets the requirements of the epoxy or polyurethane top coat manufacturer.

3.05 BENCH, CHANNEL, AND INVERT:

A. Flow channels shall conform in shape and slope to that of the existing sewers entering and exiting the manholes.

B. Invert shall be smooth, shall be semi-circular in cross-section, and shall have the same diameter as the existing pipe exiting the manhole.

C. Changes in direction of flow or sewer centerline within a manhole shall be made by forming the flow channel along a smooth curve with as long of a radius as the inside of the manhole will allow.

D. Bench shall slope toward invert as shown on the Rehabilitation of Existing Manhole detail on Drawing D02 for proper drainage to the invert channel.

E. Benches shall be built up to a height as shown on the Rehabilitation of Existing Manhole detail on Drawing D02 for the entering and exiting pipes and shall be given a uniform wood float finish.

F. Where possible, a non-shrink grout fillet shall be installed around pipe penetrations above the bench.

3.06 DROP BOWL ASSEMBLY:

A. Drop pipe and bowl shall be connected to the pipe(s) entering a manhole using manufactured couplings or fittings.

B. Schedule 40 PVC pipe shall be connected using industry-grade solvent cement.

C. Drop pipe shall be secured to the inside of manhole using steel straps or struts. Straps shall have a minimum width of 1/2 inch and a minimum thickness of 0.03 inch.

D. Tee and bottom elbow shall be firmly secured by straps. Intermediate straps shall be spaced at a minimum of 5 feet. Straps shall be epoxy-anchored to manhole using 1/4-inch anchors

(two per strap). Anchor shall be embedded into mortar a minimum of 3 inches. Bottom elbow shall be seated on bench for support.

E. If a manufactured drop bowl product is used, drop assembly shall be sized and installed in strict accordance with the manufacturer's installation instructions and guidelines.

3.07 INSPECTION, TESTING, AND ACCEPTANCE:

A. Contractor shall have appropriate equipment and OSHA training to allow the Owner and/or Engineer to enter and inspect the manholes during rehabilitation. If any defects are observed, products shall be repaired or replaced at no cost to the Owner using a method acceptable to the manufacturer and Owner and/or Engineer.

B. Vacuum testing in accordance with ASTM C1244 shall be required on one randomly-selected manhole for each group of five manholes rehabilitated with internal liners. Contractor shall perform vacuum testing with appropriate test equipment in the presence of an inspector. Any manholes failing this test shall be reworked as necessary and retested at no additional cost to the Owner. All verification and vacuum testing shall be at no cost to the Owner and shall be paid for by the manufacturer or the Contractor.

C. Holiday detection testing in accordance with ASTM D4787 shall be required on one randomly-selected manhole for each group of five manholes rehabilitated with internal chimney seals or liners. Contractor shall perform holiday detection testing in the presence of an inspector with test equipment appropriate for the product. All detected holidays shall be marked and repaired by abrading the coating surface with grit disk paper or another hand-tooling method. After abrading and cleaning, additional coating shall be hand-applied to the repair area as needed. All touch-up/repair procedures shall be in accordance with the coating manufacturer's recommendations. All verification and holiday detection testing shall be at no cost to the Owner and shall be paid for by the manufacturer or the Contractor.

D. Adhesion (Pull-off) testing shall be required on one randomly-selected chimney seal for each group of ten manholes rehabilitated with internal chimney seals or liners. A portable pull-off adhesion tester shall be used to achieve substrate failure. Any chimney seals or liners failing this test shall be reworked as necessary and retested at no additional cost to the Owner.

E. Chimney seals shall be accepted by the Owner and Engineer after they pass holiday detection testing, adhesion testing, and a visual inspection for voids, pinholes, and leakage.

F. Internal liners shall be accepted by the Owner and Engineer after they pass vacuum testing, holiday detection testing, adhesion testing, and a visual manned entry inspection for voids, pinholes, cracks, leakage, and any other defect.

G. Drop bowl assemblies~~,~~ and reconstructed channels, inverts, and benches shall be accepted by the Owner and Engineer after they pass a visual manned entry inspection for voids, pinholes, cracks, leakage, and any other defect.

END OF SECTION

NO TEXT ON THIS PAGE

# SECTION 02830

# RESETTING FENCES & GATES

## PART 1 - GENERAL

1.01 WORK INCLUDED:

A. Remove, reset and provide replacement parts as necessary for existing chain link fencing that is disturbed by reasonable construction activities subject to approval of the Engineer.

1.02 RELATED WORK:

A. All Division 1 Requirements

1.03 QUALITY ASSURANCE:

A. Provide chain link fences, gates and parts produced by a single manufacturer, including necessary erection accessories, fittings, and fastenings.

B. Installation: Performed only by the manufacturer or an experienced chain link fence installer approved by the manufacturer.

1.04 SUBMITTALS:

A. Submit manufacturer's product data for each type of fencing, railing and finish required.

B. Submit installer's certification that furnished materials meet specification requirements.

1.05 DELIVERY, STORAGE, AND HANDLING:

A. Deliver chain link fence materials in the manufacturer's original packaging with tags and labels intact and legible.

B. Handle and store material to prevent damage and deterioration.

1.06 PROJECT CONDITIONS:

A. Do not begin chain link fencing installation before completion of final grading.

## PART 2 - PRODUCTS

2.01 CHAIN LINK FENCE:

A. Chain link fabric: Match existing fabric, finish and salvages.
B. Framework: Match existing framework and finish.
C. Hardware and accessories: Match existing hardware and finish.

## PART 3 - EXECUTION

3.01 INSPECTION:

Examine final grades and installation conditions. Do not start chain link fence and pipe rail system work until unsatisfactory conditions are corrected.

3.02 PREPARATION:

A. Lay out complete fence lines.

B. Locate and mark post positions. Space line posts, equally and at maximum 10'-0" on center spacing on ground and 8 ft. maximum on center spacing on walls for fencing.

C. Provide corner posts at positions where fence changes direction more than 10 degrees.

3.03 INSTALLATION:

A. Install the chain link fence system in accordance with the manufacturer's installation instructions and complying with CLMI specifications.

3.04 CLEANING:

A. Perform cleaning during installation of the work and upon completion of the Work. Remove from Site and all debris and equipment. Repair all damage resulting from chain link fence system installation.

3.05 MEASUREMENT AND PAYMENT:

A. All work performed as described in this Section will be paid for under one or more of the payment items listed in Section 01270 - Measurement and Payment, and in the **BID SCHEDULE.** The payment items are intended to provide full payment for the work shown on the drawings and specified herein. Any work called for or implied in the documents but not listed as a payment item shall be considered **incidental** to the overall project.

END SECTION

# SECTION 02920

# LOAMING AND SEEDING

## PART 1 - GENERAL

1.01 WORK INCLUDED:

This section covers all labor, materials, and equipment necessary to do all loaming, seeding, turf establishment and related work as indicated on the drawings or as ordered by the Engineer and as herein specified. All lawns disturbed by the Contractor's operations shall be repaired as herein specified.

1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. All Division 1 Requirements

B. Section 02300 – EARTHWORK

C. SECTION 02514 - SIDEWALKS AND DRIVEWAY APRONS

D. Section 02745 - PAVING

1.03 STANDARD REFERENCE:

A. Reference is made to items and paragraphs of the 2010 edition, with amendments of "Standard Specifications for Road and Bridge Construction", State of New Hampshire Department of Transportation. References in this section to these Standard Specifications bear the prefix "NHDOT".

1.04 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

A. Six sets of information detailing the seed mixes, fertilizers, mulch material, slope protection material (if required) and origin of loam shall be submitted to the Engineer for review.

B. Three sets of test results shall be submitted to the Engineer for review.

## PART 2 - PRODUCTS

2.01 MATERIALS: Generally loam and seed shall conform to NHDOT Section 646 - Turf Establishment with the following materials:

A. Loam: Loam shall conform to NHDOT Section 641.

B. Grass Seed: Seed shall conform to NHDOT Section 644, Park Seed Type 15.

C. Fertilizer: Fertilizer shall be for initial fertilization and conform to NHDOT Section 643.

D. Limestone: Limestone shall conform to NHDOT Section 642.

E. Mulch: Mulch and mulch tackifiers shall conform to NHDOT Section 645.

PART 3 - EXECUTION

3.01 TURF ESTABLISHMENT:

A. After approval of rough grading, loam (6" thick), seed, fertilizer mulch, limestone and mulch shall be placed in accordance with the construction Requirements of NHDOT Section 646 – Turf Establishment.

B. If there is insufficient time in the planting season to complete the fertilizing and seeding, permanent seeding shall be left until the following planting season on order of the Engineer. In that event, a temporary cover crop shall be sown at no cost to the Owner. This cover crop shall be cut and watered as necessary until the beginning of the following planting season, at which time it shall be plowed or harrowed into the soil, the area shall be reseeded, fertilized, limestone applied and mulched as specified.

3.02 MAINTENANCE

The Contractor shall water and maintain the seeded grass areas until a thick and viable stand of grass has been established as determined by the Engineer.

3.03 INSPECTION AND ACCEPTANCE:

At the beginning of the planting season following that in which the permanent grass crop is sown, the seeded areas will be inspected. Any section not showing dense, vigorous growth at that time shall be promptly reseeded by the Contractor at his own expense. The seeded areas shall be watered, weeded, cut and otherwise maintained by the Contractor until the end of that planting season, when they will be accepted if the sections show dense, vigorous growth.

3.04 MEASUREMENT AND PAYMENT:

All work performed as described in this Section will be paid for under one or more of the payment items listed in Section 01270 - Measurement and Payment, and in the **BID SCHEDULE.** The payment items are intended to provide full payment for the work shown on the Contract drawings and specified herein. Any work called for or implied in the documents but not listed as a payment item shall be considered **incidental** to the overall project.

END OF SECTION

# SECTION 02930

# PLANTING

## PART 1 - GENERAL

1.01 WORK INCLUDED:

A. Furnish and install all plant material, soil amendments, miscellaneous landscape materials and maintenance as shown on the plans, details and as herein specified.

1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. ALL DIVISION 1 REQUIREMENTS

B. SECTION 02300 – EARTHWORK

C. SECTION 02920 – LOAMING AND SEEDING

1.03 QUALITY ASSURANCE:

A. Source Quality Control:

1. Do not make substitutions. If specified landscape material is not obtainable, submit proof of non-availability to the Engineer, together with proposal for use of equivalent material.

1.04 SUBMITTALS:

A. General:
Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Planting Schedule:
Proposed planting schedule, indicating dates for each type of landscape work during normal seasons for such work in area of site. Correlate with specified maintenance periods to provide maintenance from date of substantial completion. Once accepted, revise dates only as approved in writing, after documentation of reasons for delays.

1.05 DELIVERY, STORAGE AND HANDLING**:**

A. Trees:

Provide freshly dug trees (B & B materials held over from previous year are not acceptable) and shrubs. Do not prune prior to delivery unless otherwise approved by Engineer. Do not bend or bind-tie trees in such manner as to damage bark, break branches, or destroy natural shape. Provide protective covering during delivery.

B. Delivery and Planting:
Deliver trees after preparations for planting have been completed and plant immediately. If planting is delayed more than 6 hours after delivery, set trees in shade, protect from weather and mechanical damage, and keep roots moist by covering with mulch, burlap or other acceptable means of retaining moisture.

1.06 JOB CONDITIONS:

A. Utilities: Determine location of underground utilities and perform work in a manner which will avoid possible damage. Hand excavate, as required. Maintain grade stakes set by others until removal is mutually agreed upon by parties concerned. Contact Dig Safe 1-800-322-4844 prior to excavation.

B. Water: The Contractor shall be responsible to furnish his own supply of water to the site at no extra cost. All work injured or damaged due to the lack of water, or the use of too much water, shall be the Contractor's responsibility to correct. Water shall be free from impurities injurious to vegetation.

C. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify Engineer before planting.

1.07 SEQUENCING AND SCHEDULING:

A. Planting Time: Proceed with, and complete landscape work as rapidly as portions of site become available, working within seasonal limitations for each kind of landscape work required.
1. Plant or install materials during normal planting seasons for each type of plant material required:
2. Season for Planting: Deciduous materials: 3/21 thru 11/1
3. Correlate planting with specified maintenance period to provide maintenance from date of substantial completion.

1.08 SPECIAL PROJECT WARRANTY:

A. Warranty Trees and shrubs, for a period of one year after date of substantial completion, against defects including death and unsatisfactory growth.

B. Remove and replace trees found to be dead or in unhealthy condition during warranty period. Make replacements during growth season following end of warranty period. Replace trees which are in doubtful condition at end of warranty period; unless, in opinion of Engineer, it is advisable to extend warranty period for a full growing season.

C. Another warranty inspection will be conducted at end of extended warranty period, if any, to determine acceptance or rejection.

## PART 2 - PRODUCTS

### 2.01 TOPSOIL:

A. If suitable, topsoil as specified, for landscape work is not available on site, it shall be furnished as specified from an off-site source.

B. Provide new topsoil that is fertile, friable, natural loam, surface soil, reasonably free of subsoil, clay lumps, brush, weeds and other litter, and free of roots, stumps, stones larger than 2 inches in any dimension, and other extraneous or toxic matter harmful to plant growth.

C. Obtain topsoil from local sources or from areas having similar soil characteristics to that found at project site. Obtain topsoil only from naturally, well-drained sites where topsoil occurs in a depth of not less than 4 inches. Do not obtain from bogs or marshes.

D. Topsoil shall consist of fertile, friable, natural topsoil of loamy character, without admixture of subsoil material, obtained from the project site, reasonably free of clay, lumps, coarse sands, stones, plants, roots, sticks, and other foreign materials, with acidity range of between pH 6.0 and 6.8. Topsoil testing shall reflect a 4% minimum organic content, not more than 20%. If on-site topsoil does not meet these requirements, and if so directed by the Engineer, it shall be screened and/or amended at no additional cost to the Owner

1. Identify source location of topsoil proposed for use on the project.
2. Provide topsoil free of substance harmful to the plants which will be grown in the soil.

### 2.02 SOIL AMENDMENTS:

A. Lime: Natural pelletized dolomitic limestone containing not less than 85 percent of total carbonates with a minimum of 30 percent magnesium carbonates, ground so that not less than 100 percent passes a 8-mesh sieve and not less than 50 percent passes a 100-mesh sieve.

B. Aluminum Sulfate: Commercial grade.

C. Peat Humus: Natural domestic product of either reed or sedge muck, dark brown to black in color and free from lumps, roots and stones. Humus shall have been taken from a fresh water site and conditioned by six (6) months in storage pile after excavation, including at least one (1) freezing and thawing period. The acidity range shall be pH 5.0 to pH 7.0 and the maximum moisture content seventy (70) per cent by weight. Organic matter shall be eighty (80) per cent on a dry weight basis. Humus shall be low in iron and sulfur and low in content of woody material. It shall be ground or shredded so as to pass through a 3/16th inch mesh screen.

D. Bonemeal: Commercial, raw, finely ground; 4 percent nitrogen and 20 percent phosphoric acid.

E. Superphosphate: Soluble mixture of treated minerals; 20 percent available phosphoric acid.

F. Sand: Clean, washed sand, free of toxic materials.

G. Perlite: Conforming to National Bureau of Standards PS 23.

H. Vermiculite: Horticultural grade, free of toxic substances.

I. Manure: Well rotted, unleached stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials and containing no chemicals or ingredients harmful to plants.

J. Mulch: Organic mulch free from deleterious materials and suitable for top dressing of trees, shrubs, or plants and consisting of ground or shredded pine\hemlock mixture, as approved by Engineer.

K. Commercial Fertilizer: Complete fertilizer of neutral character, with some elements derived from organic sources and containing following percentages of available plant nutrients:

1. For trees, provide fertilizer, by weight, with the following composition: not less than 5 percent total nitrogen, 10 percent available phosphoric acid, and 5 percent soluble potash.

2.03 PLANT MATERIALS:

A. Quality: Provide trees of size, genus, species, and variety shown and scheduled for landscape work and complying with recommendations and requirements of ALCC.

B. Deciduous Trees:
   1. Provide trees of height and caliper scheduled.
   2. Provide single stem trees except where special forms are shown or listed.
   3. Provide balled and burlapped (B&B) deciduous trees..

2.04 MISCELLANEOUS LANDSCAPE MATERIALS:

A. Stakes and Guys: Trees shall be guyed in a tripod fashion using 2”x2”x8’ hardwood stakes-stain darked brown. Set all stakes at equal heights. Use plastic cinch ties in lieu of wire and hose. Wrap bark at point where cinch ties attach to trunk.

B. Watering Bags: 20 gallaon watering bags for tree irrigation shall be *Tree Gator®* or approved equal.

PART 3 - EXECUTION

3.01 PREPARATION - GENERAL:

Lay out individual tree locations. Stake locations and outline areas and secure Engineer’s acceptance before start of planting work. Make minor adjustments as may be required.

3.02 PREPARATION OF PLANTING SOIL:

A. Before mixing, clean topsoil of roots, plants, sods, stones, clay lumps, and other extraneous materials harmful or toxic to plant growth.

B. Mix specified soil amendments and fertilizers with topsoil at rates specified or ordered by the Engineer. Delay mixing of fertilizer if planting will not follow placing of planting soil within a few days.

3.03 EXCAVATION FOR TREES:

A. Excavate for concrete planters and specified soils as shown on the typical details on the plans. Loosen hard subsoil in bottom of excavation.

B. For balled and burlapped (B&B) trees, make excavations at least half again as wide as the ball diameter and equal to the ball depth, plus following allowance for setting of ball on a layer of compacted backfill:
   1. Allow for 3 inch thick setting layer of planting soil mixture.

C. Dispose of subsoil removed from planting excavations. Do not mix with planting soil or use as backfill.

D. Fill excavations for trees and shrubs with water and allow water to percolate out prior to planting.

3.04 PLANTING TREES:

A. Set balled and burlapped (B&B) stock on layer of compacted planting soil *mixture as shown on the plans, plum and in center of pit with top of ball at same elevation as adjacent finished landscape grades. Remove burlap from sides of balls; retain on bottoms. When set, place additional backfill around base and sides of ball, and work each layer to settle backfill and eliminate voids and air pockets. When excavation is approximately 2/3 full, water thoroughly before placing remainder of backfill. Repeat watering until no more is absorbed. Water again after placing final layer of backfill.

*(soil mixture 4% organic topsoil, amended with 10% wood ash, 10% manure, & 30% peat moss)

B. Dish top of backfill to allow for mulching.

C. Mulch pits, trenches, and planted areas. Provide not less than the following thickness of mulch; work into top of backfill, and finish level with adjacent finish grades.
   1. Provide a 4- to 5-inch thickness of mulch.
   2. Mulch shall be placed in large sucers (6’ dia.) around deciduous shade trees and 2’ beyond the outer branches of evergreen trees.

D. Apply anti-desiccant, using power spray, to provide an adequate film over trunks, branches, stems, twigs and foliage.
   1. If deciduous trees or shrubs are moved when in full-leaf, spray with anti-desiccant at nursery before moving, and spray again 2 weeks after planting.

E. Prune, thin out, and shape trees and shrubs in accordance with standard horticultural practice. Prune trees to retain required height and spread. Unless otherwise directed by the Engineer, do not cut tree leaders, and remove only injured or dead branches from flowering trees, if any.

F. Remove and replace excessively pruned or misformed stock resulting from improper pruning.

G. Guy and stake trees immediately after planting, as indicated.

3.05 MAINTENANCE:

A. Begin maintenance immediately after planting.

B. Provide two 20 gallon watering bags at each tree for drip irrigation, and provide water to bags as needed to maintain a constant drip during the growing season until final acceptance.

C. Maintain trees until final acceptance, but in no case less than following period:
   1. One (1) year from the date of substantial completion of the Project.

D. Maintain trees by pruning, cultivating, and weeding as required for healthy growth. Restore planting saucers. Tighten and repair stake and guy supports and reset trees and shrubs to proper grades or vertical position as required. Restore or replace damaged wrapping. Spray as required to keep trees free of insects and disease.

## 3.06 MISCELLANEOUS LANDSCAPE MATERIALS:

All miscellaneous landscape materials shall be installed in accordance with the details on the plans; and to the satisfaction of the Engineer.

## 3.07 CLEANUP AND PROTECTION

A. During landscape work, keep pavements clean and work area in an orderly condition.

B. Protect landscape work and materials from damage due to landscape operations, operations by other contractors and trades, and trespassers. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged landscape work as directed.

## 3.08 INSPECTION AND ACCEPTANCE

A. When work is completed, including maintenance, the Engineer will, upon request, make an inspection to determine acceptability.

B. Topsoil: The Contractor shall submit a 1 pound sample of the topsoil proposed for use on the project to the Engineer.

C. Trees: Provide trees of quantity, size, genus, species, and variety shown and scheduled for landscape work and complying with recommendations and requirements of ANSI Z60.1 “American Standard for Nursery Stock”. Provide healthy, vigorous stock, grown in a recognized nursery, in accordance with good horticultural practice and free of disease, insects, eggs, larvae, and defects such as knots, sun-scald, injuries, abrasions, or disfigurement.

D. Label at least one tree of each variety with a securely attached waterproof tag bearing legible designation of botanical and common name. Where formal arrangements or consecutive order of trees or shrubs are shown, select stock for uniform height and spread, and lable with number to assure symmetry in planting.

E. Inspection: The Engineer shall select and inspect trees at site before planting, for compliance with requirements for genus, species, variety, size, and quality. Engineer retains right to further inspect trees for size and condition of balls and root systems, insects, injuries and latent defects, and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees immediately form project site. The Contractor shall be responsible for all transporations, lodging and sustenance expenses related to the Engineer's travel to the approved nursery(ies) for plant tagging and selection.

## 3.09 MEASUREMENT AND PAYMENT:

All work performed as described in this Section will be paid for under one or more of the payment items listed in Section 01270 - Measurement and Payment, and in the **BID SCHEDULE.** The payment items are intended to provide full payment for the work shown on the Contract drawings and specified herein. Any work called for or implied in the documents but not listed as a payment item shall be considered **incidental** to the overall project.

END SECTION

# SECTION 03100

# CONCRETE FORMWORK

## PART 1 - GENERAL

### 1.01 THE REQUIREMENT:

A. Provide materials, labor, and equipment required for the design and construction of all concrete formwork, bracing, shoring and supports in accordance with the provisions of the Contract Documents.

### 1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. Section 03200 - Reinforcing Steel

B. Section 03300 - Cast-in-Place Concrete

### 1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS:

A. Without limiting the generality of the other requirements of the specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. New Hampshire State Building Code

2. ACI 318 - Building Code Requirements for Structural Concrete

3. ACI 301 - Specifications for Structural Concrete for Buildings

4. ACI 347 - Recommended Practice for Concrete Formwork

5. U.S. Product Standard for Concrete Forms, Class I, PS 1

6. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials

### 1.04 SUBMITTALS:

A. Submit the following in accordance with Section 01300, Submittals.

1. Manufacturer's data on proposed form release agent

2. Manufacturer's data on proposed formwork system including form ties

1.05 QUALITY ASSURANCE:

A. Concrete formwork shall be in accordance with ACI 301, ACI 318, and ACI 347.

PART 2 - PRODUCTS

2.01 FORMS AND FALSEWORK:

A. All forms shall be smooth surface forms unless otherwise specified.

B. Wood materials for concrete forms and falsework shall conform to the following requirements:

1. Lumber for bracing, shoring, or supporting forms shall be Douglas Fir or Southern Pine, construction grade or better, in conformance with U.S. Product Standard PS20. All lumber used for forms, shoring or bracing shall be new material.

2. Plywood for concrete formwork shall be new, waterproof, synthetic resin bonded, exterior type Douglas Fir or Southern Pine high density overlaid (HDO) plywood manufactured especially for concrete formwork and shall conform to the requirements of PS1 for Concrete Forms, Class I, and shall be edge sealed. Thickness shall be as required to support concrete at the rate it is placed, but not less than 5/8-inch thick.

C. Other form materials such as metal, fiberglass, or other acceptable material that will not adversely affect the concrete and will facilitate placement of concrete to the shape, form, line and grade indicated may be submitted to the Engineer for approval, but only materials that will produce a smooth form finish equal or better than the wood materials specified will be considered.

2.02 FORMWORK ACCESSORIES:

A. Form ties shall be provided with a plastic cone or other suitable means for forming a conical hole to insure that the form tie may be broken off back of the face of the concrete. The maximum diameter of removable cones for rod ties, or of other removable form-tie fasteners having a circular cross-section, shall not exceed 7/8-inch, and all such fasteners shall be such as to leave holes of regular shape for reaming.

B. Form release agent shall be a blend of natural and synthetic chemicals that employs a chemical reaction to provide quick, easy and clean release of concrete from forms. It shall not stain the concrete and shall leave the concrete with a paintable surface. Formulation of the form release agent shall be such that it would minimize formation of "bug holes" in cast-in-place concrete.

## PART 3 - EXECUTION

### 3.01 FORM DESIGN:

A. Forms and falsework shall be designed for total dead load, plus all construction live load as outlined in ACI 347. Design and engineering of formwork and safety considerations during construction shall be the responsibility of the Contractor.

B. Forms shall be of sufficient strength and rigidity to maintain their position and shape under the loads and operations incident to placing and vibrating the concrete. The maximum deflection of facing materials reflected in concrete surfaces exposed to view shall be 1/240 of the span between structural members.

C. All forms shall be designed for predetermined placing rates per hour, considering expected air temperatures and setting rates.

### 3.02 CONSTRUCTION:

A. The type, size, quality, and strength of all materials from which forms are made shall be subject to the approval of the Engineer. No falsework or forms shall be used which are not clean and suitable. Deformed, broken or defective falsework and forms shall be removed from the work.

B. Forms shall be smooth and free from surface irregularities. Suitable and effective means shall be provided on all forms for holding adjacent edges and ends of panels and sections tightly together and in accurate alignment so as to prevent the formation of ridges, fins, offsets, or similar surface defects in the finished concrete. Joints between the forms shall be sealed to eliminate any irregularities. The arrangement of the facing material shall be orderly and symmetrical, with the number of seams kept to a practical minimum.

C. Forms shall be true to line and grade, and shall be sufficiently rigid to prevent displacement and sagging between supports. Curved forms shall be used for curved and circular structures. Straight panels joined at angles will not be acceptable for forming curved structures. Forms shall be properly braced or tied together to maintain their position and shape under a load of freshly-placed concrete. Facing material shall be supported with studs or other backing which shall prevent both visible deflection marks in the concrete and deflections beyond the tolerances specified.

D. Forms shall be mortar tight so as to prevent the loss of water, cement and fines during placing and vibrating of the concrete. Specifically, the bottom of vertical forms that rest on concrete footings or slabs shall be provided with a gasket to prevent loss of fines and paste during placement and vibration of concrete. Such gasket may be a 1 to 1-1/2 inch diameter polyethylene rod held in position to the bottom of the form.

E. All vertical surfaces of concrete members shall be formed, and side forms shall be provided for all footings, slab edges and grade beams, except where placement of the concrete against the ground is called for on the Drawings. Not less than 1-inch of concrete shall be added to the thickness of the concrete member as shown where concrete is permitted to be placed against trimmed ground in lieu of forms. Such permission will be granted only for members of comparatively limited height and where the character of the ground is such that it can be trimmed to the required lines and will stand securely without caving or sloughing until the concrete has been placed.

F. All forms shall be constructed in such a manner that they can be removed without hammering or prying against the concrete.

G. Adequate clean-out holes shall be provided at the bottom of each lift of forms. Temporary openings shall be provided at the base of vertical forms and at other points to facilitate cleaning and observation immediately before the concrete is deposited. The size, number and location of such clean-outs shall be as acceptable to the Engineer.

H. Construction joints shall not be permitted at locations other than those shown or specified, except as may be acceptable to the Engineer.

3.03 TOLERANCES:

A. Unless otherwise indicated in the Contract Documents, formwork shall be constructed so that the concrete surfaces will conform to the tolerance limits listed in ACI 117.

B. The Contractor shall establish and maintain in an undisturbed condition and until final completion and acceptance of the project, sufficient control points and bench marks to be used for reference purposes to check tolerances. Plumb and string lines shall be installed before concrete placement and shall be maintained during placement. Such lines shall be used by Contractor's personnel and by the Engineer and shall be in sufficient number and properly installed. During concrete placement, the Contractor shall continually monitor plumb and string line form positions and immediately correct deficiencies.

3.04 FORM ACCESSORIES:

A. Suitable moldings shall be placed to bevel or round all exposed corners and edges of beams, columns, walls, slabs, and equipment pads. Chamfers shall be 3/4 inch unless otherwise noted.

B. Form ties shall be so constructed that the ends, or end fasteners, can be removed without causing appreciable spalling at the faces of the concrete. After ends, or end fasteners of form ties have been removed, the embedded portion of the ties shall terminate not less than 2 inches from the formed face of the concrete that is exposed to wastewater or enclosed surfaces above the wastewater, and not less than 1 inch from the formed face of all other concrete. Holes left by the removal of form tie cones shall be reamed with suitable toothed reamers so as to leave the surface of the holes clean and rough before being filled with

mortar as specified in Section 03350 - Concrete Finishing. No form-tying device or part thereof, other than metal, shall be left embedded in the concrete. Ties shall not be removed in such manner as to leave a hole extending through the interior of the concrete member. The use of snap-ties which cause spalling of the concrete upon form stripping or tie removal will not be permitted. No snap ties shall be broken off until the concrete is at least three days old. If steel panel forms are used, rubber grommets shall be provided where the ties pass through the form in order to prevent loss of cement paste.

3.05 APPLICATION - FORM RELEASE AGENT:

A. Forms for concrete surfaces that will not be subsequently waterproofed shall be coated with a form release agent. Form release agent shall be applied on formwork in accordance with manufacturer's recommendations.

3.06 INSERTS AND EMBEDDED ITEMS:

A. Sleeves, pipe stubs, inserts, anchors, expansion joint material, waterstops, and other embedded items shall be positioned accurately and supported against displacement prior to concreting. Voids in sleeves, inserts, and anchor slots shall be filled temporarily with readily removable material to prevent the entry of concrete into the voids.

3.07 FORM CLEANING AND REUSE:

A. The inner faces of all forms shall be thoroughly cleaned prior to concreting. Forms may be reused only if in good condition and only if acceptable to the Engineer. Light sanding between uses will be required wherever necessary to obtain uniform surface texture. Unused tie rod holes in forms shall be covered with metal caps or shall be filled by other methods acceptable to the Engineer.

3.08 FORM REMOVAL:

A. Forms shall not be disturbed until the concrete has attained sufficient strength. Forms shall be removed in such manner as not to impair safety and serviceability of the structure. All concrete to be exposed by form removal shall have sufficient strength not to be damaged thereby.

B. An accurate record shall be maintained by the Contractor of the dates of concrete placings and the exact location thereof and the dates of removal of forms. These records shall be available for inspection at all times at the site, and two copies shall be furnished the Engineer upon completion of the concrete work.

- END OF SECTION -

NO TEXT ON THIS PAGE

# SECTION 03200

# REINFORCING STEEL

## PART 1 - GENERAL

### 1.01 THE REQUIREMENTS:

A. Provide all concrete reinforcing including all cutting, bending, fastening and any special work necessary to hold the reinforcing steel in place and protect it from injury and corrosion in accordance with the requirements of this section.

### 1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. Section 03100 - Concrete Formwork

B. Section 03300 - Cast-in-Place Concrete

### 1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS:

A. Without limiting the generality of the other requirements of the specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. New Hampshire State Building Code

2. CRSI - Concrete Reinforcing Institute Manual of Standard Practice

3. ACI SP66 - ACI Detailing Manual

4. ACI 315 - Details and Detailing of Concrete Reinforcing

5. ACI 318 - Building Code Requirements for Structural Concrete

6. ASTM A 615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcing

### 1.04 SUBMITTALS:

A. Submit the following in accordance with Section 01300, Submittals.

1. Detailed placing and shop fabricating drawings, prepared in accordance with ACI 315 and ACI Detailing Manual - (SP66), shall be furnished for all concrete reinforcing. These drawings shall be made to such a scale as to clearly show joint locations, openings, and the arrangement, spacing and splicing of the bars.

2. Mill test certificates - 3 copies of each.

3. Description of the reinforcing steel manufacturer's marking pattern.

4. Requests to relocate any bars that cause interferences or that cause placing tolerances to be violated.

5. Proposed supports for each type of reinforcing.

6. Request to use splices not shown on the Drawings.

7. Request and procedure to field bend or straighten partially embedded reinforcing.

1.05 QUALITY ASSURANCE:

A. If requested by the Engineer, the Contractor shall provide samples from each load of reinforcing steel delivered in a quantity adequate for testing. Costs of initial tests will be paid by the Owner. Costs of additional tests due to material failing initial tests shall be paid by the Contractor.

PART 2 - PRODUCTS

2.01 REINFORCING STEEL:

A. Bar reinforcing shall conform to the requirements of ASTM A 615 for Grade 60 Billet Steel reinforcing. All reinforcing steel shall be from domestic mills and shall have the manufacturer's mill marking rolled into the bar which shall indicate the producer, size, type and grade. All reinforcing bars shall be deformed bars. Smooth reinforcing bars shall not be used unless specifically called for on Drawings.

B. A certified copy of the mill test on each load of reinforcing steel delivered showing physical and chemical analysis shall be provided, prior to shipment. The Engineer reserves the right to require the Contractor to obtain separate test results from an independent testing laboratory in the event of any questionable steel. When such tests are necessary because of failure to comply with this Specification, such as improper identification, the cost of such tests shall be borne by the Contractor.

C. Field welding of reinforcing steel will not be allowed.

D. Use of coiled reinforcing steel will not be allowed.

2.02 ACCESSORIES:

A. Accessories shall include all necessary chairs, slab bolsters, concrete blocks, tie wires, dips, supports, spacers and other devices to position reinforcing during concrete placement. Slab bolsters shall have gray plastic-coated legs.

B. Concrete blocks (dobies), used to support and position bottom reinforcing steel, shall have the same or higher compressive strength as specified for the concrete in which it is located.

2.03 NOT USED

2.04 DOWEL ADHESIVE SYSTEM:

A. Where shown on the Drawings, reinforcing bars anchored into hardened concrete with a dowel adhesive system shall use a two-component adhesive mix which shall be injected with a static mixing nozzle following manufacturer's instructions. All holes shall be drilled with a carbide bit unless otherwise recommended by the manufacturer. If coring holes is allowed by the manufacturer and approved by the Engineer, cored holes shall be roughened in accordance with manufacturer requirements. Thoroughly clean drill holes of all debris and drill dust with compressed air followed by a wire brush prior to installation of adhesive and reinforcing bar. Degree of hole dampness shall be in strict accordance with manufacturer recommendations. Where depth of hole exceeds the length of the static mixing nozzle, a plastic extension hose shall be used to ensure proper adhesive injection from the back of the hole. Injection of adhesive into the hole shall utilize a piston plug to minimize the formation of air pockets. The embedment depth of the bar shall be per manufacturer's recommendations, so as to provide a minimum allowable bond strength that is equal to 125 percent of the yield strength of the bar, unless noted otherwise on the Drawings. The adhesive system shall be "Epcon System G5" as manufactured by ITW Redhead, " HIT-HY 200 Injection Adhesive Anchor System" as manufactured by Hilti, Inc. “SET-XP” as manufactured by Simpson Strong-Tie Co. or “PE-1000+” by Powers Fasteners. Engineer's approval is required for use of this system in locations other than those shown on the Drawings. **Fast-set epoxy formulations shall not be acceptable. No or equal products will be considered, unless pre-qualified and approved by Engineer and Owner.**

PART 3 - EXECUTION

3.01 TEMPERATURE REINFORCING:

A. Unless otherwise shown on the Drawings or in the absence of the concrete reinforcing being shown, the minimum cross sectional area of horizontal and vertical concrete reinforcing in

walls shall be 0.0033 times the gross concrete area and the minimum cross sectional area of reinforcing perpendicular to the principal reinforcing in slabs shall be 0.0020 times the gross concrete area. Temperature reinforcing shall not be spaced further apart than five times the slab or wall thickness, nor more than 18 inches.

3.02 FABRICATION:

A. Reinforcing steel shall be accurately formed to the dimensions and shapes shown on the Drawings and the fabricating details shall be prepared in accordance with ACI 315 and ACI 318, except as modified by the Drawings.

B. The Contractor shall fabricate reinforcing bars for structures in accordance with the bending diagrams, placing lists and placing Drawings.

C. No fabrication shall commence until approval of Shop Drawings has been obtained. All reinforcing bars shall be shop fabricated unless approved by the Engineer to be bent in the field. Reinforcing bars shall not be straightened or rebent in a manner that will injure the material. Heating of bars will not be permitted.

3.03 DELIVERY, STORAGE AND HANDLING:

A. All reinforcing shall be neatly bundled and tagged for placement when delivered to the job site. Bundles shall be properly identified for coordination with mill test reports.

B. Reinforcing steel shall be stored above ground on platforms or other supports and shall be protected from the weather at all times by suitable covering. It shall be stored in an orderly manner and plainly marked to facilitate identification.

C. Reinforcing steel shall at all times be protected from conditions conducive to corrosion until concrete is placed around it.

D. The surfaces of all reinforcing steel and other metalwork to be in contact with concrete shall be thoroughly cleaned of all dirt, grease, loose scale and rust, grout, mortar and other foreign substances immediately before the concrete is placed. Where there is delay in depositing concrete, reinforcing shall be reinspected and if necessary recleaned.

3.04 PLACING:

A. Reinforcing steel shall be accurately positioned as shown on the Drawings and shall be supported and wired together to prevent displacement, using annealed iron wire ties or suitable clips at intersections. All reinforcing steel shall be supported by concrete, plastic or metal supports, spacers or metal hangers which are strong and rigid enough to prevent any displacement of the reinforcing steel. Where concrete is to be placed on the ground, supporting concrete blocks (or dobies) shall be used in sufficient numbers to support the reinforcing bars without settlement. In no case shall concrete block supports be continuous.

B. The portions of all accessories in contact with the formwork shall be made of plastic or steel coated with a 1/8 inch minimum thickness of plastic which extends at least 1/2 inch from the concrete surface. Plastic shall be gray in color.

C. Tie wires shall be bent away from the forms in order to provide the specified concrete coverage.

D. Reinforcing bars additional to those shown on the Drawings, which may be found necessary or desirable by the Contractor for the purpose of securing reinforcing in position, shall be provided by the Contractor at no additional cost to the Owner.

E. Reinforcing placing, spacing, and protection tolerances shall be within the limits specified in ACI 318 except where in conflict with the Building Code, unless otherwise specified.

F. Reinforcing bars may be moved within one bar diameter as necessary to avoid interference with other concrete reinforcing, conduits, or embedded items. If bars are moved more than one bar diameter, or enough to exceed placing tolerances, the resulting arrangement of bars shall be as acceptable to the Engineer.

G. Reinforcing shall not be straightened or rebent unless specifically shown on the drawings or authorized in writing by the Engineer. Bars with kinks or bends not shown on the Drawings shall not be used. Coiled reinforcement shall not be used.

3.05 SPLICING:

A. Reinforcing bar splices shall only be used at locations shown on the Drawings. When it is necessary to splice reinforcing at points other than where shown, the splice shall be as acceptable to the Engineer.

B. The length of lap for reinforcing bars, unless otherwise shown on the Drawings shall be in accordance with ACI 318 for a class B splice.

3.06 INSPECTION:

A. The Contractor shall advise the Engineer of his intentions to place concrete and shall allow him adequate time to inspect all reinforcing steel before concrete is placed.

B. The Contractor shall advise the Engineer of his intentions to place grout in masonry walls and shall allow him adequate time to inspect all reinforcing steel before grout is placed.

3.07 CUTTING OF EMBEDDED REBAR:

A. The Contractor shall not cut embedded rebar cast into structural concrete without prior approval of the Engineer.

- END OF SECTION –

# SECTION 03300

# CAST-IN-PLACE CONCRETE

## PART 1 - GENERAL

### 1.01 THE REQUIREMENT:

A. Provide all labor, equipment, materials and services necessary for the manufacture, transportation and placement of all plain and reinforced concrete work, as shown on the Drawings or as ordered by the Engineer.

B. The requirements in this section shall apply to the following types of concrete:

1. Class A Concrete: Normal weight structural concrete to be used in all structures, sidewalks and pavements, except where noted otherwise in the Contract Documents. All concrete shall be Class A concrete unless another class is specifically called for on Contract Documents or specified herein.

2. Class B Concrete: Normal weight structural concrete used for duct bank encasements, fence and guard post embedment, concrete fill, and other areas where specifically noted on Contract Drawings.

### 1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. Section 03100 - Concrete Formwork

B. Section 03200 - Reinforcing Steel

C. Section 03350 - Concrete Finishes

D. Section 03370 - Concrete Curing

E. Section 03600 - Grout

### 1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS:

A. Without limiting the generality of the Specifications, all work herein shall conform to or exceed the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. New Hampshire State Building Code

| | | |
|---|---|---|
| 2. | ACI 214 | Recommended Practice for Evaluation of Strength Test Results of Concrete |
| 3. | ACI 301 | Specifications for Structural Concrete for Buildings |
| 4. | ACI 304 | Guide for Measuring, Mixing, Transporting, and Placing Concrete |
| 5. | ACI 305 | Hot Weather Concreting |
| 6. | ACI 306 | Cold Weather Concreting |
| 7. | ACI 309 | Recommended Practice for Consolidation of Concrete |
| 8. | ACI 318 | Building Code Requirements for Structural Concrete |
| 9. | ACI 350 | Code Requirements for Environmental Engineering Concrete Structures |
| 10. | ASTM C 31 | Standard Methods of Making and Curing Concrete Test Specimens in the Field |
| 11. | ASTM C 33 | Standard Specification for Concrete Aggregates |
| 12. | ASTM C 39 | Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens |
| 13. | ASTM C42 | Obtaining and Testing Drilled Cores and Sawed Beams of Concrete |
| 14. | ASTM C 88 | Standard Test Method for Soundness of Aggregates by use of Sodium Sulfate or Magnesium Sulfate |
| 15. | ASTM C 94 | Standard Specification for Ready-Mixed Concrete |
| 16. | ASTM C 114 | Standard Test Method for Chemical Analysis of Hydraulic Cement |
| 17. | ASTM C 136 | Standard Method for Sieve Analysis of Fine and Coarse Aggregate |
| 18. | ASTM C 138 | Standard Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete |
| 19. | ASTM C 143 | Standard Test Method for Slump of Portland Cement Concrete |
| 20. | ASTM C 150 | Standard Specification for Portland Cement |

21. ASTM C 172 Standard Method of Sampling Fresh Concrete

22. ASTM C 192 Standard Method of Making and Curing Concrete Test Specimens in the Laboratory

23. ASTM C 231 Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method

24. ASTM C 260 Standard Specification for Air-Entraining Admixtures for Concrete

25. ASTM C 295 Standard Guide for Petrographic Examination of Aggregates for Concrete

26. ASTM C 457 Standard Recommended Practice for Microscopical Determination of Air-Void Content and Parameters of the Air-Void System in Hardened Concrete

27. ASTM C 494 Standard Specification for Chemical Admixtures For Concrete

28. ASTM C 595 Standard Specification for Blended Hydraulic Cements

29. ASTM C 618 Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolan for use as a Mineral Admixture in Portland Cement Concrete

30. ASTM C 989 Standard Specification for Slag Cement for Use in Concrete and Mortars

31. ASTM C 1077 Recommended Practice for Labs Testing Concrete

32. ASTM C 1567 Standard Test Method for Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method)

33. ASTM C 1602 Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete

1.04 SUBMITTALS:

A. Submit the following in accordance with Section 01300, Submittals.

1. Sources of all materials and certifications of compliance with specifications for all materials.

2. Certified current (less than 1 year old) chemical analysis of the Portland Cement or Blended Cement to be used.

3. Certified current (less than 1 year old) chemical analysis of fly ash or slag cement to be used.

4. Aggregate test results showing compliance with required standards, i.e., sieve analysis, aggregate soundness tests, petrographic analysis, mortar bar expansion testing per ASTM C 1567, etc.

5. Manufacturer's data on all admixtures stating compliance with required standards.

6. Concrete mix design for each class of concrete specified herein.

7. Field experience records and/or trial mix data for the proposed concrete mixes for each class of concrete specified herein.

1.05 QUALITY ASSURANCE:

A. Tests on materials used in the production of concrete shall be required as specified in PART 2 -- PRODUCTS. These tests shall be performed by an independent testing laboratory approved by the Engineer at no additional cost to the Owner.

B. Trial concrete mixes shall be tested when required in accordance with Article 3.01 at no additional cost to the Owner.

C. Field quality control tests, as specified in Article 3.10, unless otherwise stated, will be performed by a materials testing consultant employed by the Owner. However, the Contractor shall be charged for the cost of any additional tests and investigation on work performed which does not meet the Specifications. Any individual who samples and tests concrete to determine if the concrete is being produced in accordance with this Specification shall be certified as a Concrete Field Testing Technician, Grade I, in accordance with ACI CP-2. Testing laboratory shall conform to requirements of ASTM C-1077.

PART 2 - PRODUCTS

2.01 HYDRAULIC CEMENT

A. Portland Cement

1. Portland Cement shall be Type II conforming to ASTM C 150. Type I cement may be used provided either fly ash or slag cement is also included in the mix in accordance with Articles 2.02 or 2.03 respectively.

2. When potentially reactive aggregates as defined in Article 2.05 are to be used in concrete mix, cement shall meet the following requirements:

   a. For concrete mixed with only Portland Cement, the total alkalies in the cement (calculated as the percentage of $NA_2O$ plus 0.658 times the percentage of $K_2O$) shall not exceed 0.40%.

   b. For concrete mixed with Portland Cement and an appropriate amount of fly ash (Article 2.02) or slag cement (Article 2.03) the total alkalies in the Portland Cement (calculated as the percentage of $NA_2O$ plus 0.658 times the percentage of $K_2O$) shall not exceed 0.85%.

3. When non-reactive aggregates as defined in Article 2.05 are used in concrete mix, total alkalies in the cement shall not exceed 1.0%.

4. The proposed Portland Cement shall not contain more than 8% tricalcium aluminate and more than 12% tetracalcium aluminoferrite.

B. Blended Cement

1. Blended cements shall be Type IP (Portland Fly Ash Cement) or Type IS (Portland Slag Cement) conforming to ASTM C 595.

2. Type IP cement shall be an interground blend of Portland Cement and fly ash in which the fly ash constituent is between 15% and 25% of the weight of the total blend.

3. Type IS cement shall be an interground blend of Portland Cement and slag cement in which the slag constituent is between 35% and 50% of the weight of the total blend.

4. Fly ash and slag cement used in the production of blended cements shall meet the requirements of Articles 2.02 and 2.03, respectively.

5. When reactive aggregates as defined in Article 2.05 are used in concrete mix, the total alkalies in the Portland Cement (calculated as the percentage of $Na_2O$ plus 0.658 times the percentage of $K_2O$) shall not exceed 0.85%. The percentage of fly ash or slag cement shall be set to meet provisions of Article 2.05.F.2.

C. Different types of cement shall not be mixed nor shall they be used alternately except when authorized in writing by the Engineer. Different brands of cement or the same brand from different mills may be used alternately. A resubmittal will be required if different cements are proposed during the Project.

D. Cement shall be stored in a suitable weather-tight building so as to prevent deterioration or contamination. Cement which has become caked, partially hydrated, or otherwise damaged will be rejected.

2.02 FLY ASH:

A. Fly ash shall meet the requirements of ASTM C 618 for Class F, except that the loss on ignition shall not exceed 4%. Fly ash shall also meet the optional physical requirements for uniformity as shown in Table 3 of ASTM C 618.

B. For fly ash to be used in the production of type IP cement, the Pozzolan Activity Index shall be greater than 75% as specified in Table 3 of ASTM C 595.

C. Where reactive aggregates as defined in Article 2.05 are used in concrete mix, the fly ash constituent shall be between 15% and 25% of the total weight of the combined Portland Cement and fly ash. The percentage of fly ash shall be set to meet the provisions of Article 2.05.F.2.

D. Additional fly ash shall not be included in concrete mixed with Type IS or IP cement.

2.03 SLAG CEMENT:

A. Slag cement shall meet the requirements of ASTM C 989 including tests for effectiveness of slag in preventing excessive expansion due to alkali-aggregate reactivity as described in Appendix X-3 of ASTM C 989.

B. Where reactive aggregates as defined in Article 2.05 are used in concrete mix, the slag cement constituent shall be between 35% and 40% of the total weight of the combined Portland Cement and slag. The percentage of slag cement shall be set to meet the provisions of Article 2.05.F.2.

C. Additional slag cement shall not be included in concrete mixed with type IS or IP cement.

2.04 WATER:

A. Water used for mixing concrete shall be clear, potable and free from deleterious substances such as objectionable quantities of silty organic matter, alkali, salts and other impurities.

B. Water shall not contain more than 100 PPM chloride.

C. Water shall not contain more than 500 PPM dissolved solids.

D. Water shall have a pH in the range of 4.5 to 8.5.

E. Water shall meet requirements of ASTM C 1602.

2.05 AGGREGATES:

A. All aggregates used in normal weight concrete shall conform to ASTM C 33.

B. Fine Aggregate (Sand) in the various concrete mixes shall consist of natural or manufactured siliceous sand, clean and free from deleterious substances, and graded within the limits of ASTM C 33.

C. Coarse aggregates shall consist of hard, clean, durable gravel, crushed gravel or crushed rock. Coarse aggregate shall be size #57 or #67 as graded within the limits given in ASTM C 33 unless otherwise specified.

D. Aggregates shall be tested for gradation by sieve analysis tests in conformance with ASTM C 136.

E. Aggregates shall be tested for soundness in accordance with ASTM C 88. The loss resulting after five cycles shall not exceed 10 percent for fine or coarse aggregate when using magnesium sulfate.

F. When non-reactive aggregates are required in the proposed concrete mix, the non-reactive aggregates shall meet the following requirements:

1. A petrographic analysis in accordance with ASTM C295 shall be performed to identify the constituents of the fine and coarse aggregate. Non-reactive aggregates shall meet the following limitations:

(1) Optically strained, microfractured, or microcrystalline quartz, 5.0%, maximum.

(2) Chert or chalcedony, 3.0%, maximum.

(3) Tridymite or cristobalite, 1.0%, maximum.

(4) Opal, 0.5%, maximum.

(5) Natural volcanic glass in volcanic rocks, 3.0%, maximum.

2. Proposed concrete mix including non-reactive aggregates shall be evaluated by ASTM C-1567. Mean mortar bar expansions at 16 days shall be less than 0.08%. Tests shall be made using exact proportion of all materials proposed for use on the job in design mix submitted.

G. All aggregates shall be considered reactive unless they meet the requirements above for non-reactive aggregates. Aggregates with a lithology essentially similar to sources in the same region found to be reactive in service shall be considered reactive regardless of the results of the tests above.

H. Contractor shall submit a new trial mix to the Engineer for approval whenever a different aggregate or gradation is proposed.

2.06 STRUCTURAL MACRO FIBERS (NOT USED)

2.07 ADMIXTURES:

A. Air entraining agent shall be added to all concrete unless noted otherwise. The agent shall consist of a neutralized vinsol resin solution or a purified hydrocarbon with a cement catalyst which will provide entrained air in the concrete in accordance with ASTM C 260. The admixture proposed shall be selected in advance so that adequate samples may be obtained and the required tests made. Air content of concrete, when placed, shall be within the ranges given in the concrete mix design.

B. The following admixtures are required or used for water reduction, slump increase, and/or adjustment of initial set. Admixtures permitted shall confirm to the requirements of ASTM C 494. Admixtures shall be non-toxic after 30 days and shall be compatible with and made by the same manufacturer as the air-entraining admixtures.

1. Water reducing admixture shall conform to ASTM C 494, Type A and shall contain no more than 0.05% chloride ions. Acceptable products are "Eucon Series" by the Euclid Chemical Company, "Pozzolith Series" by BASF, and "Plastocrete Series" by Sika Corporation.

2. High range water reducer shall be sulfonated polymer conforming to ASTM C 494, Type F or G. The high range water reducer shall be added to the concrete at either the batch plant or at the job site and may be used in conjunction with a water reducing admixture. The high range water reducer shall be accurately measured and pressure injected into the mixer as a single dose by an experienced technician. A standby system shall be provided and tested prior to each day's operation of the job site system. Concrete shall be mixed at mixing speed for a minimum of 100 mixer revolutions after the addition of the high range water reducer. Acceptable products are "Eucon 37" or Plastol 5000 by the Euclid Chemical Company, "Rheobuild 1000 or Glenium Series" by BASF, and "Daracem 100 or Advaflow Series" by W.R. Grace.

3. A non-chloride, non-corrosive accelerating admixture may be used where specifically approved by the Engineer. The admixture shall conform to ASTM C 494, Type C or E, and shall not contain more chloride ions than are present in municipal drinking water. The admixture manufacturer must have long-term non-corrosive test data from an independent testing laboratory (of at least a year's duration) using an acceptable accelerated corrosion test method such as that using electrical potential measures. Acceptable products are "Accelguard 80/90 or NCA" by the Euclid Chemical Company and "Daraset" by W.R. Grace.

4. A water reducing retarding admixture may be used where specifically approved by the Engineer. The admixture shall conform to ASTM C494, Type D and shall not contain more than 0.05% chloride ions. Acceptable products are "Eucon NR or

Eucon Retarder 100" by the Euclid Chemical Company, "Pozzolith Retarder" by BASF, and "Plastiment" by Sika Corporation.

C. Admixtures containing calcium chloride, thiocyanate or more than 0.05 percent chloride ions are not permitted. The addition of admixtures to prevent freezing is not permitted.

D. The Contractor shall submit manufacturer's data including the chloride ion content of each admixture and certification from the admixture manufacturer that all admixtures utilized in the design mix are compatible with one another and properly proportioned prior to mix design review by the Engineer.

2.08 CONCRETE MIX DESIGN:

A. The proportions of cement, aggregates, admixtures and water used in the concrete mixes shall be based on the results of field experience or preferably laboratory trial mixes in conformance with Section 5.3. "Proportioning on the Basis of Field Experience and/or Trial Mixtures" of ACI 318 and ACI 350. When trial mixes are used they shall also conform to Article 3.01 of this Section of the Specifications. If field experience records are used, concrete strength results shall be from concrete mixed with all of the ingredients proposed for use on job used in similar proportions to mix proposed for use on job. Contractor shall submit verification confirming this stipulation has been followed. Field experience records and/or trial mix data used as the basis for the proposed concrete mix design shall be submitted to the Engineer along with the proposed mix.

B. Structural concrete shall conform to the following requirements. Cementitious materials refer to the total combined weight of all cement, fly ash, and slag cement contained in the mix.

1. Compressive Strength (28-Day)

| | |
|---|---|
| a. Concrete Class A | 4,500 psi (minimum)<br>6,500 psi (maximum) |
| b. Class B | 3,000 psi (minimum) |

2. Maximum water/cementitious materials ratio, by weight

| | |
|---|---|
| a. Concrete Class A | 0.42 |
| b. Class B | 0.50 |

| | |
|---|---|
| 3. Slump range | 4" nominal unless high range water reducing admixture is used. 3" max. before addition of high range water reducing admixture. |

4. Air Content

| | | |
|---|---|---|
| a. | Class A | 6% ±1.5% |
| b. | Class B | 3% Max |

PART 3 - EXECUTION

3.01 TRIAL MIXES:

A. When trial mixes are used to confirm the quality of a proposed concrete mix in accordance with Section 5.3, "Proportioning on the Basis of Field Experience and/or Trial Mixtures" of ACI 318 and ACI 350, an independent testing laboratory designated and retained by the Contractor and acceptable to the Engineer shall test a trial batch of each of the preliminary concrete mixes submitted by the Contractor. The trial batches shall be prepared using the aggregates, cement and admixtures proposed for the project. The trial batch materials shall be of a quantity such that the testing laboratory can obtain enough samples to satisfy requirements stated below. Tests on individual materials stated in PART 2 -- PRODUCTS should already be performed before any trial mix is done. The cost of laboratory trial batch tests for each specified concrete mix will be borne by the Contractor and the Contractor shall furnish and deliver the materials to the testing laboratory at no cost to the Owner.

B. The independent testing laboratory shall prepare a minimum of fifteen (15) standard test cylinders in accordance with ASTM C 31 in addition to conducting slump (ASTM C 143), air content (C 231) and unit weight (C 138) tests. Compressive strength test on the cylinders shall subsequently be performed by the same laboratory in accordance with ASTM C 39 as follows: Test 3 cylinders at age 7 days; test 3 cylinders at age 21 days; test 3 cylinders at age 28 days and test 3 cylinders at 56 days. The cylinders shall be carefully identified as "Trial Mix, Contract No. _____, Product _____." If the average 28-day compressive strength of the trial mix is less than that specified, or if any single cylinder falls below the required strength by more than 500 psi, the mix shall be corrected, another trial batch prepared, test cylinders taken, and new tests performed as before. Any such additional trial batch testing required shall be performed at no additional cost to the Owner. Adjustments to the mix shall be considered refinements to the mix design and shall not be the basis for extra compensation to the Contractor.

3.02 PRODUCTION OF CONCRETE

A. All concrete shall be machine mixed. Hand mixing of concrete will not be permitted. The Contractor may supply concrete from a ready mix plant or from a site mixed plant. In selecting the source for concrete production the Contractor shall carefully consider its capability for providing quality concrete at a rate commensurate with the requirements of the placements so that well bonded, homogenous concrete, free of cold joints, is assured.

B. Ready-Mixed Concrete

1. At the Contractor's option, ready-mixed concrete may be used meeting the requirements for materials, batching, mixing, transporting, and placing as specified herein and in accordance with ASTM C 94.

2. Truck mixers shall be equipped with electrically-actuated counters by which the number of revolutions of the drum or blades may be readily verified. The counter shall be of the resettable, recording type, and shall be mounted in the driver's cab. The counters shall be actuated at the time of starting mixers at mixing speeds.

3. Each batch of concrete shall be mixed in a truck mixer for not less than 100 revolutions of the drum or blades at the rate of rotation designated by the manufacturer of equipment. Additional mixing, if any, shall be at the speed designated by the manufacturer of the equipment as agitating speed. All materials including mixing water shall be in the mixer drum before actuating the revolution counter for determining the number of revolutions of mixing.

4. Truck mixers and their operation shall be such that the concrete throughout the mixed batch, as discharged, is within acceptable limits of uniformity with respect to consistency, mix and grading. If slump tests taken at approximately the 1/4 and 3/4 points of the load during discharge give slumps differing by more than one inch when the specified slump is 3 inches or less, or if they differ by more than 2 inches when the specified slump is more than 3 inches, the mixer shall not be used on the work unless the causing condition is corrected and satisfactory performance is verified by additional slump tests. All mechanical details of the mixer, such as water measuring and discharge apparatus, condition of the blades, speed of rotation, general mechanical condition of the unit and clearance of the drum, shall be checked before a further attempt to use the unit will be permitted.

5. Ready-mixed concrete shall be delivered to the site for the work and discharge shall be completed before the drum has been revolved 300 revolutions and within the time requirements stated in Article 3.03 of this Section.

6. Each and every concrete delivery shall be accompanied by a delivery ticket containing at least the following information:

   a. Date and truck number
   b. Ticket number
   c. Mix designation of concrete
   d. Cubic yards of concrete
   e. Cement brand, type and weight in pounds
   f. Weight in pounds of fine aggregate (sand)
   g. Weight in pounds of coarse aggregate (stone)
   h. Air entraining agent, brand, and weight in pounds and ounces
   i. Other admixtures, brand, and weight in pounds and ounces

j. Water, in gallons, stored in attached tank
k. Water, in gallons, maximum that can be added without exceeding design water/cement ratio
l. Water, in gallons, actually used (by truck driver)
m. Time of loading
n. Time of delivery to job (by truck driver)

7. Any truck delivering concrete to the job site, which is not accompanied by a delivery ticket showing the above information will be rejected and such truck shall immediately depart from the job site.

8. The use of non-agitating equipment for transporting ready-mixed concrete will not be permitted. Combination truck and trailer equipment for transporting ready-mixed concrete will not be permitted. The quality and quantity of materials used in ready-mixed concrete and in batch aggregates shall be subject to continuous inspection at the batching plant by the Engineer.

C. Site Mixed Concrete

1. Scales for weighing concrete ingredients shall be accurate when in use within ±0.4 percent of their total capacities. Standard test weights shall be available to permit checking scale accuracy.

2. Operation of batching equipment shall be such that the concrete ingredients are consistently measured within the following tolerances:

| | | |
|---|---|---|
| a. | Cement, fly ash, or slag cement | ± 1 percent |
| b. | Water | ± 1 percent |
| c. | Aggregates | ± 2 percent |
| d. | Admixtures | ± 3 percent |

3. Each batch shall be so charged into the mixer that some water will enter in advance of the cement and aggregates. Water shall continue for a period which may extend to the end of the first 25 percent of the specified mixing time. Controls shall be provided to prevent batched ingredients from entering the mixer before the previous batch has been completely discharged.

4. The concrete shall be mixed in a batch mixer capable of thoroughly combining the aggregates, cement, and water into a uniform mass within the specified mixing time, and of discharging the concrete without harmful segregation. The mixer shall bear a manufacturer's rating plate indicating the rate capacity and the recommended revolutions per minute and shall be operated in accordance therewith.

5. Mixers with a rate capacity of 1 cu.yd. or larger shall conform to the requirements of the Plant Mixer Manufacturers' Division of the Concrete Plant Manufacturers' Bureau.

6. Except as provided below, batches of 1 cu. yd. or less shall be mixed for not less than 1 minute. The mixing time shall be increased 15 seconds for each cubic yard or fraction thereof of additional capacity.

7. Shorter mixing time may be permitted provided performance tests made in accordance with of ASTM C 94 indicate that the time is sufficient to produce uniform concrete.

8. Controls shall be provided to insure that the batch cannot be discharged until the required mixing time has elapsed. At least three-quarters of the required mixing time shall take place after the last of the mixing water has been added.

9. The interior of the mixer shall be free of accumulations that will interfere with mixing action. Mixer blades shall be replaced when they have lost 10 percent of their original height.

10. Air-entraining admixtures and other chemical admixtures shall be charged into the mixer as solutions and shall be measured by means of an approved mechanical dispensing device. The liquid shall be considered a part of the mixing water. Admixtures that cannot be added in solution may be weighed or may be measured by volume if so recommended by the manufacturer.

11. If two or more admixtures are used in the concrete, they shall be added separately to avoid possible interaction that might interfere with the efficiency of either admixture or adversely affect the concrete.

12. Addition of retarding admixtures shall be completed within 1 minute after addition of water to the cement has been completed, or prior to the beginning of the last three-quarters of the required mixing, whichever occurs first. Retarding admixtures shall not be used unless approved by the Engineer.

13. Concrete shall be mixed only in quantities for immediate use and within the time and mixing requirements of ASTM C 94.

## 3.03 CONCRETE PLACEMENT:

A. No concrete shall be placed prior to approval of the concrete mix design. Concrete placement shall conform to the recommendations of ACI 304.

B. Prior to concrete placement, all reinforcement shall be securely and properly fastened in its correct position. Formwork shall be clean, oiled and form ties at construction joints shall be retightened. All bucks, sleeves, castings, hangers, pipe, conduits, bolts, anchors, wire, and any other fixtures required to be embedded therein shall be in place. Forms for openings to be left in the concrete shall be in place and anchored by the Contractor. All loose debris in bottoms of forms or in keyways shall be removed and all debris, water, snow, ice and foreign

matter shall be removed from the space to be occupied by the concrete. The Contractor shall notify the Engineer in advance of placement, allowing sufficient time for a concurrent inspection and for any corrective measures which are subsequently required.

C. On horizontal joints where concrete is to be placed on hardened concrete, flowing concrete containing a high range water reducing admixture or cement grout shall be placed with a slump not less than 8 inches for the initial placement at the base of the wall. Concrete or cement grout shall meet all strength and service requirements specified herein for applicable class of concrete. This concrete shall be worked well into the irregularities of the hard surface.

D. All concrete shall be placed during the daylight hours except with the consent of the Engineer. If special permission is obtained to carry on work during the night, adequate lighting must be provided.

E. When concrete arrives at the project with slump below that suitable for placing, as indicated by the Specifications, water may be added to bring the concrete within the specified slump range provided that the design water-cement ratio is not exceeded. The water shall be incorporated by additional mixing equal to at least half of the total mixing required. Water may be added only to full trucks. On-site tempering shall not relieve the Contractor from furnishing a concrete mix that meets all specified requirements.

F. Concrete shall be conveyed as rapidly as practicable to the point of deposit by methods which prevent the separation or loss of the ingredients. It shall be so deposited that rehandling will be unnecessary. Discharge of the concrete to its point of deposit shall be completed within 90 minutes after the addition of the cement to the aggregates. In hot weather, or under conditions contributing to quick stiffening of the concrete, the time between the introduction of the cement to the aggregates and discharge shall not exceed the requirements stated in Article 3.09 of this Section.

G. Where concrete is conveyed to position by chutes, a practically continuous flow in the chute shall be maintained. The angle and discharge arrangement of the chute shall be such as to prevent segregation of the concrete ingredients. The delivery end of the chute shall be as close as possible to the point of deposit and in no case shall the free pour from the delivery end of the chute exceed five feet, unless approved otherwise by Engineer.

H. Special care must be exercised to prevent splashing of forms or reinforcement with concrete, and any such splashes or accumulations of hardened or partially hardened concrete on the forms or reinforcement above the general level of the concrete already in place must be removed before the work proceeds. Concrete shall be placed in all forms in such way as to prevent any segregation.

I. Placing of concrete shall be so regulated that the pressure caused by the wet concrete shall not exceed that used in the design of the forms.

J. When placing concrete which is to be exposed, sufficient illumination shall be provided in the interior of the forms so the concrete, at places of deposit, is visible from deck and runways.

K. Concrete shall be placed so as to thoroughly embed all reinforcement, inserts, and fixtures.

L. When forms are removed, surfaces shall be even and dense, free from aggregate pockets or honeycomb. To achieve this, concrete shall be consolidated using mechanical vibration, supplemented by forking and spading by hand in the corners and angle of forms and along form surfaces while the concrete is plastic under the vibratory action. Consolidation shall conform to ACI 309.

M. Mechanical vibration shall be applied directly to the concrete, unless otherwise approved by the Engineer. The bottom of vibrators used on floor slabs must not be permitted to ride the form supporting the slab. Vibration shall be applied at the point of deposit and in the area of freshly placed concrete by a vertical penetration of the vibrator. Vibrators shall not be used to move concrete laterally within the forms.

N. The intensity of vibration shall be sufficient to cause settlement of the concrete into place and to produce monolithic joining with the preceding layer. It shall be of sufficient duration to accomplish thorough compaction and complete embedment of reinforcement and fixtures with a vibrator transmitting not less than 7,500 impulses per minute. Since the duration of vibration per square foot of surface is dependent on the frequency (impulses per minute), size of vibrator, and slump of concrete, the length of time must therefore be determined in the field. Vibration, however, shall not be continued in any one location to the extent that pools of grout are formed.

O. Care shall be taken to prevent cold joints when placing concrete in any portion of the work. The concrete placing rate shall be such as to ensure that each layer is placed while the previous layer is soft or plastic, so that the two layers can be made monolithic by penetration of the vibrators. The surface of the concrete shall be level whenever a run of concrete is stopped.

P. Concrete shall not be placed during rains sufficiently heavy or prolonged to wash mortar from coarse aggregate on the forward slopes of the placement. Once placement of concrete has commenced in a block, placement shall not be interrupted by diverting the placing equipment to other uses.

## 3.04 PLACING FLOOR SLABS ON GRADE:

A. The subgrade for slabs on ground shall be well drained and of adequate and uniform loadbearing nature. The in-place density of the subgrade soils shall be at least the minimum required by the specifications. No foundation, slab, or pavement concrete shall be placed until the depth and character of the foundation soils have been inspected and approved by the materials testing consultant.

B. The subgrade shall be free of frost before concrete placing begins.

C. The subgrade shall be moist at the time of concreting. If necessary, it shall be dampened with water in advance of concreting, but there shall be no free water standing on the subgrade nor any muddy or soft spots when the concrete is placed.

D. Floor slabs shall be screeded level or pitched to drain as indicated on the Drawings. Finishes shall conform with requirements of Section 03350 - Concrete Finishes.

3.05 PLACING CONCRETE UNDERWATER:

A. Placing concrete underwater shall not be permitted.

3.06 PLACING CONCRETE UNDER PRESSURE:

A. Where concrete is conveyed and placed by mechanically applied pressure, the equipment shall have the capacity for the operation. The operation of the pump shall be such that a continuous stream of concrete without air pockets is produced. To obtain the least line resistance, the layout of the pipeline system shall contain a minimum number of bends with no change in pipe size. If two sizes of pipe must be used, the smaller diameter should be used at the pump end and the larger at the discharge end. When pumping is completed, the concrete remaining in the pipelines, if it is to be used, shall be ejected in such a manner that there will be no contamination of the concrete or separation of the ingredients.

B. Priming of the concrete pumping equipment shall be with cement grout only. Use of specialty mix pump primers or pumping aids will not be allowed.

C. No aluminum parts shall be in contact with the concrete during the entire placing of concrete under pressure at any time.

D. Prior to placing concrete under pressure, the Contractor shall submit the concrete mix design together with test results from a materials testing consultant proving the proposed mix meets all requirements. In addition, an actual pumping test under field conditions is required prior to acceptance of the mix. This test requires a duplication of anticipated site conditions from beginning to end. The batching and truck mixing shall be the same as will be used; the same pump and operator shall be present and the pipe and pipe layouts will reflect the maximum height and distance contemplated. All submissions shall be subject to approval by the Engineer.

E. If the pumped concrete does not produce satisfactory end results, the Contractor shall discontinue the pumping operation and proceed with the placing of concrete using conventional methods.

F. The pumping equipment must have two cylinders and be designed to operate with one cylinder only in case the other one is not functioning. In lieu of this requirement, the Contractor may have a standby pump on the site during pumping.

G. The minimum diameter of the hose (conduits) shall be four inches.

H. Pumping equipment and hoses (conduits) that are not functioning properly shall be replaced.

I. Concrete samples for quality control in accordance with Article 3.10 will be taken at the placement (discharge) end of the line.

3.07 ORDER OF PLACING CONCRETE:

A. In order to minimize the effects of shrinkage, the concrete shall be placed in units as bounded by expansion joints shown on the Drawings. A minimum of 72 hours shall pass prior to placing concrete directly adjacent to previously placed concrete.

3.08 CONCRETE WORK IN COLD WEATHER:

A. Cold weather concreting procedures shall conform to the requirements of ACI 306.

B. The Engineer may prohibit the placing of concrete at any time when air temperature is 40°F. or lower. If concrete work is permitted, the concrete shall have a minimum temperature, as placed, of 55°F. for placements less than 12" thick, 50°F. for placements 12" to 36" thick, and 45°F. for placements greater than 36" thick. The temperature of the concrete as placed shall not exceed the aforementioned minimum values by more than 20°F, unless otherwise approved by the Engineer.

C. All aggregate and water shall be preheated. Precautions shall be taken to avoid the possibility of flash set when aggregate or water are heated to a temperature in excess of 100°F. in order to meet concrete temperature requirements. The addition of admixtures to the concrete to prevent freezing is not permitted. All reinforcement, forms, and concrete accessories with which the concrete is to come in contact shall be defrosted by an approved method. No concrete shall be placed on frozen ground.

3.09 CONCRETE WORK IN HOT WEATHER:

A. Hot weather concreting procedures shall conform to the requirements of ACI 305.

B. When air temperatures exceed 85°F., or when extremely dry conditions exist even at lower temperatures, particularly if accompanied by high winds, the Contractor and his concrete supplier shall exercise special and precautionary measures in preparing, delivering, placing, finishing, curing and protecting the concrete mix. The Contractor shall consult with the Engineer regarding such measures prior to each day's placing operation and the Engineer reserves the right to modify the proposed measures consistent with the requirements of this Section of the Specifications. All necessary materials and equipment shall be on hand an in position prior to each placing operation.

C. Preparatory work at the job site shall include thorough wetting of all forms, reinforcing steel and, in the case of slab pours on ground or subgrade, spraying the ground surface on the preceding evening and again just prior to placing. No standing puddles of water shall be permitted in those areas which are to receive the concrete.

D. The temperature of the concrete mix when placed shall not exceed 90°F.

E. Temperature of mixing water and aggregates shall be carefully controlled and monitored at the supplier's plant, with haul distance to the job site being taken into account. Stockpiled aggregates shall, if necessary, be shaded from the sun and sprinkled intermittently with water. If ice is used in the mixing water for cooling purposes, it must be entirely melted prior to addition of the water to the dry mix.

F. Delivery schedules shall be carefully planned in advance so that concrete is placed as soon as practical after it is properly mixed. For hot weather concrete work (air temperature greater than 85°F), discharge of the concrete to its point of deposit shall be completed within 60 minutes from the time the concrete is batched.

G. The Contractor shall arrange for an ample work force to be on hand to accomplish transporting, vibrating, finishing, and covering of the fresh concrete as rapidly as possible.

3.10 QUALITY CONTROL:

A. Field Testing of Concrete

1. The Contractor shall coordinate with the Engineer's project representative the on-site scheduling of the materials testing consultant personnel as required for concrete testing.

2. Concrete for testing shall be supplied by the Contractor at no additional cost to the Owner, and the Contractor shall provide assistance to the materials testing consultant in obtaining samples. The Contractor shall dispose of and clean up all excess material.

B. Consistency

1. The consistency of the concrete will be checked by the materials testing consultant by standard slump cone tests. The Contractor shall make any necessary adjustments in the mix as the Engineer and/or the materials testing consultant may direct and shall upon written order suspend all placing operations in the event the consistency does not meet the intent of the specifications. No payment shall be made for any delays, material or labor costs due to such eventualities.

2. Slump tests shall be made in accordance with ASTM C 143. Slump tests will be performed as deemed necessary by the materials testing consultant and each time compressive strength samples are taken.

3. Concrete with a specified nominal slump shall be placed having a slump within 1" (higher or lower) of the specified slump. Concrete with a specified maximum slump shall be placed having a slump less than the specified slump.

C. Unit Weight

1. Samples of freshly mixed concrete shall be tested for unit weight by the materials testing consultant in accordance with ASTM C 138.

2. Unit weight tests will be performed as deemed necessary by the Engineer and each time compressive strength samples are taken.

D. Air Content

1. Samples of freshly mixed concrete will be tested for entrained air content by the materials testing consultant in accordance with ASTM C 231.

2. Air content tests will be performed as deemed necessary by the materials testing consultant and each time compressive strength samples are taken.

3. In the event test results are outside the limits specified, additional testing shall occur. Admixture quantity adjustments shall be made immediately upon discovery of incorrect air entrainment.

E. Compressive Strength

1. Samples of freshly mixed concrete will be taken by the materials testing consultant and tested for compressive strength in accordance with ASTM C 172, C 31 and C 39, except as modified herein.

2. In general, one sampling shall be taken for each placement in excess of five (5) cubic yards, with a minimum of one (1) sampling for each day of concrete placement operations, or for each one hundred (100) cubic yards of concrete, or for each 5,000 square feet of surface area for slabs or walls, whichever is greater.

3. Each sampling shall consist of at least five (5) 6x12 cylinders or (8) 4x8 cylinders. Each cylinder shall be identified by a tag, which shall be hooked or wired to the side of the container. The materials testing consultant will fill out the required information on the tag, and the Contractor shall satisfy himself that such information shown is correct.

4. The Contractor shall be required to furnish labor to the Owner for assisting in preparing test cylinders for testing. The Contractor shall provide approved curing boxes for storage of cylinders on site. The insulated curing box shall be of sufficient size and strength to contain all the specimens made in any four consecutive working

days and to protect the specimens from falling over, being jarred or otherwise disturbed during the period of initial curing. The box shall be erected, furnished and maintained by the Contractor. Such box shall be equipped to provide the moisture and to regulate the temperature necessary to maintain the proper curing conditions required by ASTM C 31. Such box shall be located in an area free from vibration such as traffic of all kinds and such that all specimen are shielded from direct sunlight and/or radiant heating sources. No concrete requiring inspection shall be delivered to the site until such storage curing box has been provided. Specimens shall remain undisturbed in the curing box until ready for delivery to the testing laboratory but not less than sixteen hours.

5. The Contractor shall be responsible for maintaining the temperatures of the curing box during the initial curing of test specimens with the temperature preserved between 60°F and 80°F as measured by a maximum-minimum thermometer. The Contractor shall maintain a written record of curing box temperatures for each day curing box contains test specimens. Temperature shall be recorded a minimum of three times a day with one recording at the start of the work day and one recording at the end of the work day.

6. When transported, the cylinders shall not be thrown, dropped, allowed to roll, or be damaged in any way.

7. Compression tests shall be performed in accordance with ASTM C 39. For 6x12 cylinders, two test cylinders will be tested at seven days and two at 28 days. For 4x8 cylinders, three test cylinders will be tested at seven days, three at 28 days. The remaining cylinders will be held to verify test results, if needed.

F. Evaluation and Acceptance of Concrete

1. Evaluation and acceptance of the compressive strength of concrete shall be according to the requirements of ACI 214, ACI 318, and ACI 350.

2. The strength level of concrete will be considered satisfactory if all of the following conditions are satisfied.

   a. Every arithmetic average of any three consecutive strength tests equals or exceeds the minimum specified 28-day compressive strength for the mix (see Article 2.08).

   b. No individual compressive strength test results falls below the minimum specified strength by more than 500 psi.

   c. No more than 10% of the compressive tests have strengths greater than the maximum strength specified.

3. In the event any of the conditions listed above are not met, the mix proportions shall be corrected for the next concrete placing operation.

4. In the event that condition 2B is not met, additional tests in accordance with Article 3.10, paragraph H shall be performed.

5. When a ratio between 7-day and 28-day strengths has been established by these tests, the 7-day strengths shall subsequently be taken as a preliminary indication of the 28-day strengths. Should the 7-day test strength from any sampling be more than 10% below the established minimum strength, the Contractor shall:

   a. Immediately provide additional periods of curing in the affected area from which the deficient test cylinders were taken.

   b. Maintain or add temporary structural support as required.

   c. Correct the mix for the next concrete placement operation, if required to remedy the situation.

6. All concrete which fails to meet the ACI requirements and these specifications is subject to removal and replacement at no additional cost to the Owner.

G. When non-compliant concrete is identified, test reports shall be sent immediately to the Engineer for review.

H. Additional Tests

1. When ordered by the Engineer, additional tests on in-place concrete shall be provided and paid for by the Contractor.

2. In the event the 28-day test cylinders fail to meet the minimum strength requirements as outlined in Article 3.10, paragraph F, the Contractor shall have concrete core specimens obtained and tested from the affected area immediately.

   a. Three cores shall be taken for each sample in which the strength requirements were not met.

   b. The drilled cores shall be obtained and tested in conformance with ASTM C 42. The tests shall be conducted by a materials testing consultant approved by the Engineer.

   c. The location from which each core is taken shall be approved by the Engineer. Each core specimen shall be located, when possible, so its axis is perpendicular to the concrete surface and not near formed joints or obvious edges of a unit of deposit.

d. The core specimens shall be taken, if possible, so no reinforcing steel is within the confines of the core.

e. The diameter of core specimens should be at least 3 times the maximum nominal size of the course aggregate used in the concrete, but must be at least 2-inches in diameter.

f. The length of specimen, when capped, shall be at least twice the diameter of the specimen.

g. The core specimens shall be taken to the laboratory and when transported, shall not be thrown, dropped, allowed to roll, or damaged in any way.

h. Two (2) copies of test results shall be mailed directly to the Engineer. The concrete in question will be considered acceptable if the average compressive strength of a minimum of three test core specimens taken from a given area equal or exceed 85% of the specified 28-day strength and if the lowest core strength is greater than 75% of the specified 28-day strength.

3. In the event that concrete placed by the Contractor is suspected of not having proper air content, the Contractor shall engage a materials testing consultant approved by the Engineer, to obtain and test samples for air content in accordance with ASTM Specification C 457.

4. Concrete placed with compressive strengths greater than the maximum strength specified shall be removed and replaced or repaired as deemed necessary by the Engineer.

## 3.11 CARE AND REPAIR OF CONCRETE:

A. The Contractor shall protect all concrete against injury or damage from excessive heat, lack of moisture, overstress, or any other cause until final acceptance by the Owner. Particular care shall be taken to prevent the drying of concrete and to avoid roughening or otherwise damaging the surface. Care shall be exercised to avoid jarring forms or placing any strain on the ends of projecting reinforcing bars. Any concrete found to be damaged, or which may have been originally defective, or which becomes defective at any time prior to the final acceptance of the completed work, or which departs from the established line or grade, or which, for any other reason, does not conform to the requirements of the Contract Documents, shall be satisfactorily repaired or removed and replaced with acceptable concrete at no additional cost to the Owner.

B. Areas of honeycomb shall be chipped back to sound concrete and repaired as directed by the Engineer.

C. Concrete formwork blowouts or unacceptable deviations in tolerances for formed surfaces due to improperly constructed or misaligned formwork shall be repaired as directed by the

Engineer. Bulging or protruding areas, which result from slipping or deflecting forms shall be ground flush or chipped out and redressed as directed by the Engineer.

D. Areas of concrete in which cracking, spalling, or other signs of deterioration develop prior to final acceptance shall be removed and replaced, or repaired as directed by the Engineer. This stipulation includes concrete that has experienced cracking due to drying or thermal shrinkage of the concrete. Structural cracks shall be repaired using an epoxy injection system approved by the Engineer. Non-structural cracks shall be repaired using a hydrophilic resin pressure injected grout system approved by the Engineer, unless other means of repair are deemed necessary and approved by the Engineer. Extensive repair or replacement will be considered for concrete placed having compressive strengths greater than maximum strength specified. All repair work shall be performed at no additional cost to the Owner.

E. Concrete which fails to meet the strength requirements as outlined in Article 3.10, paragraph F, will be analyzed by the Engineer as to its adequacy based upon loading conditions, resultant stresses and exposure conditions for the particular area of concrete in question. If the concrete in question is found unacceptable based upon this analysis, that portion of the structure shall be strengthened or replaced by the Contractor at no additional cost to the Owner. The method of strengthening or extent of replacement shall be directed by the Engineer.

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# SECTION 03350

# CONCRETE FINISHES

## PART 1 - GENERAL

### 1.01 THE REQUIREMENT:

A. Furnish all materials, labor, and equipment required to provide finishes of all concrete surfaces specified herein and shown on the Drawings.

### 1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. Section 03100 – Concrete Formwork

B. Section 03300 – Cast-in-Place Concrete

C. Section 03600 – Grout

### 1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS:

A. Without limiting the generality of the other requirements of the specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. ACI 301 – Specifications for Structural Concrete for Buildings

2. ACI 318 – Building Code Requirements for Structural Concrete

### 1.04 SUBMITTALS:

A. Submit the following in accordance with Section 01300 – Submittals.

1. Manufacturer's literature on all products specified herein.

## PART 2 - PRODUCTS

### 2.01 CONCRETE FLOOR SEALER:

A. Floor sealer shall be Diamond Clear VOX or Super Diamond Clear VOX by the Euclid Chemical Company, MasterKure CC 300 SB by BASF Master Builder Solutions.

## PART 3 - EXECUTION

### 3.01 FINISHES ON FORMED CONCRETE SURFACES:

A. After removal of forms, the finishes described below shall be applied in accordance with Article 3.05 - Concrete Finish Schedule. Unless the finish schedule specifies otherwise, all surfaces shall receive at least a Type I finish. The Engineer shall be the sole judge of acceptability of all concrete finish work.

1. Type I - Rough: All fins, burrs, offsets, marks and all other projections left by the forms shall be removed. Projections, depressions, etc. below finished grade required to be removed will only be those greater than ¼-inch. All holes left by removal of ends of ties, and all other holes, depressions, bugholes, air/blow holes or voids shall be filled solid with cement grout after first being thoroughly wetted and then struck off flush. The only holes below grade to be filled will be tie holes and any other holes larger than ¼-inch in any dimension. Honeycombs shall be chipped back to solid concrete and repaired as directed by the Engineer. All holes shall be filled with tools, such as sponge floats and trowels, that will permit packing the hole solidly with cement grout. Cement grout shall consist of one part cement to three parts sand, epoxy bonding agent (for tie holes only) and the amount of mixing water shall be as little as consistent with the requirements of handling and placing. Color of cement grout shall match the adjacent wall surface.

2. Type II - Grout Cleaned: Where this finish is required, it shall be applied after completion of Type I finish. After the concrete has been predampened, a slurry consisting of one part cement (including an appropriate quantity of white cement in order to produce a color matching the surrounding concrete) and 1-1/2 parts sand passing the No. 16 sieve, by damp loose volume, shall be spread over the surface with clean burlap pads or sponge rubber floats. Mix proportions shall be submitted to the Engineer after a sample of the work is established and accepted. Any surplus shall be removed by scraping and then rubbing with clean burlap.

3. Type III - Smooth Rubbed: Where this finish is required, it shall be applied after the completion of the Type I finish. No rubbing shall be done before the concrete is thoroughly hardened and the mortar used for patching is firmly set. A smooth, uniform surface shall be obtained by wetting the surface and rubbing it with a carborundum stone to eliminate irregularities. Unless the nature of the irregularities requires it, the general surface of the concrete shall not be cut into. Corners and edges shall be slightly rounded by the use of the carborundum stone. Brush finishing or painting with grout or neat cement will not be permitted. A 100 square foot example shall be established at the beginning of the project to establish acceptability.

## 3.02 SLAB AND FLOOR FINISHES:

A. The finishes described below shall be applied to floors, slabs, flow channels and top of walls in accordance with Article 3.05 - Concrete Finish Schedule. The Engineer shall be the sole judge of acceptability of all such finish work.

1. Type "A" - Screeded: This finish shall be obtained by placing screeds at frequent intervals and striking off to the surface elevation required. When a Type "F" finish is subsequently to be applied, the surface of the screeded concrete shall be roughened with a concrete rake to 1/2” minimum deep grooves prior to final set.

2. Type "B" - Wood or Magnesium Floated: This finish shall be obtained after completion of a Type "A" finish by working a previously screeded surface with a wood or magnesium float or until the desired texture is reached. Floating shall begin when the water sheen has disappeared and when the concrete has sufficiently hardened so that a person's foot leaves only a slight imprint. If wet spots occur, water shall be removed with a squeegee. Care shall be taken to prevent the formation of laitance and excess water on the finished surface. All edges shall be edged with an 1/8-inch tool as directed by the Engineer. The finished surface shall be true, even, and free from blemishes and any other irregularities.

3. Type "C" - Cork Floated: This finish shall be similar to Type "B" but slightly smoother than that obtained with a wood float. It shall be obtained by power or band floating with cork floats.

4. Type "D" - Steel Troweled: This finish shall be obtained after completion of a Type "B" finish. When the concrete has hardened sufficiently to prevent excess fine material from working to the surface, the surface shall be compacted and smoothed with not less than two thorough and complete steel troweling operations. In areas which are to receive a floor covering such as tile, resilient flooring, or carpeting, the applicable Specification Sections and Contract Drawings shall be reviewed for the required finishes and degree of flatness. In areas that are intermittently wet such as pump rooms, only one troweling operation is required to provide some trowel marks for slip resistance. All edges shall be edged with an 1/8-inch tool as directed by the Engineer. The finish shall be brought to a smooth, dense surface, free from defects and blemishes.

5. Type "E" - Broom or Belt: This finish shall provide the surface with a transverse scored texture by drawing a broom or burlap belt across the surface immediately after completion of a Type "B" finish. All edges shall be edged with an 1/8-inch tool as directed by the Engineer.

## 3.03 CONCRETE SEALERS:

A. Concrete sealers shall be applied where specifically required on the Contract Drawings or specified herein.

B. Sealers shall be applied after installation of all equipment, piping, etc. and after completion of any other related construction activities. Application of sealers shall be in strict accordance with manufacturer's requirements.

C. Concrete floor sealer shall be applied to all floor slabs not painted and not intended to be immersed.

3.04 FINISHES ON EQUIPMENT PADS:

A. Formed surfaces of equipment pads shall receive a Type III finish.

B. Top surfaces of equipment pads, except those surfaces subsequently required to receive grout and support equipment bases, shall receive a Type "D" finish, unless otherwise noted. Surfaces which will later receive grout shall, before the concrete takes its final set, be made rough by removing the sand and cement that accumulates on the top to the extent that the aggregate will be exposed with irregular indentations in the surface up to 1/2 inch deep.

3.05 CONCRETE FINISH SCHEDULE:

| Item | Type of Finish |
|---|---|
| Exterior formed surfaces below grade | I |
| Exterior exposed formed surfaces above grade and down to one foot below grade. All other exposed concrete surfaces not specified elsewhere | II |
| Exterior concrete slabs exposed to weather | E |

- END OF SECTION -

# SECTION 03370

# CONCRETE CURING

## PART 1 - GENERAL

### 1.01 THE REQUIREMENT:

A. Protect all freshly deposited concrete from premature drying and from the weather elements. The concrete shall be maintained with minimal moisture loss at a relatively constant temperature for a period of time necessary for the hydration of the cement and proper hardening of the concrete in accordance with the requirements specified herein.

### 1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. Section 03100 – Concrete Formwork

B. Section 03300 – Cast-In-Place Concrete

C. Section 03350 – Concrete Finishes

### 1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS:

A. Without limiting the generality of the other requirements of the specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. ACI 301 – Specifications for Structural Concrete for Buildings

2. ACI 304 – Guide for Measuring, Mixing, Transporting, and Placing Concrete

3. ACI 305 – Hot Weather Concreting

4. ACI 306 – Cold Weather Concreting

5. ACI 308 – Standard Practice for Curing Concrete

6. ASTM C171 – Standard Specifications for Sheet Materials for Curing Concrete

7. ASTM C309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete

8. ASTM C1315 – Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete

1.04 SUBMITTALS:

A. Submit the following in accordance with Section 01300, Submittals.

1. Proposed procedures for protection of concrete under wet weather placement conditions.

2. Proposed normal procedures for protection and curing of concrete.

3. Proposed special procedures for protection and curing of concrete under hot and cold weather conditions.

4. Proposed method of measuring concrete surface temperature changes.

5. Manufacturer's literature and material certification for proposed curing compounds.

PART 2 - PRODUCTS

2.01 LIQUID MEMBRANE-FORMING CURING COMPOUND:

A. Clear curing and sealing compound shall be a clear styrene acrylate type complying with ASTM C 1315, Type 1, Class A with a minimum solids content of 30%. Moisture loss shall not be greater than 0.40 kg/m$^2$ when applied at 300 sq.ft./gal. Manufacturer's certification is required. Acceptable products are Super Diamond Clear VOX by the Euclid Chemical Company, MasteKure CC 300 SB by BASF Master Builder Solutions, and Cure & Seal 30 Plus by Symons Corporation.

B. Where specifically approved by Engineer, on slabs to receive subsequent applied finishes, compound shall conform to ASTM C 309. Acceptable products are "Kurez DR VOX" or "Kurez W VOX" by the Euclid Chemical Company. Install in strict accordance with manufacturer's requirements.

2.02 EVAPORATION REDUCER:

A. Evaporation reducer shall be BASF, "MasterKure ER 50", or Euclid Chemical "Euco-Bar".

## PART 3 - EXECUTION

### 3.01 PROTECTION AND CURING

A. All freshly placed concrete shall be protected from the elements, flowing water and from defacement of any nature during construction operations.

B. As soon as the concrete has been placed and horizontal top surfaces have received their required finish, provision shall be made for maintaining the concrete in a moist condition for at least a 5-day period thereafter. Horizontal surfaces shall be kept covered, and intermittent, localized drying will not be permitted.

C. The Contractor shall use one of the following methods to insure that the concrete remains in a moist condition for the minimum period stated above.

1. Ponding or continuous fogging or sprinkling.

2. Application of mats or fabric kept continuously wet.

3. Continuous application of steam (under 150°F).

4. Application of sheet materials conforming to ASTM C171.

5. If approved by the Engineer, application of a curing compound in accordance with Article 3.04.

D. The Contractor shall keep absorbent wood forms wet until they are removed. After form removal, the concrete shall be cured by one of the methods in paragraph C.

E. Any of the curing procedures used in Paragraph 3.01-C may be replaced by one of the other curing procedures listed in Paragraph 3.01-C after the concrete is one-day old. However, the concrete surface shall not be permitted to become dry at any time.

### 3.02 CURING CONCRETE UNDER COLD WEATHER CONDITIONS:

A. Suitable means shall be provided for a minimum of 72 hours after placing concrete to maintain it at or above the minimum as placed temperatures specified in Section 03300, Cast-In-Place Concrete, for concrete work in cold weather. During the 72-hour period, the concrete surface shall not be exposed to air more than 20°F above the minimum as placed temperatures.

B. Stripping time for forms and supports shall be increased as necessary to allow for retardation in concrete strength caused by colder temperatures. This retardation is magnified when using concrete made with blended cements or containing fly ash or ground granulated blast furnace slag. Therefore, curing times and stripping times shall be further increased as necessary when using these types of concrete.

C. The methods of protecting the concrete shall be approved by the Engineer and shall be such as will prevent local drying. Equipment and materials approved for this purpose shall be on the site in sufficient quantity before the work begins. The Contractor shall assist the Engineer by providing holes in the forms and the concrete in which thermometers can be placed to determine the adequacy of heating and protection. All such thermometers shall be furnished by the Contractor in quantity and type which the Engineer directs.

D. Curing procedures during cold weather conditions shall conform to the requirements of ACI 306.

3.03 CURING CONCRETE UNDER HOT WEATHER CONDITIONS:

A. When air temperatures exceed 85°F, the Contractor shall take extra care in placing and finishing techniques to avoid formation of cold joints and plastic shrinkage cracking. If ordered by the Engineer, temporary sun shades and/or windbreakers shall be erected to guard against such developments, including generous use of wet burlap coverings and fog sprays to prevent drying out of the exposed concrete surfaces.

B. Immediately after screeding, horizontal surfaces shall receive an application of evaporation reducer. Apply in accordance with manufacturer's instructions. Final finish work shall begin as soon as the mix has stiffened sufficiently to support the workmen.

C. Curing and protection of the concrete shall begin immediately after completion of the finishing operation. Continuous moist-curing consisting of method 1 or 2 listed in paragraph 3.01-C is mandatory for at least the first 24 hours. Method 2 may be used only if the finished surface is not marred or blemished during contact with the coverings.

D. At the end of the initial 24-hour period, curing and protection of the concrete shall continue for at least six (6) additional days using one of the methods listed in paragraph 3.01-C.

E. Curing procedures during hot weather conditions shall conform to the requirements of ACI 305.

3.04 USE OF CURING COMPOUND:

A. Curing compound shall be used only where specifically approved by the Engineer.

B. When permitted, the curing compound shall maintain the concrete in a moist condition for the required time period, and the subsequent appearance of the concrete surface shall not be affected.

C. The compound shall be applied in accordance with the manufacturer's recommendations after water sheen has disappeared from the concrete surface and after finishing operations. Maximum coverage for the curing and sealing compound shall be 300 square feet per gallon for trowel finishes and 200 square feet per gallon for floated or broom surfaces. Maximum

coverage for compounds placed where subsequent finishes will be applied shall be 200 square feet per gallon. For rough surfaces, apply in two directions at right angles to each other.

3.05 EARLY TERMINATION OF CURING:

A. Moisture retention measures may be terminated earlier than the specified times only when at least one of the following conditions is met:

1. The strength of the concrete reaches 85 percent of the specified 28-day compressive strength in laboratory-cured cylinders representative of the concrete in place, and the temperature of the in-place concrete has been constantly maintained at 50 degrees Fahrenheit or higher.

2. The strength of concrete reaches the specified 28-day compressive strength as determined by accepted nondestructive methods or laboratory-cured cylinder test results.

- END OF SECTION –

NO TEXT ON THIS PAGE

# SECTION 03600

# GROUT

## PART 1 - GENERAL

### 1.01 THE REQUIREMENT:

A. Furnish all materials, labor, and equipment required to provide all grout used in concrete work and as bearing surfaces for base plates, in accordance with the Contract Documents.

### 1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. Requirements of related work are included in Division 1 and Division 2 of these Specifications.

### 1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS:

A. Without limiting the generality of the other requirements of the specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

| | | |
|---|---|---|
| 1. | CRD-C 621 | Corps of Engineers Specification for Non-shrink Grout |
| 2. | ASTM C 109 | Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 inch or 50 mm cube Specimens) |
| 3. | ASTM C 531 | Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts and Monolithic Surfacings |
| 4. | ASTM C 579 | Test Method for Compressive Strength of Chemical-Resistant Mortars and Monolithic Surfacings |
| 5. | ASTM C 827 | Standard Test Method for Early Volume Change of Cementitious Mixtures |
| 6. | ASTM C 144 | Standard Specification for Aggregate for Masonry Mortar |
| 7. | ASTM C 1107 | Standard Specification for Packaged Dry, Hydraulic Cement Grout (Nonshrink) |

1.04 SUBMITTALS:

A. Submit the following in accordance with Section 01300 - Submittals.

1. Certified test results verifying the compressive strength and shrinkage and expansion requirements specified herein.

2. Manufacturer's literature containing instructions and recommendations on the mixing, handling, placement and appropriate uses for each type of grout used in the work.

1.05 QUALITY ASSURANCE:

A. Field Tests

1. Compression test specimens will be taken during construction from the first placement of each type of grout and at intervals thereafter as selected by the Engineer to insure continued compliance with these Specifications. The specimens will be made by the Engineer or its representative.

a. Compression tests and fabrication of specimens for cement grout and non-shrink grout will be performed as specified in ASTM C 109 at intervals during construction as selected by the Engineer. A set of three specimens will be made for testing at seven days, 28 days and any additional time period as appropriate.

b. Compression tests and fabrication of specimens for epoxy grout will be performed as specified in ASTM C 579, Method B, at intervals during construction as selected by the Engineer. A set of three specimens will be made for testing at seven days and any other time period as appropriate.

2. The cost of all laboratory tests on grout will be borne by the Owner, but the Contractor shall assist the Engineer in obtaining specimens for testing. The Contractor shall be charged for the cost of any additional tests and investigation on work performed which does not meet the specifications. The Contractor shall supply all materials necessary for fabricating the test specimens, at no additional cost to the Owner.

3. All grout, already placed, which fails to meet the requirements of these Specifications, is subject to removal and replacement at no additional cost to the Owner.

## PART 2 - PRODUCTS

### 2.01 MATERIALS:

A. Cement Grout

1. Cement grout shall be composed of Portland Cement and sand in the proportion specified in the Contract Documents and the minimum amount of water necessary to obtain the desired consistency. If no proportion is indicated, cement grout shall consist of one part Portland Cement to three parts sand. Water amount shall be as required to achieve desired consistency without compromising strength requirements. White portland cement shall be mixed with the Portland Cement as required to match color of adjacent concrete.

2. The minimum compressive strength at 28 days shall be 4000 psi.

3. For beds thicker than 1-1/2 inch and/or where free passage of grout will not be obstructed by coarse aggregate, 1-1/2 parts of coarse aggregate having a top size of 3/8 inch should be added.

4. Sand shall conform to the requirements of ASTM C144.

B. Non-Shrink Grout

1. Non-shrink grout shall conform to CRD-C 621 and ASTM C 1107, Grade B or C when tested at a max. fluid consistency of 30 seconds per CDC 611/ASTM C939 at temperature extremes of 45°F and 90°F and an extended working time of 15 minutes. Grout shall have a min. 28-day strength of 7,000 psi. Non-shrink grout shall be, "Euco N-S" by the Euclid Chemical Company, "Sikagrout 212" by Sika Corporation, Conspec 100 Non-Shrink Non-Metallic Grout by Conspec, Masterflow 555 Grout by BASF Master Builder Solutions.

### 2.02 CURING MATERIALS:

A. Curing materials shall be as specified in Section 03370, Concrete Curing for cement grout and as recommended by the manufacturer for prepackaged grouts.

## PART 3 - EXECUTION

### 3.01 GENERAL:

A. The different types of grout shall be used for the applications stated below unless noted otherwise in the Contract Documents. Where grout is called for in the Contract Documents

which does not fall under any of the applications stated below, non-shrink grout shall be used unless another type is specifically referenced.

1. Cement grout shall be used for grout toppings and for patching of fresh concrete.

2. Non-shrink grout shall be used for grouting beneath base plates.

B. New concrete surfaces to receive cement grout shall be as specified in Section 03350, Concrete Finishes, and shall be cleaned of all dirt, grease and oil-like films. Existing concrete surfaces shall likewise be cleaned of all similar contamination and debris, including chipping or roughening the surface if a laitance or poor concrete is evident. The finish of the grout surface shall match that of the adjacent concrete. Curing and protection of cement grout shall be as specified in Section 03370, Concrete Curing.

C. All mixing, surface preparation, handling, placing, consolidation, and other means of execution for prepackaged grouts shall be done according to the instructions and recommendations of the manufacturer.

D. The Contractor, through the manufacturer of a non-shrink grout and epoxy grout, shall provide on-site technical assistance upon request, at no additional cost to the Owner.

3.02 CONSISTENCY:

A. The consistency of grouts shall be that necessary to completely fill the space to be grouted for the particular application. Dry pack consistency is such that the grout is plastic and moldable but will not flow.

3.03 MEASUREMENT OF INGREDIENTS:

A. Measurements for cement grout shall be made accurately by volume using containers. Shovel measurement shall not be allowed.

B. Prepackaged grouts shall have ingredients measured by means recommended by the manufacturer.

3.04 GROUT INSTALLATION:

A. Grout shall be placed quickly and continuously, shall completely fill the space to be grouted and be thoroughly compacted and free of air pockets. The grout may be poured in place, pressure grouted by gravity, or pumped. The use of pneumatic pressure or dry-packed grouting requires approval of the Engineer. For grouting beneath base plates, grout shall be poured from one side only and thence flow across to the open side to avoid air-entrapment.

- END OF SECTION -

# SECTION 05010

# METAL MATERIALS

## PART 1 – GENERAL

### 1.01 THE REQUIREMENT:

A. Metal materials not otherwise specified shall conform to the requirements of this Section.

### 1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. Materials for fasteners are included in Section 05050, Metal Fastening.

B. Requirements for specific products made from the materials specified herein are included in other sections of the Specifications. See the section for the specific item in question.

### 1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS:

A. ASTM A36 Standard Specification for Structural Steel

B. ASTM A47 Standard Specification for Malleable Iron Castings

C. ASTM A48 Standard Specification for Gray Iron Castings

D. ASTM A53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless

E. ASTM A167 Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

F. ASTM A276 Standard Specification for Stainless and Heat-Resisting Steel Bars and Shapes

G. ASTM A307 Standard Specification for Carbon Steel Externally Threaded Standard Fasteners

H. ASTM A446 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) quality

I. ASTM A500 Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

J. ASTM A501 Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing

K. ASTM A529 Standard Specification for Structural Steel with 42 000 psi

(290 Mpa) Minimum Yield Point (1/2 in. (12.7 mm) Maximum Thickness)

L. ASTM A536 Standard Specification for Ductile Iron Castings

M. ASTM A570 Standard Specification for Hot-Rolled Carbon Steel Sheet and Strip, Structural Quality

N. ASTM A992 Standard Specification for Structural Steel Shapes

O. ASTM A666 Standard Specification for Austenitic Stainless Steel, Sheet, Strip, Plate, and Flat Bar for Structural Applications

P. ASTM B26 Standard Specification for Aluminum-Alloy Sand Castings

Q. ASTM B85 Standard Specification for Aluminum-Alloy Die Castings

R. ASTM B108 Standard Specification for Aluminum-Alloy Permanent Mold Castings

S. ASTM B138 Standard Specification for Manganese Bronze Rod, Bar, and Shapes

T. ASTM B209 Standard Specification for Aluminum-Alloy Sheet and Plate

U. ASTM B221 Standard Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

V. ASTM B308 Standard Specification for Aluminum-Alloy Standard Structural Shapes, Rolled or Extruded

W. ASTM B574 Standard Specification for Nickel-Molybdenum-Chromium Alloy Rod

X. ASTM F468 Standard Specification for Nonferrous Bolts, Hex Cap Screws, and Studs for General Use

Y. ASTM F593 Standard Specification for Stainless Steel Fasteners

1.04 SUBMITTALS:

A. Material certifications shall be submitted along with any shop drawings for metal products and fabrications required by other sections of the Specifications.

1.05 QUALITY ASSURANCE:

A. Owner may engage the services of a testing agency to test any metal materials for conformance with the material requirements herein. If the material is found to be in conformance with Specifications the cost of testing will be borne by the Owner. If the material does not conform to the Specifications, the cost of testing shall be paid by the Contractor and all materials not in conformance as

determined by the Engineer shall be replaced by the Contractor at no additional cost to the Owner. In lieu of replacing materials the Contractor may request further testing to determine conformance, but any such testing shall be paid for by the Contractor regardless of outcome of such testing.

## PART 2 PRODUCTS

### 2.01 CARBON AND LOW ALLOY STEEL:

A. Material types and ASTM designations shall be as listed below:

| | | |
|---|---|---|
| 1. | Structural Fabrications | A992 |
| 2. | Sheet Steel | A 570 Grade C |
| 3. | Steel Angles and Plates | A36 |
| 4. | Bars and Rods | A 36 or A307 Grade A |
| 5. | Pipe - Structural Use | A53 Type E or S, Grade B |
| 6. | Tubes | A500 Grade B or A501 |
| 7. | Cold-Formed Structural Studs and Joists (18-22 gauge) | A 446 Grade C |
| | Cold-Formed Structural Studs and Joists (12-16 gauge) | A 446 Grade D |

### 2.02 STAINLESS STEEL:

A. All stainless steel fabrications exposed to underwater service shall be Type 316. All other stainless steel fabrications shall be Type 304, unless noted otherwise.

B. Material types and ASTM designations are listed below:

| | | |
|---|---|---|
| 1. | Plates and Sheets | ASTM A167 or A666 Grade A |
| 2. | Structural Shapes | ASTM A276 |
| 3. | Fasteners (Bolts, etc.) | ASTM F593 |

### 2.03 ALUMINUM:

A. All aluminum shall be alloy 6061-T6, unless otherwise noted or specified herein.

B. Material types and ASTM designations are listed below:

| | | |
|---|---|---|
| 1. | Structural Shapes | ASTM B308 |

| | | |
|---|---|---|
| 2. | Castings | ASTM B26, B85, or B108 |
| 3. | Extruded Bars | ASTM B221 - Alloy 6061 |
| 4. | Extruded Rods, Shapes and Tubes | ASTM B221 - Alloy 6063 |
| 5. | Plates | ASTM B209 - Alloy 6061 |
| 6. | Sheets | ASTM B221 - Alloy 3003 |

C. All aluminum structural members shall conform to the requirements of Section 05140, Structural Aluminum.

D. All aluminum shall be provided with mill finish unless otherwise noted.

E. Where bolted connections are indicated, aluminum shall be fastened with stainless steel bolts.

F. Aluminum in contact with dissimilar materials shall be insulated with an approved dielectric.

2.04 CAST IRON:

A. Material types and ASTM designations are listed below:

| | | |
|---|---|---|
| 1. | Gray | ASTM A48 Class 30B |
| 2. | Malleable | ASTM A47 |
| 3. | Ductile | ASTM A536 Grade 60-40-18 |

2.05 BRONZE:

A. Material types and ASTM designations are listed below:

| | | |
|---|---|---|
| 1. | Rods, Bars and Sheets | ASTM B138 - Alloy B Soft |

2.06 HASTELLOY:

A. All Hastelloy shall be Alloy C-276.

PART 3 – EXECUTION (NOT USED)

END OF SECTION

# SECTION 05050

# METAL FASTENING

## PART 1 – GENERAL

### 1.01 THE REQUIREMENT:

A. Furnish all materials, labor, and equipment required to provide all metal welds and fasteners not otherwise specified, in accordance with the Contract Documents.

### 1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. Section 05010 - Metal Materials

B. Left intentionally blank

C. Section 05061 – Stainless Steel

### 1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS:

A. Without limiting the generality of the other requirements of the specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. New Hampshire State Building Code
2. ACI 318 Building Code Requirements for Structural Concrete
3. ACI 355.2 Qualifications of Post-Installed Mechanical Anchors in Concrete
4. ACI 355.4 Qualifications of Post-Installed Adhesive Anchors in Concrete
5. AISC 348 The 2009 RCSC Specification for Structural Joints
6. AISC Code of Standard Practice
7. AWS D1.1 Structural Welding Code – Steel
8. AWS D1.2 Structural Welding Code – Aluminum
9. AWS D1.6 Structural Welding Code – Stainless Steel
10. Aluminum Association Specifications for Aluminum Structures

11. ASTM A572/A572M-94C Standard Specification for High Strength Low-Alloy Columbium-Vanadium Structural Steel Grade 5

12. ASTM A36 Standard Specification for Carbon Structural Steel

13. ASTM A325 Standard Specification for High-Strength Bolts for Structural Steel Joints

14. ASTM A489 Standard Specification for Eyebolts

15. ASTM A490 Standard Specification for Quenched and Tempered Alloy Steel Bolts for Structural Steel Joints

16. ASTM A563 Standard Specifications for Carbon and Alloy Steel Nuts

17. ASTM D1785 Standard Specification for Polyvinyl Chloride (PVC) Plastic Pipe

18. ASTM F436 Standard Specification for Hardened Steel Washers

19. ASTM F467 Standard Specification for Nonferrous Nuts for General Use

20. ASTM F593 Standard Specification for Stainless Steel Bolts; Hex Cap Screws, and Studs

21. ASTM F594 Standard Specification for Stainless Steel Nuts

22. ASTM F1554 Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength

1.04 SUBMITTALS:

A. Submit the following in accordance with Section 01300, Submittals.

1. Shop Drawings providing the fastener's manufacturer and type and certification of the fastener's material and capacity.

2. Manufacturer’s installation instructions.

3. Copy of valid certification for each person who is to perform field welding.

4. Certified weld inspection reports, when required.

5. Welding procedures.

1.05 QUALITY ASSURANCE:

A. Fasteners not manufactured in the United States shall be tested and certification provided with respect to specified quality and strength standards. Certifications

of origin shall be submitted for all U.S. fasteners supplied on the project.

B. Installer Qualifications: Drilled-in anchors shall be installed by an Installer with at least three years of experience performing similar installations. Installer shall be certified as an Adhesive Anchor Installer in accordance with ACI-CRSI Adhesive Anchor Installation Certification Program.

C. Installer Training: Conduct a thorough training with the manufacturer or the manufacturer's representative for the Installer on the project. Training shall consist of a review of the complete installation process for drilled-in anchors, to include but not be limited to the following:

1. Hole drilling procedure.

2. Hole preparation and cleaning technique.

3. Adhesive injection technique and dispenser training/maintenance.

4. Rebar doweling preparation and installation.

5. Proof loading/torquing.

D. All steel welding shall be performed by welders certified in accordance with AWS D1.1. All aluminum welding shall be performed by welders certified in accordance with AWS D1.2. All stainless steel welding shall be performed by welders certified in accordance with AWS D1.6. Certifications of field welders shall be submitted prior to performing any field welds.

E. Welds and high strength bolts used in connections of structural steel will be visually inspected in accordance with Article 3.04.

F. The Owner may engage an independent testing agency to perform testing of welded connections and to prepare test reports in accordance with AWS. Inadequate welds shall be corrected or redone and retested to the satisfaction of the Engineer and/or an acceptable independent testing laboratory, at no additional cost to the Owner.

G. Provide a welding procedure for each type and thickness of weld. For welds that are not prequalified, include a Performance Qualification Report. The welding procedure shall be given to each welder performing the weld. The welding procedure shall follow the format in Annex E of AWS D1.1 with relevant information presented.

## PART 2 – PRODUCTS

### 1.06 ANCHOR RODS (ANCHOR BOLTS):

A. Anchor rods shall conform to ASTM F1554 Grade 36 except where stainless steel or other approved anchor rods are shown on the Drawings. Anchor rods shall have hexagonal heads and shall be supplied with hexagonal nuts meeting

the requirements of ASTM A563 Grade A.

B. Where anchor rods are used to anchor galvanized steel or are otherwise specified to be galvanized, anchor rods and nuts shall be hot-dip galvanized in accordance with ASTM F1554.

C. Where pipe sleeves around anchor rods are shown on the Drawings, pipe sleeves shall be cut from Schedule 40 PVC plastic piping meeting the requirements of ASTM D1785.

1.07 HIGH STRENGTH BOLTS:

A. High strength bolts and associated nuts and washers shall be in accordance with ASTM A325 or ASTM A490. Bolts, nuts and washers shall meet the requirements of AISC 348 "The 2009 RCSC Specification for Structural Joints".

B. Where high strength bolts are used to connect galvanized steel or are otherwise specified to be galvanized, bolts, nuts, and washers shall be hot-dip galvanized in accordance with ASTM A325.

1.08 STAINLESS STEEL BOLTS:

A. Stainless steel bolts shall conform to ASTM F-593. All underwater fasteners, fasteners in confined areas containing fluid, and fasteners in corrosive environments shall be Type 316 stainless steel unless noted otherwise. Fasteners for aluminum and stainless steel members not subject to the above conditions shall be Type 304 stainless steel unless otherwise noted.

B. Stainless steel bolts shall have hexagonal heads with a raised letter or symbol on the bolts indicating the manufacturer, and shall be supplied with hexagonal nuts meeting the requirements of ASTM F594. Nuts shall be of the same alloy as the bolts.

1.09 CONCRETE ANCHORS:

A. General

1. Where concrete anchors are called for on the Drawings, one of the types listed below shall be used; except, where one of the types listed below is specifically called for on the Drawings, only that type shall be used. The determination of anchors equivalent to those listed below shall be on the basis of test data performed by a commercial testing laboratory. There are two types used:

a. Expansion anchors shall be wedge, sleeve, drop-in or undercut mechanical anchors.

b. Adhesive anchors shall consist of threaded rods or bolts anchored with an adhesive system into hardened concrete. Adhesive anchors shall be

two part injection type using the manufacturer's static mixing nozzle.

2. Expansion anchors shall not be used to hang items from above or in any other situations where direct tension forces are induced in anchor.

3. Unless otherwise noted, all concrete anchors which are submerged or are used in hanging items or have direct tension induced upon them, or which are subject to vibration from equipment such as pumps and generators, shall be adhesive anchors.

4. Adhesive anchors shall be tested in accordance with the ICC Evaluation Service acceptance criteria to be creep resistant and capable of resisting long-term tensile loads.

5. Fire Resistance: All anchors installed within fire resistant construction shall either be enclosed in a fire resistant envelope, be protected by approved fire-resistive materials, be used to resist wind and earthquake loads only, or anchor non-structural elements.

B. Concrete Anchor Design:

An anchor design consists of specifying anchor size, quantity, spacing, edge distance and embedment to resist all applicable loads. Where an anchor design is indicated on the Drawings, it shall be considered an engineered design and anchors shall be installed to the prescribed size, spacing, embedment depth and edge distance. If all parts of an anchor design are provided on the Drawings except embedment depth, the anchors will be considered an engineered design and the Contractor shall provide the embedment depth as indicated in Paragraph B.3 unless otherwise directed by the Engineer. Where an anchor design is not indicated by the Engineer on the Drawings, the Contractor shall provide the anchor design per the requirements listed below.

1. Structural Anchors: All concrete anchors shall be considered structural anchors if they transmit load between structural elements; transmit load between non-structural components that make up a portion of the structure and structural elements; or transmit load between life-safety related attachments and structural elements. Examples of structural concrete anchors include but are not limited to column anchor bolts, anchors supporting non-structural walls, sprinkler piping support anchors, anchors supporting heavy, suspended piping or equipment, anchors supporting barrier rails, etc. For structural anchors, the Contractor shall submit an engineered design with signed and sealed calculations performed by an Engineer currently registered in the State of New Hampshire. Structural anchors shall be of a type recommended by the anchor manufacturer for use in cracked concrete and shall be designed by the Contractor in accordance with ACI 318 Appendix D. Anchors in Seismic Design Categories C through F shall meet the prequalification requirements of ACI 355.2 Qualifications of Post-Installed Mechanical Anchors in Concrete or ACI 355.4 Qualification of Post-Installed Adhesive Anchors in Concrete.

Anchors resisting earthquake forces in Seismic Design Categories C - F shall conform to IBC 2006 1908.1.16 or IBC 2009 1908.1.9 as applicable, including, seismic tests.

2. Non-Structural Anchors: All other concrete anchors may be considered non-structural concrete anchors. The Contractor shall perform an engineered design for non-structural anchors. The Engineer may request the Contractor provide anchor design details for review, but submission of a signed, sealed design is not required. Non-structural anchors shall be designed by the contractor for use in uncracked concrete.

3. Minimum anchor embedment shall be as indicated on the Drawings or determined by the Contractor's engineered design. Concrete anchors shall be embedded no less than the manufacturer's standard embedment (expansion anchors) or to provide a minimum allowable bond strength equal to the allowable yield capacity of the rod/bolt (adhesive anchors).

C. Structural Anchors:

1. Mechanical Anchors:

a. Wedge Anchors: Wedge anchors shall be "Kwik Bolt TZ" by Hilti, Inc., "TruBolt +" by ITW Redhead, "Strong-Bolt" or "Strong-Bolt 2" by Simpson Strong-Tie Co. or "Powerstud SD-1" or "Powerstud SD-2" by Powers Fasteners.

b. Screw Anchors: Screw anchors shall be "Kwik HUS-EZ" by Hilti, Inc., "Titen HD" by Simpson Strong-Tie Co., or "Wedge-Bolt +" by Powers Fasteners.

c. Sleeve Anchors: Sleeve anchors shall be "HSL-3 Heavy Duty Sleeve Anchor" by Hilti, Inc. or "Power-Bolt +" by Powers Fasteners.

d. Undercut Anchors: Undercut anchors shall be "HDA Undercut Anchor" by Hilti, Inc., "Torq-Cut Undercut Anchor" by Simpson Strong-Tie Co., "Atomic + Undercut Anchor" by Powers Fasteners

2. Adhesive Anchors:

a. Adhesive anchors shall be "Epcon G5" by ITW Redhead, "HIT HY-150 Max SD" by Hilti, Inc., "SET-XP" by Simpson Strong-Tie Co., or "Powers 1000+" by Powers Fasteners.

b. Structural adhesive anchor systems shall be IBC compliant for use in both cracked and uncracked concrete in all Seismic Design Categories, shall comply with the latest revision of ICC-ES Acceptance Criteria AC308, and shall have a valid ICC-ES report in accordance with the applicable building code. **Fast-set epoxy formulations shall not be acceptable. No or equal products will be considered unless**

**prequalified and approved by the Engineer and Owner.**

D. Non-Structural Anchors: In addition to the acceptable non-structural anchors listed below, all structural anchors listed above may also be used as non-structural anchors.

1. Mechanical Anchors:

   a. Wedge Anchors: Wedge anchors shall be “Kwik Bolt 3” by Hilti, Inc. or “TruBolt” by ITW Redhead.

   b. Screw Anchors: Screw anchors shall be “Wedge-Bolt” by Powers Fasteners or “Large Diameter Tapcon (LDT) Anchor” by ITW Redhead.

   c. Sleeve Anchors: Sleeve anchors shall be “HSL Heavy Duty Sleeve Anchors” by Hilti, Inc. “Power-Bolt” by Powers Fasteners or “Dynabolt Sleeve Anchor” by ITW Redhead.

   d. Drop-In Anchors: Drop-in anchors shall be “Drop-In” by Simpson Strong-Tie Co., “HDI Drop-In Anchor” by Hilti, Inc. or “Multi-Set II Drop-In Anchor” by ITW Redhead.

   e. Undercut Anchors: Undercut anchors shall be “HDA Undercut Anchor” by Hilti, Inc.

2. Adhesive Anchors:

   a. Adhesive anchors shall be “Epcon A7” or “Epcon C6” by ITW Redhead, “HIT HY-150 Max SD” by Hilti, Inc., “SET XP” by Simpson Strong-Tie Co., or “Powers AC 100+ Gold” or “PE-1000SD” by Powers Fasteners.

   b. Non-structural adhesive anchor embedment depth of the rod/bolt shall provide a minimum allowable bond strength that is equal to the allowable yield capacity of the rod/bolt unless noted otherwise on the Drawings.

   c. **Fast-set epoxy formulations shall not be acceptable. No or equal products will be considered unless prequalified and approved by the Engineer and Owner.**

E. Concrete Anchor Rod/Bolt Materials:

1. Concrete anchors used to anchor structural steel shall be a threaded steel rod per manufacturer’s recommendations for proposed adhesive system, but shall not have a yield strength (fy) less than 58 ksi nor an ultimate strength (fu) less than 72.5 ksi, unless noted otherwise. Where steel to be anchored is galvanized, concrete anchors shall also be galvanized unless otherwise

indicated on the Drawings.

2. Concrete anchors used to anchor aluminum, FRP, or stainless steel shall be Type 304 stainless steel unless noted otherwise. All underwater concrete anchors shall be Type 316 stainless steel.

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1.11 WELDS:

A. Electrodes for welding structural steel and all ferrous steel shall comply with AWS Code, using E70 series electrodes for shielded metal arc welding (SMAW), or F7 series electrodes for submerged arc welding (SAW).

B. Electrodes for welding aluminum shall comply with the Aluminum Association Specifications and AWS D1.2.

C. Electrodes for welding stainless steel and other metals shall comply with AWS D1.6.

1.12 WELDED STUD CONNECTORS:

A. Welded stud connectors shall conform to the requirements of AWS D1.1 Type C.

1.13 EYEBOLTS:

A. Eyebolts shall conform to ASTM A489 unless noted otherwise.

1.14 HASTELLOY FASTENERS:

A. Hastelloy fasteners and nuts shall be constructed of Hastelloy C-276.

1.15 ANTISEIZE LUBRICANT:

A. Antiseize lubricant shall be C5-A Anti-Seize by Loctite Corporation, Molykote P-37 Anti-Seize Paste by Dow Corning, 3M Anti-Seize by 3M, or equal.

PART 3 – EXECUTION

1.16 MEASUREMENTS:

A. The Contractor shall verify all dimensions and review the Drawings and shall report any discrepancies to the Engineer for clarification prior to starting fabrication.

1.17 ANCHOR INSTALLATION:

A. Anchor Rods, Concrete Anchors, and Masonry Anchors

1. Anchor rods shall be installed in accordance with AISC "Code of Standard Practice" by setting in concrete while it is being placed and positioned by means of a rigidly held template.

2. The Contractor shall verify that all concrete and masonry anchors have been installed in accordance with the manufacturer's recommendations and that the capacity of the installed anchor meets or exceeds the specified safe holding capacity.

3. Concrete anchors shall not be used in place of anchor rods without Engineer's approval.

4. All stainless steel threads shall be coated with antiseize lubricant.

B. High Strength Bolts

1. All bolted connections for structural steel shall use high strength bolts. High strength bolts shall be installed in accordance with AISC 348 "The 2009 RCSC Specification for Structural Joints". All bolted joints shall be Type N, snug-tight, bearing connections in accordance with AISC Specifications unless noted otherwise on the Drawings.

C. Concrete Anchors

1. At least 25 percent of all concrete anchors installed shall be proof tested to 1.33 times the allowable load specified by the manufacturer, or as indicated on the Drawings.

2. All concrete anchors shall be installed in strict conformance with the manufacturer's recommendations. A representative of the manufacturer shall be on site when required by the Engineer.

3. All holes shall be drilled with a carbide bit unless otherwise recommended by the manufacturer. If coring holes is allowed by the manufacturer and approved by the Engineer, cored holes shall be roughened in accordance with manufacturer requirements. Thoroughly clean drill holes of all debris and drill dust with compressed air followed by a wire brush prior to installation of adhesive and threaded rod/bolt unless otherwise recommended by the manufacturer. Degree of hole dampness shall be in strict accordance with manufacturer recommendations. Where depth of hole exceeds the length of the static mixing nozzle, a plastic extension hose shall be used to ensure proper adhesive injection from the back of the hole. Injection of adhesive into the hole shall utilize a piston plug to minimize the formation of air pockets. Wipe rod free from oil that may be present from shipping or handling.

D. Other Bolts

1. All dissimilar metal shall be connected with appropriate fasteners and shall

be insulated with a dielectric or approved equal.

2. All stainless steel bolts shall be coated with antiseize lubricant.

1.18 WELDING:

A. All welding shall comply with AWS Code for procedures, appearance, quality of welds, qualifications of welders and methods used in correcting welded work.

B. Welded stud connectors shall be installed in accordance with AWS D1.1.

1.19 INSPECTION:

A. High strength bolting will be visually inspected in accordance with AISC 348 "The 2009 RCSC Specification for Structural Joints". Rejected bolts shall be either replaced or retightened as required.

B. Field welds will be visually inspected in accordance with AWS Codes. Inadequate welds shall be corrected or redone as required in accordance with AWS Codes.

END OF SECTION

# SECTION 05061

# STAINLESS STEEL

## PART 1 – GENERAL

### 1.01 SECTION INCLUDES:

A. The Contractor shall furnish, install and erect the stainless steel work as shown on the Contract Drawings and specified herein.

B. Stainless steel work shall be furnished complete with all accessories, mountings and appurtenances of the type of stainless steel and finish as specified or required for a satisfactory installation.

### 1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. Section 01300 – Submittals

B. Section 05010 - Metal Materials

C. Section 05050 - Metal Fastening

### 1.03 REFERENCES:

| | | | |
|---|---|---|---|
| A. | ASTM A193 | - | Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service. |
| B. | ASTM A194 | - | Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service. |
| C. | ASTM A262 | - | Practice for Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steel. |
| D. | ASTM A276 | - | Stainless and Heat-Resisting Steel Bars and Shapes. |
| E. | ASTM A314 | - | Stainless and Heat-Resisting Steel Billets and Bars for Forging. |
| F. | ASTM A380 | - | Practice for Cleaning and Descaling Stainless Steel Parts, Equipment and Systems. |
| G. | ASTM A473 | - | Stainless and Heat-Resisting Steel Forgings. |
| H. | ASTM A666 | - | Austenitic Stainless Steel, Sheet, Strip, Plate and Flat Bar. |

I. ASTM A774 - Stainless Steel Pipe Fittings

J. ASTM A778 - Stainless Steel Pipe

K. ASTM F593 - Stainless Steel Bolts, Hex Cap Screws and Studs.

L. ASTM F594 - Stainless Steel Nuts.

M. ANSI/ASME B1.1 - Unified Inch Screw Thread (UN and UNR Thread Form).

1.04 TESTS:

A. All stainless steel materials including stainless test welds, shall be checked for compliance with tests for susceptibility to intergranular attack. Such tests shall be Practices A, B and E of ASTM A262. Detailed procedures for the tests shall be submitted to the Engineer for approval prior to start of work. Practice A shall be used only for acceptance of materials but not for rejection of materials, and shall be used for screening material intended for testing in Practice B and Practice E. The maximum acceptable corrosion rate under Practice B shall be 0.004 inch per month, rounded off to the third decimal place. If the certified mill report indicates that such test has been satisfactory performed, the fabricator may not be required to repeat the test. Material passing Practice E shall be acceptable.

B. Sample selection for the susceptibility to intergranular attack tests shall be as follows:

1. One (1) sample per heat per heat treatment lot for plates and forgings;

2. One (1) sample per each Welding Procedure Qualification regardless of the joint design;

3. If tests indicate a reduction in corrosion resistance, welding procedure shall be adjusted or heat treatment determined as needed to restore required corrosion resistance.

4. The samples so chosen shall have received all the post-weld heat treatments identical to the finished part.

1.05 SUBMITTALS:

A. The Contractor shall prepare and submit for approval shop drawings for all stainless steel fabrication in accordance with Section 01300, Submittals.

B. Submittals shall include, but not be limited to, the following:

1. Certified test reports for susceptibility to intergranular attack.

2. Affidavit of compliance with type of stainless steel shown on the Contract Drawings or specified herein.

3. Certified weld inspection reports.

4. Cleaning and handling of stainless steel in accordance with Paragraph 3.04, Cleaning and Handling.

C. Samples of finish, on each type of stainless steel to be furnished, shall be submitted to the Engineer upon request.

1.06 QUALITY ASSURANCE:

A. Shop inspections may be made by the Engineer. The Contractor shall give ample notice to the Engineer prior to the beginning of any stainless steel fabrication work so that inspection may be provided. The Contractor shall furnish all facilities for the inspection of materials and workmanship in the shop, and the inspectors shall be allowed free access to the necessary parts of the works.

B. Inspectors shall have the authority to reject any materials or work which does not meet the requirements of the Contract Drawings or the Specifications.

C. Inspection at the shop is intended as a means of facilitating the work and avoiding errors, but is expressly understood that it will in no way relieve the Contractor from his responsibility for furnishing proper materials or workmanship.

1.07 HANDLING, STORAGE AND DELIVERY:

A. Mechanical damage (e.g., scratches and gouges) to the stainless steel material shall not be permitted and is cause for rejection. Care shall be taken in the material handling since such mechanical damage will result in the passive oxide film being "punctured" leading to a possible lower resistance to the initiation of corrosion than the surrounding chemically-passivated surface.

B. Stainless steel plates and sheets shall be stored vertically in racks and not be dragged out of the racks or over one another. Racks shall be protected to prevent iron contamination.

C. Heavy stainless steel plates shall be carefully separated and chocked with wooden blocks so that the forks of a fork-lift could be inserted between plates without mechanically damaging the surface.

D. Stainless steel plates and sheets laid out for use shall be off the floor and be divided by wooden planks to prevent surface damage and to facilitate subsequent handling.

E. Plate clamps, if used, shall be used with care as the serrated faces can dig in,

indent and gouge the surface.

F. Stainless steel fabrications shall be loaded in such a manner that they may be transported and unloaded without being overstressed, deformed or otherwise damaged.

G. Stainless steel fabrications and packaged materials shall be protected from corrosion and deterioration and shall be stored in a dry area. Materials stored outdoors shall be supported above ground surfaces on wood runners and protected with approved effective and durable covers.

H. Stainless steel fabrications shall not be placed in or on a structure in a manner that might cause distortion or damage to the fabrication. The Contractor shall repair or replace damaged stainless steel fabrications or materials as directed by the Engineer.

1.08 FIELD MEASUREMENTS:

A. The Contractor shall verify all dimensions and shall make any field measurements necessary and shall be fully responsible for accuracy and layout of the work.

B. The Contractor shall review the Contract Drawings and any discrepancies shall be reported to the Engineer for clarification prior to starting fabrication.

PART 2 - PRODUCTS

2.01 MATERIALS AND FINISHES:

A. Stainless steel shall be Type 304 unless it is used for underwater service. Stainless steel for underwater service shall be Type 316. Minimum mechanical finish shall be No. 4 as stated in Table 2 unless otherwise noted on the Contract Drawings.

B. The basic mill forms (sheet, strip, plate and bar) are classified by size as shown on Table 1. Tables 2, 3 and 4 identify finishes and conditions in which sheet, bar and plate are available.

C. Tables 2, 3 and 4 show numbered finishes and conditions for sheet, bar and plate. While there are no specific designations for polished finishes on bar or plate, the sheet finish designations are used to describe the desired effect. This also applies to finishes on ornamental tubing.

D. There are three standard finishes for strip, which are broadly described by the finishing operations employed:

1. No. 1 Strip Finish

No. 1 strip finish is approximately the same as No. 2D Sheet Finish. It varies in appearance from dull gray matte to a fairly reflective surface, depending largely on alloy composition and amount of cold reduction.

2. No. 2 Strip Finish is approximately the same as a No. 2B sheet finish. It is smoother, more reflective than No. 1, and likewise varies with alloy composition.

3. Bright annealed finish is a highly reflective finish that is retained by final annealing in a controlled atmosphere furnace.

**Table 1**

**Classification of Stainless Steel Product Form**

| Item | 1. Description | Dimensions | | |
|---|---|---|---|---|
| | | **Thickness** | **Width** | **Diameter or Size** |
| Sheet | Coils and cut length:<br>Mill finishes Nos. 1, 2D and 2B<br>Polished finishes Nos. 3, 4, 6, 7 & 8 | <br>under 3/16"<br>under 3/16" | <br>24" and over<br>all widths | <br>--<br>-- |
| Strip | Cold finished, coils or cut lengths<br>Polished finishes Nos. 3, 4, 6,7 & 8 | under 3/16"<br>under 3/16" | under 24"<br>all widths | --<br>-- |
| Plate | Flat rolled or forged | 3/16" and over | over 10" | -- |
| Bar | Hot finished rounds, squares, octagons and hexagons<br>Hot finished flats<br><br>Cold finished rounds, squares, octagons and hexagons<br>Cold finished flats | --<br>1/8" to 8" incl.<br><br>--<br>1/8" to 4-1/2" | --<br>1/4" to 10" incl.<br><br>--<br>3/8" to 4-1/2" | 1/4" and over<br>--<br><br><br>over 1/8"<br>-- |
| Wire | Cold finishes only: (in coil)<br>Round, square, octagon, hexagon and flat wire | <br>under 3/16" | <br>under 3/8" | <br>-- |
| Pipe & Tubing | Several different classifications, with differing specifications, are available. | | | |
| Extrusion | Not considered “standard” shapes. Currently limited in size to approximately 6-1/2" diameter or structurals. | | | |

## Table 2

## Standard Mechanical Sheet Finishes

| | | | |
|---|---|---|---|
| **Unpolished or Rolled Finishes:** | | No. 4 | A polished surface obtained by finishing with a 120-150 mesh abrasive, following initial grinding with coarser abrasives. This is a general purpose bright finish with a visible "grain" which prevents mirror reflection. |
| No. 1 | A rough dull surface which results from hot rolling to the specified thickness followed by annealing and descaling. | | |
| No. 2D | A dull finish which results from cold rolling followed by annealing and descaling, and may perhaps get a final light roll pass through unpolished rolls. A 2D finish is used where appearance is of no concern. | No. 6 | A dull satin finish having lower reflectivity than No. 4 finish. It is produced by Tampico brushing the No. 4 finish in a medium of abrasive and oil. It is used for architectural applications and ornamentation where a high luster is undesirable, and to contrast with brighter finishes. |
| No. 2B | A bright cold-rolled finish resulting in the same manner as No. 2D finish, except that the annealed and descaled sheet receives a final light roll pass through polished rolls. This is the general purpose cold-rolled finish that can be used as is, or as a preliminary step to polishing. | No. 7 | A high reflective finish that is obtained by buffing finely ground surfaces but not to the extent of completely removing the "grit" lines. It is used chiefly for architectural and ornamental purposes. |
| **Polished Finishes**: | | No. 8 | The most reflective surface, which is obtained by polishing with successively finer abrasives and buffing extensively until all grit lines from preliminary grinding operations are removed. It is used for applications such as mirrors and reflectors. |
| No. 3 | An intermediate polish surface obtained by finishing with a 100 grit abrasive. Generally used where a semi-finished polished surface is required. A No. 3 finish usually receives additional polishing during fabrication. | | |

**Table 3**

**Conditions and Finishes for Bar**

| **Conditions** | **Surface Finishes**[1] |
|---|---|
| Hot worked only | (a) Scale not removed (excluding spot conditioning)<br>(b) Rough turned[2]<br>(c) Pickled or blast cleaned and pickled. |
| Annealed or otherwise heat treated. | (a) Scale not removed (excluding spot conditioning)<br>(b) Rough turned<br>(c) Pickled or blast cleaned and pickled<br>(d) Cold drawn or cold rolled<br>(e) Centerless ground<br>(f) Polished |
| Annealed and cold worked to high tensile strength[3] | (d) Cold drawn or cold rolled<br>(e) Centerless ground<br>(f) Polished |

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1 Surface finishes (b), (e) and (f) are applicable to round bars only.

2 Bars of the 4xx series stainless steels which are highly hardenable, such as Types 414, 420, 420F, 431, 440A, 440B and 440C, are annealed before rough turning. Other hardenable grades, such as Types 403, 410, 416 and 416Se, may also require annealing depending on their composition and size.

3 Produced in Types 302, 303Se, 304 and 316.

**Table 4**

**Conditions and Finishes for Plate**

| Condition and Finish | Description and Remarks |
|---|---|
| Hot rolled | Scale not removed. Not heat treated. Plates not recommended for final use in this condition.[4] |
| Hot rolled, annealed or heat treated | Scale not removed. Use of plates in this condition is generally confined to heat resisting applications. Scale impairs corrosion resistance.[1] |
| Hot rolled, annealed or heat treated, blast cleaned or pickled | Condition and finish commonly preferred for corrosion resisting and most heat resisting applications. |
| Hot rolled, annealed, descaled and temper passed | Smoother finish for specialized applications. |
| Hot rolled, annealed, descaled cold rolled, annealed, descaled, optionally temper passed | Smooth finish with greater freedom from surface imperfection than the above. |
| Hot rolled, annealed or heat treated, surface cleaned and polished | Polished finishes refer to Table 2. |

## PART 3 - EXECUTION

### 3.01 FABRICATION:

A. Holes for bolts and screws shall be drilled. Fastenings shall be concealed where practicable. Joints exposed to the weather shall be formed to exclude water.

B. As far as practicable, all fabricated units shall be fitted and assembled in the shop, with all cuts and bends made to precision measurements in accordance with details shown on approved shop drawings.

C. Work shall be fabricated so that it is installed in a manner that will provide for expansion and contraction, prevent the shearing of bolts, screws and other fastenings, ensure rigidity, and provide close fitting of sections.

D. All finished and/or machined faces shall be true to line and level. Stainless steel sections shall be well formed to shape and size with sharp lines and angles; curved work shall be sprung evenly to curves.

E. All work shall be fitted together at the shop as far as possible, and delivered complete and ready for erection. Proper care shall be exercised in handling all work so as not to injure the finished surfaces.

### 3.02 WELDING:

A. Welding shall be done in a manner that will prevent buckling and in accordance with Specification 05050 – Metal Fastening, and as modified hereinafter.

B. All welds exposed in the work shall be ground smooth and finished to match the finish of the adjacent stainless steel surfaces.

C. Select weld rods that provide weld filler metal having corrosion resistant properties as nearly identical or better than the base metal to insure preservation of the corrosion-resistant properties. Provide heat treatment at welds where testing of weld procedure indicates it is required to restore the corrosion resistance.

D. Thermal conductivity of stainless steel is about half that of other steels; and the following methods may be used to accommodate this situation:

1. Use lower weld current setting.

2. Use skip-weld techniques to minimize heat concentration.

3. Use back-up chill bars or other cooling techniques to dissipate heat.

E. Edges of the stainless steel to be welded shall be cleaned of contaminants.

3.03 FASTENERS:

A. Stainless steel fasteners shall be used for joining stainless steel work.

B. Stainless steel fasteners shall be made of alloys that are equal to or more corrosion resistant than the materials they join.

3.04 CLEANING AND HANDLING:

A. All stainless steel surfaces shall be precleaned, descaled, passivated and inspected before, during and after fabrication in accordance with the applicable sections of ASTM A380 and as detailed in the procedures to be submitted to the Engineer for approval prior to start of work. Degreasing and passivation of stainless steel articles shall be conducted as the last step after fabrication.

B. Measures to protect cleaned surfaces shall be taken as soon as final cleaning is completed and shall be maintained during all subsequent handling, storage and shipping.

1. The Contractor shall submit for approval specific procedures listing all the steps to be followed in detecting contamination and in descaling, cleaning, passivation and protecting of all stainless steel.

2. Area showing clear indications of contamination shall be recleaned, repassivated and reinspected.

C. At approved stages in the shop operations, contaminants such as scale, embedded iron, rust, dirts, oil, grease and any other foreign matter shall be removed from the metal, as directed or approved by the Engineer. The adequacy of these operations shall be checked by the Engineer. Operations in the shop shall be conducted so as to avoid contamination of the stainless steel and to keep the metal surfaces free from dirt and foreign matter.

D. In order to prevent incipient corrosion during fabrication, special efforts shall be made at all times to keep all stainless steel surfaces from coming in contact with other metals.

1. Stainless steel and stainless steel welds shall be cleaned with clean sand free of iron, stainless steel wool, stainless steel brushes, or other approved means and shall be protected at all times from contamination by any materials, including carbon steel, that shall impair its resistance to corrosion.

2. Approved methods of cutting, grinding and handling shall be used to prevent contamination. If air-arc, or carbon-arc cutting is used, additional

metal shall be removed by approved mechanical means so as to provide clean, weldable edges. All grinding of stainless steel shall be performed with aluminum oxide or silicon carbide grinding wheels bonded with resin or rubber. Grinding wheels used on carbon steel shall not be used on stainless steel.

3. Sand, grinding wheels, brushes and other materials used for cleaning stainless steel shall be checked periodically by the Engineer for contaminants. Cleaning aids found to contain contaminants shall not be used on the work.

3.05 INSTALLATION:

A. All stainless steel fabrications shall be erected square, plumb and true, accurately fitted, adequately anchored in place, set at proper elevations and positions.

B. All inserts, anchor rods and all other miscellaneous work specified in the Detailed Specifications or shown on the Contract Drawings or required for the proper completion of the work, which are embedded in concrete, shall be properly set and securely held in position in the forms before the concrete is placed.

C. All stainless steel fabrications shall be installed in conformance with details shown on the Contract Drawings or on the approved shop drawings.

END OF SECTION

# SECTION 05540

# CASTINGS

## PART 1 - GENERAL

### 1.01 REQUIREMENT:

A. Furnish all materials, labor, and equipment required to provide all castings in accordance with the requirements of the Contract Documents.

### 1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. Section 02604 – Utility Structures

B. Section 05010 - Metal Materials

### 1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS:

A. Without limiting the generality of the other requirements of the specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. New Hampshire State Building Code

### 1.04 SUBMITTALS

A. Submit the following in accordance with Section 01300, Submittals.

1. Complete fabrication and erection drawings of all castings specified herein.

2. Other submittals as required in accordance with Section 05010, Metal Materials, and Section 05050, Metal Fastening.

## PART 2 - PRODUCTS

### 2.01 METAL MATERIALS:

A. Metal materials used for castings shall conform to Section 05010, Metal Materials, unless noted otherwise.

### 2.02 METAL FASTENING:

A. All welds and fasteners used for castings shall conform to Section 05050, Metal Fastening, unless noted otherwise.

2.03 IRON CASTINGS:

A. General - Iron Castings shall include, but not be limited to frames, covers, and grates for trench drains, catch basins, and inlets/.

1. Castings shall be of gray iron of uniform quality, free from defects, smooth and well cleaned by shotblasting.

2. Catalog numbers on the Drawings are provided only to show required types and configuration. All covers shall be cast with raised letters as designated on the Drawings.

3. Castings shall be as manufactured by Dewey Brothers, or Neenah Foundry Company.

B. Covers and Grates

1. Covers and grates shall be provided with matching frames. Cover shall fit flush with the surrounding finished surface. The cover shall not rock or rattle when loading is applied.

2. Round covers and frames shall have machined bearing surfaces.

3. Design loadings:

a. Where located within a structure, a minimum design loading of 300 psf shall be used, unless noted otherwise.

b. At all locations not within a structure, the design loading shall be a standard AASHTO H-20 truck loading, unless otherwise noted.

C. Watertight gasketing, bolting, locking devices, patterns, lettering, pickholes, vents, or self-sealing features shall be as detailed on the Drawings.

D. Specific cover and grate types shall be those called out in section 02604 - Utility Structures, and as shown on the contract drawings.

2.04 CATCH BASIN HOODS/TRAPS:

A. Catch basin traps shall be cast iron construction per the standards of section 2.03.

B. Catch basin traps for installation in existing concrete catch basins with straight vertical walls, and installed in all new catch basins shall be Neenah type R-3700 or approved equal. Traps shall be installed using stainless steel drop anchors per section 05050 – Metal Fastening.

C. Catch basin traps for installation in existing brick catch basins shall be Neenah

type R-3705 or approved equal. Traps shall be provided with cleanouts, and shall be sized appropriately to suit the existing catch basin laterals. Traps shall be installed per the contract drawings.

## PART 3 - EXECUTION

### 3.01 FABRICATION:

A. All measurements and dimensions shall be based on field conditions and shall be verified by the Contractor prior to fabrication. Such verification shall include coordination with adjoining work.

B. All fabricated work shall be shop fitted together as much as practicable, and delivered to the field, complete and ready for erection. All miscellaneous items such as stiffeners, fillets, connections, brackets, and other details necessary for a complete installation shall be provided.

C. Finished members shall conform to the lines, angles, and curves shown on the Drawings and shall be free from distortions of any kind.

### 3.02 INSTALLATION:

A. Assembly and installation of fabricated system components shall be performed in strict accordance with manufacturer's recommendations.

B. All castings shall be erected square, plumb and true, accurately fitted, adequately anchored in place, and set at proper elevations and positions.

END OF SECTION

NO TEXT ON THIS PAGE

# SECTION 07111

# BITUMINOUS DAMPPROOFING

## PART 1 - GENERAL

### 1.01 THE REQUIREMENT:

A. Provide all labor, equipment materials and services necessary for the supply and application of Bituminous Dampproofing at all manholes and structures including surface preparation and appurtenant work where required as shown in the Contract Drawings, or as ordered by the Engineer.

### 1.02 SUBMITTALS:

A. The Contractor shall submit manufacturer’s technical product data on the bituminous dampproofing and installation instructions for all materials required under this section

### 1.03 DELIVERY, STORAGE AND HANDLING:

A. Delivery of Materials:

1. Deliver materials in manufacturer's original, unopened and undamaged containers, with information accurately representing container contents as approved by Engineer at time of Working Drawing submission.

2. Include the following information on the label:

   a. Name of material and supplier.

   b. Installation, handling and protection requirements.

3. Deliver materials in sufficient quantities to allow uninterrupted continuity of the Work.

B. Storage of Materials:

1. Store materials in original, undamaged containers with manufacturer's labels and seals intact.

2. Store all materials in a dry, enclosed area, off the ground and away from all possible contact with water and in a location where temperature can be constantly maintained between 60 F and 75 F and out of direct sunlight.

3. Prevent damage to materials during storage primarily by minimizing the amount of time they are stored at the site before being incorporated into construction systems.

C. Handling of Materials:

1. Do not open containers, or expose materials to detrimental conditions or physical damage. Materials which are so exposed shall be removed from the site and shall not be incorporated into the Work.

2. Handle materials in a manner which prevents contamination and inclusion of foreign materials.

3. Do not open packages or containers until all necessary preparatory Work is complete, approved and installation will begin immediately. Do not allow materials to become wet or soiled or covered with ice or snow.

## PART 2 - PRODUCTS

### 2.01 BITUMINOUS DAMPROOFING:

A. Bituminous dampproofing materials shall conform to Federal Specification SS-A-701 and shall be Dehydratine 4 as manufactured by W.R.Grace & Company; Tremco; Hydrocide 648 as manufactured by Sonneborn or approved equal.

## PART 3 - EXECUTION

### 3.01 APPLICATION:

A. Bituminous dampproofing shall be applied in strict accordance with the printed instructions of the approved manufacturer. The surface must be free and clean of all foreign matter. Do not apply over a frost covered surface. All cracks, voids, honeycombs, etc., shall be filled and repaired with mortar to provide a sound structural surface. No heating or thinning is required. If thinning is absolutely necessary, use a small amount of mineral spirits. Apply by brush or spray in a continuous unbroken film free from pinholes or other surface breaks. All surfaces to be dampproofed shall receive two coats. Each coat shall dry a minimum of 20 to 24 hours before application of the next coating. The second coat shall be applied perpendicular to the first. Allow a minimum of 48hours for drying before backfilling. Each coat shall be applied at a rate of 65 square feet per gallon. Bituminous dampproofing can be factory applied providing application meets the coating manufacturer’s requirements. Additional field coatings must be applied as directed by the Engineer to repair any coating imperfections and chipped or damaged areas.

END OF SECTION

# SECTION 07900

# JOINT FILLERS, SEALANTS AND CAULKING

## PART 1 - GENERAL

### 1.01 THE REQUIREMENT:

A. Furnish labor, materials, equipment and appliances required for the complete execution of Work shown on the Drawings and specified herein.

### 1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. Section 03250 - Concrete Accessories

B. Section 03290 - Joints in Concrete

C. Section 08800 - Glass and Glazing

### 1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS:

A. Without limiting the generality of the other requirements of the specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. ASTM C-920 Elastomeric Joint Sealants
2. ASTM D-1056 Flexible Cellular Materials - Sponge or Expanded Rubber
3. SWRI Sealant and Caulking Guide Specification
4. Federal Specification TT-S-00227 E

### 1.04 SUBMITTALS:

A. In accordance with the procedures and requirements set forth in Section 01300 - Submittals, submit the following:

1. Manufacturers literature and installation instructions.
2. Color samples of each type of sealant.

### 1.05 QUALITY ASSURANCE:

A. Applicator shall be a company specializing in the installation of sealants with a minimum of five years experience.

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1.06 DELIVERY, STORAGE AND HANDLING:

A. Deliver materials in unopened labeled packages.

B. Store materials in location protected from freezing or damages.

C. Reject and remove from the site materials within broken or damaged packaging.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Sealants

1. Type 1: Multi-component, non-sag, low-modulus polyurethane rubber sealant meeting ASTM C-920, Type M, Grade NS, Class 25, use NT, M, A, and O. Capable of withstanding 50% in extension or compression such as Sikaflex-2C NS/SL, Sika Corporation, or Sonolastic NP-2, Sonneborn, or DynaTrol II by Pecora Corporation.

2. Type 2: Single component polyurethane sealant meeting ASTM C-920, Type S, Grade NS, Class 25, Use NT, M, A, and O. Capable of withstanding 25% in extension or compression such as Sikaflex 1A by Sika Corporation, DynaTrol 1-XL by Pecora Corporation, or Sonolastic NP-1 by BASF Construction Chemicals.

3. Type 3: Single component, low-modulus moisture curing silicone meeting ASTM C-920, Type S, Grade NS, Class 25, Use NT, M, G, and A. Capable of withstanding 50% extension and compression. Pecora 890 by Pecora Corporation, Sonolastic Omni Seal by BASF Construction Chemicals.

4. Type 4: Single component, mildew resistant, moisture-curing silicone meeting ASTM C-920, Type S, Grade NS, Class 25, Use NT, M, G, and A. Pecora 898 by Pecora Corporation, Sonolastic Omni Plus by BASF Construction Chemicals.

5. Type 5: Single component, acrylic latex meeting ASTM C-834. AC-20+ Silicone by Pecora Corporation, Sonneborn Sonolac by BASF Construction Chemicals.

6. Type 6: High grade butyl sealant meeting Federal Specification TT-S-00-1657. BC-158 by Pecora Corporation or equal.

7. Type 7: Multi-component chemical resistant polysulfide sealant conforming to ASTM C-920, Type M, Grade NS, Class 25 such as Deck-O-Seal by W.R. Meadows, Tammsflex by Tamms, or Synthacalk GC2+ by

Pecora Corporation.

8. Type 8: Nonsag, Multi Component, traffic grade polyurethane sealant meeting ASTM C920, Type 19, Grate NS, Class 25, use T, M, A, and O. DynaTread by Pecora Corporation, Sonolastic Ultra by BASF Construction Chemicals.

B. Primer: Non-staining primer recommended by sealant manufacturer for the substrates on this project.

C. Backer Rod: Closed cell foam, nonreactive with caulking materials, non-oily, and approved by the sealant manufacturer. Minimum density shall be 3.24 pounds per cubic foot. Use no asphalt or bitumen-impregnated fiber with sealants.

D. Joint Cleaner: Recommended by sealant or caulking compound manufacturer.

E. Bond breaker: Either polyethylene film or plastic tape as recommended by the sealant manufacturer.

F. Color: Where manufacturer's standard colors do not closely match materials being sealed, provide a custom color.

PART 3 - EXECUTION

3.01 QUALITY CONTROL:

A. Coordinate work with details shown on approved shop drawings prepared by other trades.

B. Verify conditions in the field.

C. Schedule work to follow closely the installation of other trades.

D. Apply sealants and related items in temperatures and dry conditions recommended by the manufacturers.

E. Do not paint sealant, unless recommended by sealant and paint manufacturer.

3.02 PREPARATION:

A. Protect finished surfaces adjoining by using masking tape or other suitable materials.

B. Clean and prime joints before starting any caulking or sealing work.

C. Thoroughly clean joints and spaces of mortar and other foreign materials. Cleaning agent shall be Xylol or similar non-contaminating solvent to remove any film from metal surfaces. Masonry or concrete surfaces shall be brushed or

air jet cleaned.

D. Joint Requirements

1. All joints and spaces to be sealed in exterior work shall be less than 1/2 inch deep and not less than 1/4 inch wide. If joints in masonry are less than that specified herein, the mortar shall be cut out to the required width and depth. All joints and spaces to receive sealant shall be completely prepared and thoroughly dry before installation of sealant.

2. Unless otherwise specified, joints and spaces which are open to a depth of 1/2 inch or greater shall be solidly filled with back-up material to within 1/4 inch of the surface. Back-up material shall be packed tightly and made continuous throughout the length of the joints. Bond breaker shall be applied as required. If joints are less than 1/4 inch deep, the back-up material may be omitted, a bond breaker substituted and the joint completely filled with sealant. The back-up material shall not project beyond the 1/4 inch depth of the open space in any joint. The following width-to-depth ratio table shall be adhered to, unless otherwise recommended by manufacturer.

| | Sealant Depth | |
|---|---|---|
| Joint Width | Minimum | Maximum |
| ¼ inch | 1/4 inch | 1/4 inch |
| Over 1/4 inch to 1/2 inch | 1/4 inch | Equal to width |
| Over 1/2 inch to 1 inch | 1/2 inch | Equal to width |
| Over 1 inch to 2 inch | 1/2 inch | 1/2 of width |

3.03 APPLICATION:

A. Exercise care before, during, and after installation so as not to damage any material by tearing or puncturing. All finished work shall be approved before covering with any other material or construction.

B. Apply sealant by an approved type of gun except where the use of a gun is not practicable, suitable hand tools shall be used. Avoid applying the compound to any surface outside of the joints or spaces to be sealed. Mask areas where required to prevent overlapping of sealant.

C. All joints shall be waterproof and weathertight.

D. Point sealed joints to make a slightly concave joint, the edges of which are flush with the surrounding surfaces. Exposed joints in the interior side of the door and other frames shall be neatly pointed flush or to match adjacent jointing work.

E. Adjacent materials which have been soiled shall be cleaned immediately and the work left in neat and clean condition.

F. Comply with sealant manufacturer's written instructions except where more stringent requirements are shown or specified and except where manufacturer's technical representative directs otherwise.

3.04 ADJUSTMENT AND CLEANING:

A. Remove misplaced sealant compounds promptly using methods and materials recommended by the manufacturer, as the work progresses.

B. Allow sealants to cure and remove protective edging, of doors, louvers, saddles windows etc. as directed by the Engineer.

3.05 SCHEDULE:

| **Application** | **Sealant** | **Color** |
|---|---|---|
| Vertical and horizontal joints bordered on both sides by concrete, masonry, precast concrete, natural stone or other porous building material. | Type 2 | To closely match adjacent surfaces or mortar and as selected by the Owner. |
| Vertical and horizontal joints bordered on both sides by painted metals, anodized aluminum, mill finished aluminum, PVC, glass or other non-porous building material. | Type 3 | To closely match adjacent surfaces and as selected by the Owner. |
| Masonry expansion and control joints less than 1¼" wide. | Type 2 | To closely match adjacent surfaces and as selected by the Owner. |
| Masonry expansion and control joints equal or greater than 1¼ inches wide and not to exceed 2”. | Type 1 | To closely match adjacent surfaces and as selected by the Owner. |
| Interior – wood trim and finish joints. | Type 5 | Color to be selected by Owner |
| Sanitary areas, joints in ceramic tile, around plumbing fixtures, countertops, and back splashes. See Note 1. | Type 4 | To closely match adjacent surfaces and as selected by the Owner. |
| Perimeter sealing of doors, windows, louvers, piping, ducts, and electrical conduit. See Note 2. | Type 2 OR Type 3 | To closely match adjacent surfaces and as selected by the Owner. |

| Application | Sealant | Color |
|---|---|---|
| Below thresholds. | Type 6 | Manufacturer's standard |
| Submerged in liquids. See Note 4. | Type 1 | Manufacturer's standard |
| Submerged in liquids with high concentration of chlorine (> 2 ppm). | Type 7 | Manufacturer’s standard |
| Horizontal Joints exposed to vehicular or pedestrian traffic. | Type 8 | To closely match adjacent surfaces. |
| Other joints indicated on the drawings or customarily sealed but not listed. | Type recommended by manufacturer | To closely match adjacent surfaces and as selected by the Owner. |

Note 1. Sealant for Laboratory Countertop shall be as recommended by countertop manufacturer.

Note 2. Provide UL approved sealants for penetrations thru fire-rated walls and as specified in Section 07270.

Note 3. Sealants which will come in contact with potable water shall meet the requirements of NSF 61.

Note 4. Where sealant will be immersed in liquid chemicals verify compatibility prior to installation of sealant.

END OF SECTION

# SECTION 09900

# PAINTING

## PART 1 - GENERAL

### 1.01 THE REQUIREMENT:

A. Furnish labor, materials, equipment and appliances required for complete execution of Work shown on Drawings and Specified herein.

B. Section Includes:

1. Paint Materials

2. Shop Painting

3. Field Painting

a. Surface Preparation

b. Piping and Equipment Identification

c. Schedule of Colors

d. Work in Confined Spaces

e. OSHA Safety Colors

### 1.02 RELATED SECTIONS:

A. Section 15030 - Piping and Equipment Identification Systems

### 1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS:

A. Without limiting the generality of these specifications the Work shall conform to the applicable requirements of the following documents:

1. SSPC – The Society for Protective Coatings Standards

| | | |
|---|---|---|
| a. | SSPC-Vis 1 | Pictorial Surface Preparation Standards for Painting Steel Structures |
| b. | SSPC-SP2 | Hand Tool Cleaning |
| c. | SSPC-SP3 | Power Tool Cleaning |

d. SSPC-SP5 White Metal Blast Cleaning

e. SSPC-SP6 Commercial Blast Cleaning

f. SSPC-SP10 Near-White Metal Blast

g. SSPC-SP13/NACE6 Surface Preparation of Concrete

2. NACE - National Association of Corrosion Engineers

3. ASTM D1737 - Test Method for Elongation of Attached Organic Coatings with Cylindrical Mandrel Apparatus

4. ASTM B117 - Method of Salt Spray (Fog) Testing

5. ASTM D4060 - Test Method for Abrasion Resistance of Organic Coating by the Taber Abraser

6. ASTM D3359 - Method for Measuring Adhesion by Tape Test

1.04 SUBMITTALS:

A. In accordance with the procedures and requirements set forth in Section 01300 - Submittals, submit the following:

1. Manufacturer's literature and Material Safety Data Sheets for each product.

2. Painting schedule identifying surface preparation and paint systems proposed. Cross-reference with Tables 9-1 and 9-2. Provide the name of the paint manufacturer, and name, address, and telephone number of manufacturer's representative who will inspect the work. Submit schedule for approval as soon as possible following the Award of Contract, so approved schedule may be used to identify colors and specify shop paint systems for fabricated items.

1.05 SYSTEM DESCRIPTION:

A. Work shall include surface preparation, paint application, inspection of painted surfaces and corrective action required, protection of adjacent surfaces, cleanup and appurtenant work required for the proper painting of all surfaces to be painted. Surfaces to be painted are designated within the Painting Schedule and may include new and existing piping, miscellaneous metals, equipment, buildings, exterior fiberglass, exposed electrical conduit and appurtenance.

B. Perform Work in strict accordance with manufacturer's published recommendations and instructions, unless the Engineer stipulates that deviations will be for the benefit of the project.

C. Paint surfaces which are customarily painted, whether indicated to be painted or not, with painting system applied to similar surfaces, areas and environments, and as approved by Engineer.

D. Piping and equipment shall receive color coding and identification. Equipment shall be the same color as the piping system.

1.06 QUALITY ASSURANCE:

A. Painting operations shall be accomplished by skilled craftsman and licensed by the state to perform painting work.

B. Provide a letter indicating that the painting applicator has five years of experience, and 5 references which show previously successful application of the specified or comparable painting systems. Include the name, address, and the telephone number for the Owner of each installation for which the painting applicator provided services.

1.07 STORAGE AND DELIVERY:

A. Bring materials to the job site in the original sealed and labeled containers.

B. Container label to include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Store paint materials at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

PART 2 - MATERIALS

2.01 GENERAL INFORMATION:

A. The term "paint" is defined as both paints and coatings including emulsions, enamels, stains, varnishes, sealers, and other coatings whether organic or inorganic and whether used as prime, intermediate, or finish coats.

B. Purchase paint from an approved manufacturer. Manufacturer shall assign a representative to inspect application of their product both in the shop and field. The manufacturer's representative shall submit a report to the Engineer at the completion the Work identifying products used and verifying that surfaces were properly prepared, products were properly applied, and the paint systems were proper for the exposure and service.

C. Provide primers and intermediate coats produced by same manufacturer as finish coat. Use only thinners approved by paint manufacturer, and only within manufacturer's recommended limits.

D. Ensure compatibility of total paint system for each substrate. Test shop primed equipment delivered to the site for compatibility with final paint system. Provide an acceptable barrier coat or totally remove shop applied paint system when incompatible with system specified, and repaint with specified paint system.

E. Use painting materials suitable for the intended use and recommended by paint manufacturer for the intended use.

F. Require that personnel perform work in strict accordance with the latest requirements of OSHA Safety and Health Standards for construction. Meet or exceed requirements of regulatory agencies having jurisdiction and the manufacturer's published instructions and recommendations. Maintain a copy of all Material Safety Data Sheets at the job site of each product being used prior to commencement of work. Provide and require that personnel use protective and safety equipment in or about the project site. Provide respiratory devices, eye and face protection, ventilation, ear protection, illumination and other safety devices required to provide a safe work environment.

2.02 ACCEPTABLE MANUFACTURERS:

A. Subject to compliance with the Specifications, provide products from one of the following manufacturers:

1. Tnemec Company Inc.

2. Ameron

3. CARBOLINE

4. Sherwin-Williams

PART 3 - EXECUTION

3.01 SHOP PAINTING:

A. Shop prime fabricated steel and equipment with at least one shop coat of prime paint compatible with finish paint system specified. Prepare surface to be shop painted in strict accordance with paint manufacturer's recommendations and as specified. Finish coats may be shop applied, if approved by the Engineer. Package, store and protect shop painted items until they are incorporated into Work. Repair painted surfaces damaged during handling, transporting, storage, or installation to provide a painting system equal to the original painting received at the shop.

B. Identify surface preparation and shop paints on Shop Drawings. Verify compatibility with field applied paints.

3.02 SURFACE PREPARATION:

A. General

1. Surfaces to be painted shall be clean and dry, and free of dust, rust, scale, and foreign matter. No solvent cleaning, power or hand tool cleaning shall be permitted unless approved by the Engineer.

2. Protect or remove, during painting operations, hardware, accessories, machined surfaces, nameplates, lighting fixtures, and similar items not intended to be painted prior to cleaning and painting. Reposition items removed upon completion of painting operations.

3. Examine surfaces to be coated to determine that surfaces are suitable for specified surface preparation and painting. Report to Engineer surfaces found to be unsuitable in writing. Do not start surface preparation until unsuitable surfaces have been corrected. Starting surface preparation precludes subsequent claim that such surfaces were unsuitable for the specified surface preparation or painting.

4. Surface preparation shall be in accordance with specifications and manufacturer's recommendations. Provide additional surface preparation, and fill coats where manufacturer recommends additional surface preparation, in addition to requirements of specification.

5. Touch-up shop or field applied coatings damaged by surface preparation or any other activity, with the same shop or field applied coating; even to the extent of applying an entire coat when required to correct damage prior to application of the next coating. Touch-up coats are in addition to the specified applied systems, and not considered a field coat.

6. Protect motors and other equipment during blasting operation to ensure blasting material is not blown into motors or other equipment. Inspect motors and other equipment after blasting operations and certify that no damage occurred, or where damage occurred, the proper remedial action was taken.

7. Field paint shop painted equipment in compliance with Color Coding and as approved by Engineer.

B. Metal Surface Preparation

1. Conform to current The Society for Protective Coatings Standards (SSPC) Specifications for metal surface preparation. Use SSPC-Vis-1 pictorial standards or

NACE visual standards TM-01-70 or TM-01-75 to determine cleanliness of abrasive blast cleaned steel.

2. Perform blast cleaning operations for metal when following conditions exist:

   a. Moisture is not present on the surface.

   b. Relative humidity is below 80%.

   c. Ambient and surface temperatures are 5°F or greater than the dew point temperature.

   d. Painting or drying of paint is not being performed in the area.

   e. Equipment is in good operating condition.

   f. Proper ventilation, illumination, and other safety procedures and equipment are being provided and followed.

3. Sandblast ferrous metals to be shop primed, or component mechanical equipment in accordance with SSPC-SP5, White Metal Blast.

4. Sandblast field prepared ferrous metals in accordance with SSPC-SP10, Near White Metal Blast, where metal is to be submerged, in a corrosive environment, or in severe service.

5. Sandblast field prepared ferrous metals in accordance with SSPC-SP6 Commercial Blast, where metal is to be used in mild or moderate service, or non-corrosive environment.

6. Clean nonferrous metals, copper, or galvanized metal surfaces in accordance to SSPC-SP1, Solvent Cleaning, or give one coat of metal passivator or metal conditioner compatible with the complete paint system.

7. Prime cleaned metals immediately after cleaning to prevent rusting.

8. Clean rusted metals down to bright metal by sandblasting and immediately field primed.

C. Concrete Surface Preparation

1. Cure concrete a minimum of 30 days before surface preparation, and painting begins.

2. Test concrete for moisture content using test method recommended by the paint manufacturer. Do not begin surface preparation, or painting until moisture content is acceptable to manufacturer.

3. Prepare concrete surfaces to receive coatings in accordance with SSPC-13 – Concrete Surface Preparation. Remove contaminants, open bugholes, surface voids, air pockets, and other subsurface irregularities. Do not expose underlying aggregate. Use dry, oil-free air for blasting operations. Surface texture after blasting shall be similar to that of medium grit sandpaper. Remove residual abrasives, dust, and loose particles by vacuuming or blowing with high pressure air.

4. Acid etch (Reference ASTM D 260) concrete floors to receive paint. Following method is a minimum requirement. Remove residual dust and dirt. Wet surface of concrete until surface is damp. Etch surface with 15% to 20% muriatic acid solution to produce a "medium sandpaper" texture. Do not allow acid solution to dry on concrete. Rinse concrete when bubbling action of the acid begins to subside. Continue rinsing process until pH is 7 or higher. Remove excess water and allow concrete to thoroughly dry before coating. Other methods may be used, if approved by Engineer.

5. Surface defects, such as hollow areas, bugholes, honeycombs, and voids shall be filled with polymeric filler compatible with painting system. Complete fill coats may be used in addition to specified painting system and as approved by the Engineer. Fins, form marks, and all protrusions or rough edges shall be removed.

6. Repair existing concrete surfaces which are deteriorated to the point that surface preparation exposes aggregate with fill coats or patching mortar as recommended by paint manufacturer and as directed by the Engineer.

7. Clean concrete of all dust, form oils, curing compounds, oil, tar, laitance, efflorescence, loose mortar, and other foreign materials before paints are applied.

D. Wood

1. Clean wood surfaces free of all foreign matter, with cracks and nail holes and other defects properly filled and smoothed. Remove sap and resin by scraping and wipe clean with rags dampened with mineral spirits.

2. Saturate end grain, cut wood, knots, and pitch pockets with an appropriate sealer before priming.

3. Prime and backprime wood trim before setting in place.

4. After prime coat has dried, fill nailholes, cracks, open joints, and other small holes with approved spackling putty. Lightly sand wood trim prior to applying second coat of paint.

E. Castings

1. Prepare castings for painting by applying a brush or a knife-applied filler. Fillers are not to be used to conceal cracks, gasholes, or excessive porosity.

2. Apply one coat of primer with a minimum thickness of 1.2 mils in addition to coats specified. Allow sufficient drying time before further handling.

F. Masonry

1. Cure for a minimum of 30 days prior to paint application.

2. Clean masonry surfaces free from all dust, dirt, oil, grease, loose mortar, chalky deposits, efflorescence, and other foreign materials.

3. Test masonry for moisture content. Use test method recommended by paint manufacturer. Do not begin painting until moisture content is acceptable to manufacturer.

G. Gypsum Drywall

1. Sand joint compound with sandpaper to provide a smooth flat surface. Avoid sanding of adjacent drywall paper.

2. Remove dust, dirt, and other contaminants.

H. Previously-Painted Surfaces

1. Totally remove existing paint when: surface is to be submerged in a severe environment, paint is less than 75% intact, brittle, eroded or has underfilm rusting.

2. Surfaces which are greater than 75% intact require removal of failed paints and then spot primed. Spot priming is in addition to coats specified.

3. Remove surface contamination such as oil, grease, loose paint, mill scale, dirt, foreign matter, rust, mold, mildew, mortar, efflorescence, and sealers.

4. Clean and dull glossy surfaces prior to painting in accordance with the manufacturer's recommendations.

5. Check existing paints for compatibility with new paint system. If incompatible, totally remove existing paint system or apply a barrier coat recommended by the paint manufacturer. Remove existing paints of undetermined origin. Prepare a test patch of approximately 3 square feet over existing paint. Allow test patch to dry thoroughly and test for adhesion. If proper adhesion is not achieved remove existing paint and repaint.

## 3.03 APPLICATION OF PAINT:

A. Apply paint by experienced painters with brushes or other applicators approved by the Engineer, and paint manufacturer.

B. Apply paint without runs, sags, thin spots, or unacceptable marks.

C. Apply at rate specified by the manufacturer to achieve at least the minimum dry mil thickness specified. Apply additional coats, if necessary, to obtain thickness.

D. Special attention shall be given to nuts, bolts, edges, angles, flanges, etc., where insufficient film thicknesses are likely. Stripe paint prior to applying prime coat. Stripe painting shall be in addition to coats specified.

E. Perform thinning in strict accordance with the manufacturer's instructions, and with the full knowledge and approval of the Engineer and paint manufacturer.

F. Allow paint to dry a minimum of twenty-four hours between application of any two coats of paint on a particular surface, unless shorter time periods are a requirement by the manufacturer. Longer drying times may be required for abnormal conditions as defined by the Engineer and paint manufacturer. Do not exceed manufacturer's recommended drying time between coats.

G. Suspend painting when any of the following conditions exist:

1. Rainy or excessively damp weather.

2. Relative humidity exceeds 85%.

3. General air temperature cannot be maintained at 50□F or above through the drying period, except on approval by the Engineer and paint manufacturer.

4. Relative humidity will exceed 85% or air temperature will drop below 40□F within 18 hours after application of paint.

5. Surface temperature of item is within 5 degrees of dewpoint.

6. Dew or moisture condensation are anticipated.

7. Surface temperature exceeds the manufacturer's recommendations.

3.04 <u>INSPECTION:</u>

A. Each field coat of paint will be inspected and approved by the Engineer or his authorized representative before succeeding coat is applied. Tint successive coats so that no two coats for a given surface are exactly the same color. Tick-mark surfaces to receive black paint in white between coats.

B. Use magnetic dry film thickness gauges and wet fiber thickness gauges for quality control. Furnish magnetic dry film thickness gauge for use by the Engineer.

C. Coatings shall pass a holiday detector test.

D. Determination of Film Thickness: Randomly selected areas, each of at least 107.5 contiguous square feet, totaling at least 5% of the entire control area shall be tested. Within this area, at least 5 squares, each of 7.75 square inches, shall be randomly selected. Three readings shall be taken in each square, from which the mean film thickness shall be calculated. No more than 20 percent of the mean film thickness measurements shall be below the specified thickness. No single measurement shall be below 80 percent of the specified film thickness. Total dry film thickness greater than twice the specified film thickness shall not be acceptable. Areas where the measured dry film thickness exceeds twice that specified shall be completely redone unless otherwise approved by the Engineer. When measured dry film thickness is less than that specified additional coats shall be applied as required.

E. Holiday Testing: Holiday test painted ferrous metal surfaces which will be submerged in water or other liquids, or surfaces which are enclosed in a vapor space in such structures. Mark areas which contain holidays. Repair or repaint in accordance with paint manufacturer's printed instructions and retest.

1. Dry Film Thickness Exceeding 20 Mils: For surfaces having a total dry film thickness exceeding 20 mils: Pulse-type holiday detector such as Tinker & Rasor Model AP-W, D.E. Stearns Co. Model 14/20, shall be used. The unit shall be adjusted to operate at the voltage required to cause a spark jump across an air gap equal to twice the specified coating thickness.

2. Dry Film Thickness of 20 Mils or Less: For surfaces having a total dry film thickness of 20 mils or less: Tinker & Rasor Model M1 non-destructive type holiday detector, K-D Bird Dog, shall be used. The unit shall operate at less than 75-volts. For thicknesses between 10 and 20 mils, a non-sudsing type wetting agent, such as Kodak Photo-Flow, shall be added to the water prior to wetting the detector sponge.

F. Paint manufacturer or his representative shall provide their services as required by the Engineer. Services shall include, but not be limited to, inspecting existing paint, determination of best means of surface preparation, inspection of completed work, and final inspection of painted work 11 months after the job is completed.

3.05 PROTECTION OF ADJACENT PAINT AND FINISHED SURFACES:

A. Use covers, masking tape, other method when protection is necessary, or requested by Owner or Engineer. Remove unwanted paint carefully without damage to finished paint or surface. If damage does occur, repair the entire surface adjacent to and including the damaged area without visible lapmarks and without additional cost to the Owner.

B. Take all necessary precautions to contain dispersion of sandblasting debris and paint to the limits of the work. Take into account the effect of wind and other factors which may cause dispersion of the sandblasting debris and paint. Suspend painting operations when sanding debris or paint cannot be properly confined. Assume all responsibilities and cost associated with damage to adjacent structures, vehicles, or surfaces caused by the surface preparation and painting operations.

3.06 PIPING AND EQUIPMENT IDENTIFICATION:

A. Piping and equipment identification shall be in accordance with Section 15030, Piping and Equipment Identification Systems.

3.07 SCHEDULE OF COLORS:

A. Match colors indicated. Piping and equipment colors are indicated in Section 15030. Colors which are not indicated shall be selected from the manufacturer's full range of colors by the Engineer. No variation shall be made in colors without the Engineer's approval. Color names and numbers shall be identified according to the appropriate color chart issued by the manufacturer of the particular product in question.

3.08 WORK IN CONFINED SPACES:

A. Provide and maintain safe working conditions for all employees. Supply fresh air continuously to confined spaces through the combined use of existing openings, forced-draft fans and temporary ducts to the outside, or direct air supply to individual workers. Exhaust paint fumes to the outside from the lowest level in the contained space. Provide explosion-proof electrical fans, if in contact with fumes. No smoking or open fires will be permitted in, or near, confined spaces where painting is being done. Follow OSHA, state and local regulations at all times.

3.09 OSHA SAFETY COLORS:

A. Paint wall around wall-mounted breathing or fire apparatus with the appropriate safety red color; area not exceed 2-feet wide by 3-feet high, unless apparatus covers the area. Fire apparatus include fire hoses, extinguisher, and hydrants.

B. Paint hazardous areas and objects in accordance with OSHA regulations.

3.10 CLEANING UP:

A. The contractor shall remove all leftover paint, cans, brushes, rags and any other materials or equipment associated with painting from the site at the completion of work

TABLE 9-1
PAINTING SCHEDULE

| SURFACE | APPLICATION | PAINTING SYSTEM & NO. OF COATS | PRODUCT REFERENCE (TABLE 9.2) | TOTAL MIN. DRY FILM THICKNESS (MILS) |
|---|---|---|---|---|
| Concrete and Masonry<br><br>Interior masonry and concrete walls and ceilings | All new structures | 1 coat sealer<br>2 coats acrylic epoxy | 101<br>116 | 75-85 sq.ft./gal.<br>4-6/coat |
| Interior masonry and concrete walls in chemical rooms | | 1 coat sealer<br>2 coats epoxy polyamide | 117<br>102 | 60-80 sq.ft./gal.<br>4-6/coat |
| Exterior masonry cavity walls on cavity face of inner wythe | All new structures | Dampproofing | See Section 07150 | |
| Exterior below grade if interior is dry | Accessible areas (e.g. pipe galleries, pump rooms, basements, etc.) | Waterproofing | See Section 07100 | |
| Submerged wastewater | | 2 coats high solids epoxy<br><br>Provide filler as required and recommended by manufacturer | 119 | 6-10/coat |
| Containment Liner | Secondary containment floors, curbs and walls. | 2 coats high solids epoxy coating<br>Slip resistant floor finish. | 119 | 6-10/coat |
| Metals<br><br>Interior and exterior nonsubmerged (gloss) | All new blowers, pumps, motors and mechanical equipment, piping, | 1 coat epoxy polyamide primer<br><br>1 coat epoxy polyamide | 104<br><br>102 | 4-6<br><br>4-6 |

| | | | | |
|---|---|---|---|---|
| | etc. | 1 coat aliphatic polyurethane | 115 | 3-5 |
| Interior insulated | | 1 coat acrylic latex | 103 | 4 |
| Submerged Wastewater | | 2 coats high solids epoxy | 119 | 8-10/coat |
| Monorails, structural steel, misc. metals (steel) | | 1 coat epoxy polyamide<br><br>1 coat aliphatic polyurethane | 102<br><br>115 | 5-8<br><br>3-4 |
| Aluminum surfaces in contact with concrete | | 2 coats coal tar | 107 | 26 |
| | | | | |

TABLE 9-1
PAINTING SCHEDULE (CONTINUED)

| SURFACE | APPLICATION | PAINTING SYSTEM & NO. OF COATS | PRODUCT REFERENCE (TABLE 9.2) | TOTAL MIN. DRY FILM THICKNESS (MILS) |
|---|---|---|---|---|
| Other<br><br>Plywood ceiling | All new structures | 2 coats acrylic latex | 103 | 2-3/coat |
| Interior: Tar-dipped piping where color is required | | 2 coats epoxy resin sealer<br>2 coats epoxy polyamide | 112<br><br>102 | 5-8/coat<br><br>5-8/coat |
| PVC Piping | | 1 coat epoxy polyamide<br>1 coat aliphatic polyurethane | 102<br>115 | 5-8<br>3-4 |

TABLE 9-2

PRODUCT LISTING

| RE F. | SYSTEM | PURPOSE | PRODUCT | | | |
|---|---|---|---|---|---|---|
| | | | Tnemec Series | AMERON | CARBOLINE | Sherwin-Williams |
| 101 | Acrylic filler | Primer-sealer | 130-6601 | AMERCOAT 147 | Sanitile 100 | Cement-Plex 875 |
| 102 | Epoxy polyamide | Finish coat semi-gloss or gloss | 66 | AMERCOAT 385 | Carboguard 890 | Macropoxy 646 |
| 103 | Acrylic latex | Sealer | 6 | AMERGUARD 220 | Carbocrylic 3359DTM | DTM Acrylic Primer/Finish |
| 104 | Epoxy Polyamide – metal | Primer | 66 | AMERCOAT 385 | Carboguard 893SG | Macropoxy 646 |
| 105 | Epoxy | Primer/Finish | 20 | -- | Carboguard 561/56LT | Macropoxy 646 NSF |
| 106 | Coal tar epoxy | Finish high-coat build | 46H-413 | AMERCOAT 78HB | Bitumastic 300M | Hi-Mil Sher Tar Epoxy |
| 107 | Coal tar | Sealer | 46-465 | AMERCOAT 78HB | Bitumastic 300M | Hi-Mil Sher Tar Epoxy |
| 108 | Alkyd-medium oil | Finish coat | 2H | AMERCOAT 5401 HS | Carbocoat 139 | Industrial Enamel |
| 109 | Alkyd-long oil | Finish coat | 23 | AMERCOAT 5401 HS | Carbocoat 139 | Industrial Enamel |
| 110 | Epoxy polyamide | Primer | 66-1211 | AMERCOAT 385 | Carboguard 893SG | Macropoxy 646 |
| 112 | Epoxy polyamide | Sealer | 66-1211 | AMERCOAT | Carboguard | Macropoxy 920 Pre- |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | 385 | 893SG | Prime |
| 113 | Urethane | Barrier coat | 530 | -- | Rustbond | -- |
| 114 | Polyamine Epoxy | Intermediate coat | 27 | -- | Carboguard 893SG | -- |
| 115 | Aliphatic Polyurethane | Finish coat | 1074 or 1075 | AMERCOAT 450 HS | Carbothane 134HB | Acrolon 218HS |
| 116 | Acrylic epoxy | Finish coat | 113 or 114 | AMERCOAT 335 | Sanitile 255 | Water-Based Catalyzed Epoxy |
| 117 | Epoxy block filler | Sealer | 54-562 | AMERLOCK 400 BF | Sanitile 600 | Cement Plex 875 |
| 118 | Catalyzed epoxy | Finish coat | 84 | AMERCOAT 320 | Carboguard 890 | Macropoxy 646 |
| 119 | High solids epoxy | Finish coat | 104 | AMERLOCK 400 | Carboguard 890 | Tank Clad HS |
| 120 | Epoxy | Top coat | N69 | -- | Carboguard 890 | -- |

- END OF SECTION -

# Appendix A

NO TEXT ON THIS PAGE

# R E P O R T

January 6, 2015
14-0420 S

# Pavement Exploration and Evaluation Services

## Burke Street

## Nashua, New Hampshire

PREPARED FOR:
Hayner/Swanson, Inc.
Attention: Paul F. Hayner, Jr., P.E.
3 Congress Street
Nashua, NH 03062

PREPARED BY:
S. W. Cole Engineering, Inc.
10 Centre Road
Somersworth, NH 03878-2926
(603) 692-0088

S.W.COLE ENGINEERING, INC.

- *Geotechnical Engineering*
- *Construction Materials Testing*
- *GeoEnvironmental Services*
- *Ecological Services*

www.swcole.com

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Attachment A Limitations
Attachment B Exploration Location Plans prepared by HEB
Attachment C Test Boring Logs prepared by Northern Test Boring, Inc.

Sheet 1 Site Location Map
Sheet 1A Exploration Location Plan
Sheets 2 – 7 Hand Boring Logs
Sheet 8 Key to the Notes and Symbols
Sheet 9 Pavement Core Thickness

14-0420 S

January 6, 2015

Hayner/Swanson, Inc.
Attention: Paul F. Hayner, Jr., P.E.
3 Congress Street
Nashua, NH 03062

Subject: Pavement Explorations and Evaluation Services
Burke Street Reconstruction
Nashua, New Hampshire

Dear Paul:

In accordance with our Proposal dated May 16, 2014, we have completed a subsurface exploration program and pavement evaluation for Burke Street in Nashua, New Hampshire. This report summarizes our findings and geotechnical recommendations and its contents are subject to the limitations set forth in Attachment A.

## 1.0 INTRODUCTION

### 1.1 Scope and Purpose

The purpose of our work was to explore the subsurface conditions at locations selected by S. W. Cole Engineering, Inc. (S.W.COLE) and provide a general assessment of the quality of the existing pavement section and subgrade soils and make general suggestions on proposed pavement construction/reconstruction options. Our scope of services included, 12 hand sampling explorations, 24 additional pavement core locations, soils laboratory testing, a geotechnical analysis of the subsurface findings and preparation of this report.

### 1.2 Existing Conditions

Burke Street is about 3,000 linear feet with the majority of both sides of the road including vertical granite curbing with a relatively low reveal. It is suspected that the street has undergone previous pavement overlays. We understand that during the summer of 2014

a water line replacement project occurred along Burke Street resulting in a newly paved strip running along the street where the trench for the water line was excavated. The road shows evidence of other trench patches for various utilities.

We understand that it is desirable for the City to leave the curb in-place without disturbing.

General site vicinity is shown on the “Site Location Map” attached as Sheet 1.

## 2.0 EXPLORATION AND TESTING

### 2.1 Explorations

Twelve hand borings (HB-1 though HB-12) were made at the site on October 23 and 24, 2014 by S. W. Cole Engineering, Inc. (S.W.COLE). The approximate exploration locations are shown on the “Exploration Location Plan” attached as Sheet 1A. Logs of the hand borings are attached as Sheets 2 through 7. A key to the notes and symbols used on the hand boring logs is attached as Sheet 8.

Additionally, twenty-four cores (C-1 through C-24) were made at the site on December 15, 2014 for the purpose of determining pavement thickness. Station and offset locations and pavement thicknesses are attached as Sheet 9.

### 2.2 Testing

Soil samples obtained from the explorations were returned to our laboratory for further classification and testing. The results of six gradation tests (ASTM C-117/C-136) are attached as Sheets 10 through 15.

## 3.0 SITE AND SUBSURFACE CONDITIONS

### 3.1 Subsurface Conditions along New Water Line Trench

Hand borings HB-1, HB-5 and HB-9 were completed within the boundaries of the recently backfilled and paved water line trench. The explorations generally encountered a layer of hot-mix asphalt (HMA) pavement overlying aggregate base material (fill), overlying granular subbase material (fill), overlying sand fill used to backfill the trench. The following is a general description of soil types encountered in the explorations. Not all strata were encountered within each exploration.

Hot Mix Asphalt (HMA) Pavement: The explorations generally encountered 3.0 to 3.6 inches of HMA.

Aggregate Base: Below the HMA pavement, the hand borings encountered aggregate base material that generally consisted of dark brown sand and gravel with some silt and asphalt fragments. The material appeared to be a reclaimed asphalt product that was placed as a base material. At hand boring HB-5 pieces of iron slag were observed in the aggregate base. The thickness of the aggregate base ranged from approximately 5.5 to 6.5 inches at the three hand boring locations.

Aggregate Subbase: Below the aggregate base, the explorations encountered aggregate subbase material that generally consisted of light brown sand and gravel with cobbles and traces of silt at borings HB-5 and HB-9, while the aggregate base at hand boring HB-1 consisted of dark brown silty sand with some gravel. The aggregate subbase was observed to depths of 16.8, 20.4, and 16.8 inches at hand borings HB-1, HB-5 and HB-9, respectively.

Sand Fill: Below the aggregate subbase the test borings generally encountered a brown sand and silt with varying quantities of gravel, asphalt and iron slag fragments. This material was most likely the general material used to backfill the trench as the water line was installed. Hand borings B-1, B-5, and B-9 were terminated in this layer at depths of 34.8, 26.4 and 27.6 inches, respectfully.

### 3.2 Subsurface Conditions Outside of New Water Line Trench

Hand borings HB-2, HB-3, HB-4, HB-6, HB-7, HB-8, and HB-10 through HB-12 were completed outside the boundaries of the recently backfilled and paved water line trench. The explorations generally encountered a layer of hot-mix asphalt (HMA) pavement overlying base material (fill), overlying sand fill or native sand. The following is a general description of soil types encountered in the explorations. Not all strata were encountered within each exploration.

Hot Mix Asphalt (HMA) Pavement: The explorations generally encountered 4.2 to 9.6 inches of HMA. At hand borings HB-6, HB-8, HB-10 and HB-12 a few inches of a tar / macadam product were observed below the HMA layer.

Slag Base: Below the HMA pavement, the hand borings encountered slag base material that generally consisted of dark brown silty sand and gravel with iron slag pieces and some ash. The material appeared to be a product created with the combination of sand and gravel and broken up iron slag that was used as a base material. This slag base material was not observed at hand boring HB-2. At hand borings HB-11 and HB-12 several inches of a crushed gravel product were observed between the pavement and the slag base material. The thickness of the slag base ranged from approximately 1.2 inches at hand boring HB-11 to 15.6 inches at hand boring HB-8, however, hand borings HB-7 and HB-10 were terminated within this slag base layer.

Native Silt/Sand: Below the slag base, the explorations encountered native silt and sand that generally consisted of soils ranging from brown silty sand with some gravel to brown silt and sand. At hand boring HB-2 a fill silty sand fill was encountered rather than native silty sand. At hand boring HB-11 approximately 1.5 feet of fill ranging from sand and gravel to sand and silt was observed between the slag base layer and the native silt and sand.

### 3.3 Pavement Cores

The pavement cores made supplemental to the hand borings were generally made in non-trench patch areas and encountered 5 to 8 inches of pavement. Details relative to pavement thickness at the cores are presented on Sheet 9.

### 3.4 Groundwater Conditions

Saturated soils were not encountered at the hand boring locations. Long-term groundwater information was not obtained. Groundwater levels will fluctuate seasonally, particularly during periods of snowmelt and precipitation.

### 3.5 Frost Conditions

The design freezing index for the Nashua, New Hampshire area is approximately 1200 Fahrenheit-Degree-Days, which corresponds to a frost penetration on the order of 4.0 feet.

## 4.0 EVALUATION AND DISCUSSION

### 4.1 General Findings

In summary the asphalt pavement (and tar/macadam) thickness is considerable in the non-waterline patch sections of the road. The combined asphalt pavement (and

tar/macadam) thickness in these areas vary from about 4 to 10 inches with the average of about 6.5 inches. The "base" material underlying the majority of the road consists of silty sand and gravel with percent silt varying from 10 to 17% based on samples tested. The thickness of the base varies considerably and in our opinion is not a traditional "base" product. This "base" material consistently contains gravel to small boulder size pieces of iron slag. The slag is denser than rock and not easily broken during excavation.

The alternatives have been developed with the understanding that the existing road surface will be lowered on average about 4 inches to gain curb reveal. Further, it is our understanding that the base material with iron slag is considered "urban fill" and is subject to tipping fees for disposal at the Nashua Landfill, therefore, alternatives seek to avoid removal/disposal of this material. We considered the several alternatives, discussed with Hanyer/Swanson, Inc., Hazen and Sawyer, Inc., and the City of Nashua Engineering Department at a meeting on December 3, 2014. Based on discussion at the meeting, the following alternative was agreed upon:

**Strip Pavement, Shim with Aggregate Base, Pave Road**

The road will be stripped of all pavement. Following pavement removal, the road will need to be graded (cut/filled) to accommodate a curb reveal and uniform pavement thickness. Additional material required to raise grade will consist of crushed aggregate base. Following preparation of road base, two layers of pavement (3.0" binder and 1.5" surface) would be placed.

The reasoning for the selection of this alternative is as follows:

- The current road serves as a test example of long-term road performance constructed on the existing base material containing slag and relatively high percentages of fines.
- Generally allows for maintaining existing curbing in-place.
- Avoids the necessity for disposal of large volumes of potential "urban fill" by not box cutting for a traditional pavement section.
- Inquiries with local contractors indicated that the iron slag pieces would be problematic during reclaim.
- Resulting products from reclaim would include abnormally high percentages of asphalt while still not meeting gradation specification for a traditional base material.

## 4.2 Roadway Reconstruction Considerations

The objective of the reconstruction alternative is to re-use excavated materials in fine grading operations and not export any materials from the site. The materials below the pavement contain iron slag pieces and will likely require specific disposal at a facility regulated to accept such materials. In the event that excess material is generated, the material must be stockpile on site and covered with polyethylene sheeting. The material must be representatively sampled and tested for environmental characterization prior to disposal. All disposal options and associated cost must be discussed and negotiated with the Owner and Engineer prior to disposal.

The pavement is underlain in some areas with macadam binder and we anticipate that the underlying granular soils will adhere to the macadam. The pavement should be removed in such a manner to remove adhered base materials containing slag from the underside of the pavement prior to pavement disposal.

Further, it is the intention to allow the existing curb to remain in place as much as possible. This may require saw cutting pavement in close proximity, parallel to the curb line, and use of smaller equipment or hand excavation methods to remove the pavement adjacent to the curb without the curb toppling over.

With the exception of the significant trench patching on the roadway, the overall pavement product appears to have performed relatively well for its anticipated age of more than 20 years. This was the basis for evaluation as a test example of how a new pavement layer supported by similar materials would perform. However, the City must understand that the proposed road reconstruction methods were focused on ways to avoid costly disposal of urban fill, in-turn resulting in a non-traditional pavement section. The base materials within the pavement section is non-uniform in thickness and contains fines contents exceeding what is normally allowed in specified road sections. The City must understand the possibility that this road will not have as long of a serviceable pavement life as a traditional box-cut pavement section. Accelerated road deterioration due to frost heaving and sub-standard base materials must be expected.

## 4.3 Flexible Pavement Section

We offer the following recommendations for pavement section based on the “2010 NHDOT Specifications for Road and Bridge Construction.”

| FLEXIBLE PAVEMENT SECTION - ROADWAY | |
|---|---|
| **Material** | **Heavy Duty** |
| NHDOT 9.5 mm Superpave Wearing Course (50 Gyration Design) | 1 ½ inches |
| NHDOT 19 mm Superpave Binder Course (50 Gyration Design) | 3 inches |
| Re-graded Existing Base and Shimmed with NHDOT Crushed Gravel (304.3) or Crushed stone (fine) (304.4) | - |

| FLEXIBLE PAVEMENT SECTION – DRIVEWAY PATCHES | |
|---|---|
| **Material** | **Heavy Duty** |
| NHDOT 9.5 mm Superpave Wearing Course (50 Gyration Design) | 1 ¼ inches |
| NHDOT 19 mm Superpave Binder Course (50 Gyration Design) | 2 ½ inches |
| Re-graded Existing Base and Shimmed with NHDOT Crushed Gravel (304.3) or Crushed stone (fine) (304.4) | - |

Aggregate base materials should be compacted to 95 percent of their maximum dry density as determined by ASTM D-1557. Pavement layers should be compacted to 92 percent of their Theoretical Maximum Density as determined by AASHTO T 209. Tack coat should be used between successive layers of pavement.

Frost penetration can be on the order of 4.0 feet in this area of the state. In the absence of full frost depth excavation, the exclusivity of frost-susceptible soils, or the use of insulation, some frost heaving and pavement distress must be anticipated. Use of a pavement section extending to the frost depth is not common for this type of road in New England and is generally deemed to be cost-prohibitive. It is important to reduce the amount of water infiltration into the pavement section to reduce the potential for frost heaving.

We recommend the implementation of life-cycle maintenance for the new pavement. This should include crack cleaning and sealing on a periodic basis to reduce the potential for surface water from infiltrating the pavement section.

**4.4 Design Review and Construction Testing**

S.W.COLE should be retained to review the site work design drawings to determine that our interpretation of the subsurface conditions and geotechnical recommendations have been appropriately interpreted and implemented.

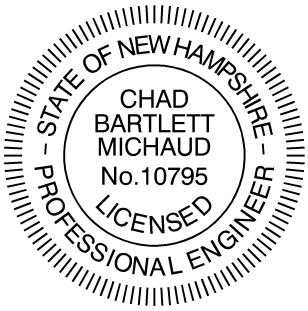
Further, S.W.COLE should be retained to provide soils engineering and testing services during the base and pavement placement phases of the work. This is to observe compliance with the design concepts, specifications, and design recommendations and to allow design changes in the event that subsurface conditions are found to differ from those anticipated prior to the start of construction. S.W.COLE is available to provide testing of soils and asphalt construction materials.

**5.0 CLOSURE**

It has been a pleasure to be of assistance to you with this phase of your project. Please do not hesitate to contact us if you have any questions or if we may be of further assistance.

Very truly yours,

**S. W. Cole Engineering, Inc.**




Chad B. Michaud, P.E.
Senior Geotechnical Engineer

CBM:ajh

## *Attachment A*
## *Limitations*

This report has been prepared for the exclusive use of Hayner/Swanson, Inc. for specific application to the Burke Street Reconstruction Project along Burke Street in Nashua, New Hampshire. S. W. Cole Engineering, Inc. (S.W.COLE) has endeavored to conduct the work in accordance with generally accepted soil and foundation engineering practices. No warranty, expressed or implied, is made.

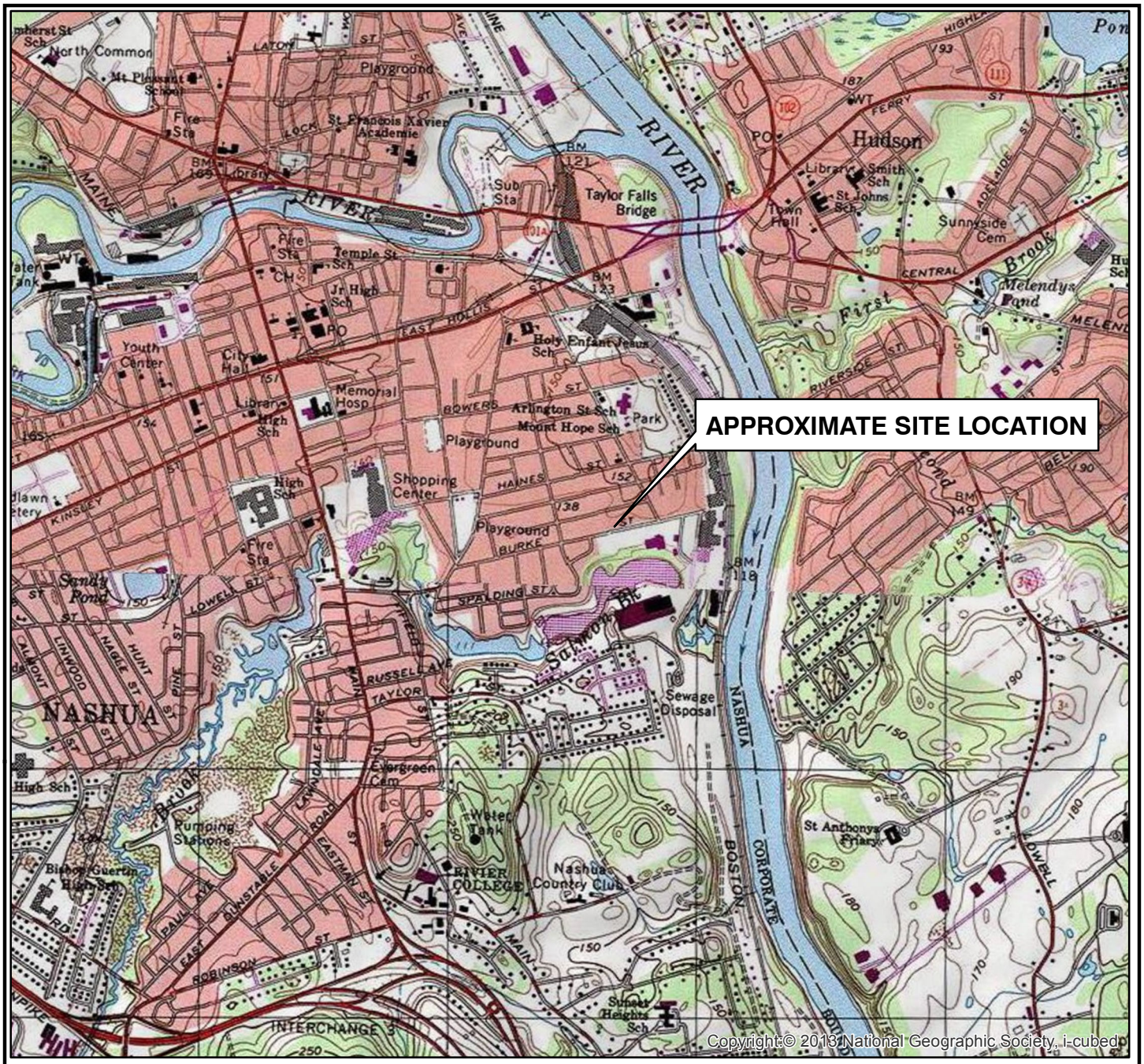
The soil profiles described in the report are intended to convey general trends in subsurface conditions. The boundaries between strata are approximate and are based upon interpretation of exploration data and samples.

The analyses performed during this investigation and recommendations presented in this report are based in part upon the data obtained from subsurface explorations made at the site. Variations in subsurface conditions may occur between explorations and may not become evident until construction. If variations in subsurface conditions become evident after submission of this report, it will be necessary to evaluate their nature and to review the recommendations of this report.

Observations have been made during exploration work to assess site groundwater levels. Fluctuations in water levels will occur due to variations in rainfall, temperature, and other factors.

S.W.COLE's scope of work has not included the investigation, detection, or prevention of any Biological Pollutants at the project site or in any existing or proposed structure at the site. The term "Biological Pollutants" includes, but is not limited to, molds, fungi, spores, bacteria, and viruses, and the byproducts of any such biological organisms.

Recommendations contained in this report are based substantially upon information provided by others regarding the proposed project. In the event that any changes are made in the design, nature, or location of the proposed project, S.W.COLE should review such changes as they relate to analyses associated with this report. Recommendations contained in this report shall not be considered valid unless the changes are reviewed by S.W.COLE.




2,000 0 2,000 4,000

Scale in Feet

S.W.COLE ENGINEERING, INC.

HAYNER/SWANSON, INC.

## SITE LOCATION MAP

BURKE STREET RECONSTRUCTION
BURKE STREET
NASHUA, NEW HAMPSHIRE

| | | | |
|---|---|---|---|
| Job No. | 14-0420 | Scale | 1:24,000 |
| Date: | 10/30/2014 | Sheet | 1 |

**NOTE:**
SITE LOCATION MAP PREPARED FROM ESRI ArcGIS ONLINE AND DATA PARTNERS INCLUDING USGS AND © 2007 NATIONAL GEOGRAPHIC SOCIETY.

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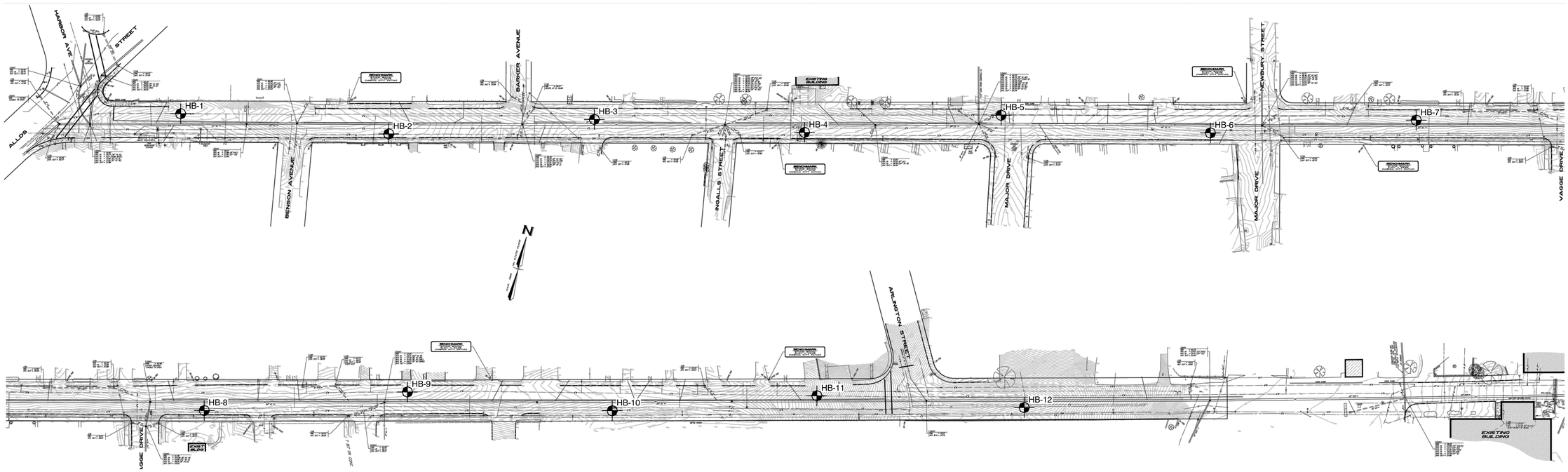



LEGEND:

APPROXIMATE BORING LOCATION

NOTES:

1. EXPLORATION LOCATION PLAN WAS PREPARED FROM A 1"=20' SCALE PLAN OF THE SITE ENTITLED "TOPOGRAPHIC WORKSHEET", PREPARED BY HAZEN & SAWYER P.C., DATED SEPTEMBER 16, 20104.
2. THE BORINGS WERE LOCATED IN THE FIELD BY TAPED MEASUREMENTS FROM EXISTING SITE FEATURES.
3. THIS PLAN SHOULD BE USED IN CONJUNCTION WITH THE ASSOCIATED S. W. COLE ENGINEERING, INC. GEOTECHNICAL REPORT.
4. THE PURPOSE OF THIS PLAN IS ONLY TO DEPICT THE LOCATION OF THE EXPLORATIONS IN RELATION TO THE EXISTING CONDITIONS AND PROPOSED CONSTRUCTION AND IS NOT TO BE USED FOR CONSTRUCTION.

0 30 60 120 180 240

SCALE IN FEET

S.W.COLE ENGINEERING, INC.

HAYNER/SWANSON, INC.

**EXPLORATION LOCATION PLAN**

BURKE STREET RECONSTRUCTION
BURKE STREET
NASHUA, NEW HAMPSHIRE

| | | | |
|---|---|---|---|
| Job No.: | 14-0420 | Scale: | 1" = 60' |
| Date : | 10/30/2014 | Sheet: | 1A |

R:\2014\14-0420\CAD\Drawings\14-0420 Sheet 1A ELP.dwg, 10/30/2014 3:48:04 PM, lhopkins

S.W.COLE ENGINEERING, INC.

# HAND BORING LOGS

PROJECT / CLIENT: BURKE STREET RECONSTRUCTION / HAYNER/SWANSON, INC.

LOCATION: BURKE STREET, NASHUA, NEW HAMPSHIRE PROJECT NO. 14-0420

## HAND BORING HB-1

DATE: 10/23/2014 SURFACE ELEVATION: ± 45.5 FT LOCATION: STA 1+20 IN ASPHALT PATCH

| SAMPLE NO. | SAMPLE DEPTH | DEPTH (IN) | STRATUM DESCRIPTION | TEST RESULTS |
|---|---|---|---|---|
| | | 3.0 | ASPHALT | SEE GRADATION |
| | | 8.4 | D. BROWN SAND AND GRAVEL WITH SOME SILT AND ASPHALT FRAGEMENTS (RECLAIM) | |
| | | 16.8 | DARK BROWN SILTY SAND WITH SOME GRAVEL (FILL) | |
| | | 34.8 | BROWN SILTY SAND (FILL) | |
| | | | BOTTOM OF HAND BORING AT APPROXIMATELY 34.8 INCHES OR 2.9 FEET | |

COMPLETION DEPTH: 34.8 INCHES OR 2.9 FEET DEPTH TO WATER: NO WATER ENCOUNTERED

## HAND BORING HB-2

DATE: 10/23/2014 SURFACE ELEVATION: ± 46.4 FT LOCATION: STA 3+60

| SAMPLE NO. | SAMPLE DEPTH | DEPTH (IN) | STRATUM DESCRIPTION | TEST RESULTS |
|---|---|---|---|---|
| | | 9.6 | ASPHALT | SEE GRADATION |
| | | 36.0 | BROWN GRAVELLY SILTY SAND WITH TRACE PLASTIC FRAGMENTS (FILL) | |
| | | | BOTTOM OF HAND BORING AT APPROXIMATELY 36 INCHES OR 3.0 FEET | |

COMPLETION DEPTH: 36 INCHES OR 3.0 FEET DEPTH TO WATER: NO WATER ENCOUNTERED

S.W.COLE ENGINEERING, INC.

# HAND BORING LOGS

PROJECT / CLIENT: BURKE STREET RECONSTRUCTION / HAYNER/SWANSON, INC.

LOCATION: BURKE STREET, NASHUA, NEW HAMPSHIRE PROJECT NO. 14-0420

## HAND BORING HB-3

DATE: 10/23/2014 SURFACE ELEVATION: ± 44.7 FT LOCATION: WESTBOUI STA 6+00

| SAMPLE NO. | SAMPLE DEPTH | DEPTH (IN) | STRATUM DESCRIPTION | TEST RESULTS |
|---|---|---|---|---|
| | | 9.0 | ASPHALT | SEE GRADATION |
| | | 21.6 | DARK BROWN SILTY GRAVEL AND SAND AND WITH IRON SLAG PIECES (FILL) | |
| | | 36.0 | BROWN SILTY SAND WITH TRACE GRAVEL | |
| | | | BOTTOM OF HAND BORING AT APPROXIMATELY 36 INCHES OR 3.0 FEET | |

COMPLETION DEPTH: 36 INCHES 3.0 FEET DEPTH TO WATER: NO WATER ENCOUNTERED

## HAND BORING HB-4

DATE: 10/23/2014 SURFACE ELEVATION: ± 43.3 FT LOCATION: STA 8+40

| SAMPLE NO. | SAMPLE DEPTH | DEPTH (IN) | STRATUM DESCRIPTION | TEST RESULTS |
|---|---|---|---|---|
| | | 4.2 | ASPHALT | |
| | | 15.6 | DARK BROWN SILTY GRAVEL AND SAND AND SOME IRON SLAG PIECES (FILL) | |
| | | 24.0 | BROWN SILTY SAND WITH SOME GRAVEL | |
| | | | BOTTOM OF HAND BORING AT APPROXIMATELY 24 INCHES OR 2.0 FEET | |

COMPLETION DEPTH: 24 INCHES OR 2.0 FEET DEPTH TO WATER: NO WATER ENCOUNTERED

S.W.COLE ENGINEERING, INC.

# HAND BORING LOGS

PROJECT / CLIENT: BURKE STREET RECONSTRUCTION / HAYNER/SWANSON, INC.

LOCATION: BURKE STREET, NASHUA, NEW HAMPSHIRE PROJECT NO. 14-0420

## HAND BORING HB-5

DATE: 10/23/2014 SURFACE ELEVATION: ± 42.0 FT LOCATION: STA 10+80 IN ASPHALT PATCH

| SAMPLE NO. | SAMPLE DEPTH | DEPTH (IN) | STRATUM DESCRIPTION | TEST RESULTS |
|---|---|---|---|---|
| | | 3.6 | ASPHALT | SEE GRADATION |
| | | 9.6 | DARK BROWN GRAVEL AND SAND WITH TRACE SILT AND WITH SOME ASPHALT PIECES (RECLAIMED) | |
| | | 20.4 | LIGHT BROWN SANDY GRAVEL WITH TRACE SILT AND COBBLES (FILL) | |
| | | 26.4 | BROWN SILTY SAND WITH SOME ASPHALT AND SLAG FRAGMENTS (FILL) | |
| | | | BOTTOM OF HAND BORING AT APPROXIMATELY 26.4 OR 2.2 FEET | |

COMPLETION DEPTH: 26.4 OR 2.2 FEET DEPTH TO WATER: NO WATER ENCOUNTERED

## HAND BORING HB-6

DATE: 10/23/2014 SURFACE ELEVATION: ± 42.9 FT LOCATION: STA 13+20

| SAMPLE NO. | SAMPLE DEPTH | DEPTH (IN) | STRATUM DESCRIPTION | TEST RESULTS |
|---|---|---|---|---|
| | | 8.4 | ASPHALT | |
| | | 9.6 | TAR / MACADAM | |
| | | 20.4 | DARK BROWN SILTY SAND AND GRAVEL WITH IRON SLAG PIECES (FILL - SOUTH SIDE ) BROWN SILTY SAND WITH SOME GRAVEL (FILL - NORTH SIDE) | |
| | | 36.0 | BROWN SAND AND SILT WITH TRACE GRAVEL | |
| | | | BOTTOM OF HAND BORING AT APPROXIMATELY 36 INCHES OR 3.0 FEET | |

COMPLETION DEPTH: 36 INCHES OR 3.0 FEET DEPTH TO WATER: NO WATER ENCOUNTERED

S.W.COLE ENGINEERING, INC.

# HAND BORING LOGS

PROJECT / CLIENT: BURKE STREET RECONSTRUCTION / HAYNER/SWANSON, INC.

LOCATION: BURKE STREET, NASHUA, NEW HAMPSHIRE PROJECT NO. 14-0420

## HAND BORING HB-7

DATE: 10/23/2014 SURFACE ELEVATION: ± 43.3 FT LOCATION: STA 15+60

| SAMPLE NO. | SAMPLE DEPTH | DEPTH (IN) | STRATUM DESCRIPTION | TEST RESULTS |
|---|---|---|---|---|
| | | | ASPHALT | |
| | | 6.6 | | |
| | | | DARK BROWN SILTY GRAVEL AND SAND WITH SLAG PIECES AND ASH FRAGMENTS (FILL) | |
| | | 19.2 | | |
| | | | BOTTOM OF HAND BORING AT APPROXIMATELY 19.2 INCHES OR 1.6 FEET DUE TO REFUSAL ON PROBABLE COBBLE | |

COMPLETION DEPTH: 19.2 INCHES OR 1.6 FEET DEPTH TO WATER: NO WATER ENCOUNTERED

## HAND BORING HB-8

DATE: 10/23/2014 SURFACE ELEVATION: ± 42.7 FT LOCATION: STA 18+00

| SAMPLE NO. | SAMPLE DEPTH | DEPTH (IN) | STRATUM DESCRIPTION | TEST RESULTS |
|---|---|---|---|---|
| | | | ASPHALT | |
| | | 7.2 | | |
| | | 8.4 | TAR / MACADAM | |
| | | | DARK BROWN SILTY GRAVEL AND SAND WITH IRON SLAG PIECES AND ASH FRAGMENTS (FILL) | |
| | | 24.0 | | |
| | | 36.0 | BROWN SILT AND SAND | |
| | | | BOTTOM OF HAND BORING AT APPROXIMATELY 36 INCHES OR 3.0 FEET | |

COMPLETION DEPTH: 36 INCHES OR 3.0 FEET DEPTH TO WATER: NO WATER ENCOUNTERED

S.W.COLE ENGINEERING, INC.

# HAND BORING LOGS

PROJECT / CLIENT: BURKE STREET RECONSTRUCTION / HAYNER/SWANSON, INC.

LOCATION: BURKE STREET, NASHUA, NEW HAMPSHIRE PROJECT NO. 14-0420

## HAND BORING HB-9

DATE: 10/24/2014 SURFACE ELEVATION: ± 43.2 FT LOCATION: STA 20+40 IN ASPHALT PATCH

| SAMPLE NO. | SAMPLE DEPTH | DEPTH (IN) | STRATUM DESCRIPTION | TEST RESULTS |
|---|---|---|---|---|
| | | 3.0 | ASPHALT | SEE GRADATION |
| | | 9.6 | D. BROWN SAND AND GRAVEL WITH TRACE SILT AND ASPHALT FRAGEMENTS (RECLAIM) | |
| | | 16.8 | LIGHT BROWN GRAVEL AND SAND WITH TRACE SILT (FILL) | |
| | | 27.6 | BROWN SAND AND SILT WITH SOME GRAVEL (FILL) | |
| | | | BOTTOM OF HAND BORING AT APPROXIMATELY 27.6 INCHES OR 2.3 FEET | |

COMPLETION DEPTH: 27.6 INCHES OR 2.3 FEET DEPTH TO WATER: NO WATER ENCOUNTERED

## HAND BORING HB-10

DATE: 10/23/2014 SURFACE ELEVATION: ± 43.4 FT LOCATION: STA 22+80

| SAMPLE NO. | SAMPLE DEPTH | DEPTH (IN) | STRATUM DESCRIPTION | TEST RESULTS |
|---|---|---|---|---|
| | | 6.0 | ASPHALT | |
| | | 9.6 | TAR / MACADAM | |
| | | 21.6 | DARK BROWN SILTY GRAVEL AND SAND WITH IRON SLAG PIECES AND SOME ASH FRAGMENTS (FILL) | |
| | | | BOTTOM OF HAND BORING AT APPROXIMATELY 21.6 INCHES OR 1.8 FEET DUE TO REFUSAL ON PROBABLE PIECE OF IRON SLAG | |

COMPLETION DEPTH: 21.6 INCHES OR 1.8 FEET DEPTH TO WATER: NO WATER ENCOUNTERED

S.W.COLE ENGINEERING, INC.

# HAND BORING LOGS

PROJECT / CLIENT: BURKE STREET RECONSTRUCTION / HAYNER/SWANSON, INC.

LOCATION: BURKE STREET, NASHUA, NEW HAMPSHIRE PROJECT NO. 14-0420

## HAND BORING HB-11

DATE: 10/24/2014 SURFACE ELEVATION: ± 46.0 FT LOCATION: STA 25+20

| SAMPLE NO. | SAMPLE DEPTH | DEPTH (IN) | STRATUM DESCRIPTION | TEST RESULTS |
|---|---|---|---|---|
| | | 4.8 | ASPHALT | |
| | | 10.8 | BROWN GRAVEL AND SAND WITH TRACE SILT (FILL) | |
| | | 12.0 | BROWN SILTY SAND WITH SOME ASPHALT FRAGEMENTS (FILL) | |
| | | 24.0 | BROWN SAND AND GRAVEL WITH TRACE SILT (FILL) | |
| | | 30.0 | DARK BROWN SAND AND SILT WITH SOME GRAVEL (FILL) | |
| | | 43.2 | BROWN SILT AND SAND | |
| | | | BOTTOM OF HAND BORING AT APPROXIMATELY 43.2 INCHES OR 3.6 FEET | |

COMPLETION DEPTH: 43.2 INCHES OR 3.6 FEET DEPTH TO WATER: NO WATER ENCOUNTERED

## HAND BORING HB-12

DATE: 10/24/2014 SURFACE ELEVATION: ± 49.3 FT LOCATION: STA 27+60

| SAMPLE NO. | SAMPLE DEPTH | DEPTH (IN) | STRATUM DESCRIPTION | TEST RESULTS |
|---|---|---|---|---|
| | | 6.0 | ASPHALT | |
| | | 8.4 | TAR / MACADAM | |
| | | 12.0 | BROWN SILTY SAND AND GRAVEL (FILL) | |
| | | 26.4 | BROWN SAND AND GRAVEL WITH SOME SILT AND SLAG PIECES AND SOME BRICK PIECES (FILL) | SEE GRADATION |
| | | 44.4 | BROWN SILT AND SAND | |
| | | | BOTTOM OF HAND BORING AT APPROXIMATELY 44.4 INCHES OR 3.7 FEET | |

COMPLETION DEPTH: 44.4 INCHES OR 3.7 FEET DEPTH TO WATER: NO WATER ENCOUNTERED

# KEY TO THE NOTES & SYMBOLS
## Test Boring and Test Pit Explorations

All stratification lines represent the approximate boundary between soil types and the transition may be gradual.

**Key to Symbols Used:**

| | | |
|---|---|---|
| w | - | water content, percent (dry weight basis) |
| $q_u$ | - | unconfined compressive strength, kips/sq. ft. - based on laboratory unconfined compressive test |
| $S_v$ | - | field vane shear strength, kips/sq. ft. |
| $L_v$ | - | lab vane shear strength, kips/sq. ft. |
| $q_p$ | - | unconfined compressive strength, kips/sq. ft. based on pocket penetrometer test |
| O | - | organic content, percent (dry weight basis) |
| $W_L$ | - | liquid limit - Atterberg test |
| $W_P$ | - | plastic limit - Atterberg test |
| WOH | - | advance by weight of hammer |
| WOM | - | advance by weight of man |
| WOR | - | advance by weight of rods |
| HYD | - | advance by force of hydraulic piston on drill |
| RQD | - | Rock Quality Designator - an index of the quality of a rock mass. RQD is computed from recovered core samples. |
| $\gamma_T$ | - | total soil weight |
| $\gamma_B$ | - | buoyant soil weight |

**Description of Proportions:**

0 to 5% TRACE
5 to 12% SOME
12 to 35% "Y"
35+% AND

***REFUSAL:*** **Test Boring Explorations** - Refusal depth indicates that depth at which, in the drill foreman's opinion, sufficient resistance to the advance of the casing, auger, probe rod or sampler was encountered to render further advance impossible or impracticable by the procedures and equipment being used.

***REFUSAL:*** **Test Pit Explorations** - Refusal depth indicates that depth at which sufficient resistance to the advance of the backhoe bucket was encountered to render further advance impossible or impracticable by the procedures and equipment being used.

Although refusal may indicate the encountering of the bedrock surface, it may indicate the striking of large cobbles, boulders, very dense or cemented soil, or other buried natural or man-made objects or it may indicate the encountering of a harder zone after penetrating a considerable depth through a weathered or disintegrated zone of the bedrock.

| Core No. | Pavement Thickness (in) | Station +/- | Distance L/R | Notes |
|---|---|---|---|---|
| C-1 | 7 | 0+40 | 10' R | |
| HB-1 | 3 | 1+20 | L | PATCH |
| C-2 | 8 | 2+00 | 8' R | |
| C-3 | 2.25 | 2+80 | 6' L | PATCH |
| HB-2 | 9.6 | 3+60 | R | |
| C-4 | 8 | 4+40 | 8' L | |
| C-5 | 7 | 5+20 | 10' R | |
| HB-3 | 9 | 6+00 | L | |
| C-6 | 5.5 | 6+80 | 8' R | |
| C-7 | 6 | 7+60 | 9' L | |
| HB-4 | 4.2 | 8+40 | R | |
| C-8 | 6.25 | 9+20 | 12' L | |
| C-9 | 7 | 10+00 | 6' R | |
| HB-5 | 3.6 | 10+80 | L | PATCH |
| C-10 | 7.5 | 11+60 | 8' R | |
| C-11 | 6.5 | 12+40 | 6' L | |
| HB-6 | 8.4 | 13+20 | R | PLUS 1.2" MACADAM |
| C-12 | 6 | 14+00 | 14' L | |
| C-13 | 6.5 | 14+80 | 12' R | |
| HB-7 | 6.6 | 15+60 | L | |
| C-14 | 6.25 | 16+40 | 8' R | |
| C-15 | 6 | 17+20 | 13' L | |
| HB-8 | 7.2 | 18+00 | R | PLUS 1.2" MACADAM |
| C-16 | 6 | 18+80 | 6' L | |
| C-17 | 6 | 19+60 | 7' R | |
| HB-9 | 3 | 20+40 | L | PATCH |
| C-18 | 6 | 21+20 | 14' R | |
| C-19 | 5.5 | 22+00 | 5' L | |
| HB-10 | 6 | 22+80 | R | PLUS 3.6" MACADAM |
| C-20 | 5 | 23+60 | 9' L | |
| C-21 | 5.75 | 24+40 | 8' R | |
| HB-11 | 4.8 | 25+20 | L | |
| C-22 | 5 | 26+00 | 12' R | |
| C-23 | 5.5 | 26+80 | 6' L | |
| HB-12 | 6 | 27+60 | R | PLUS 2.4" MACADAM |
| C-24 | 5.25 | 28+40 | 8' L | |

Station 0+00 begins at intersection of Burke Street and Allds Street.

S.W.COLE ENGINEERING, INC.

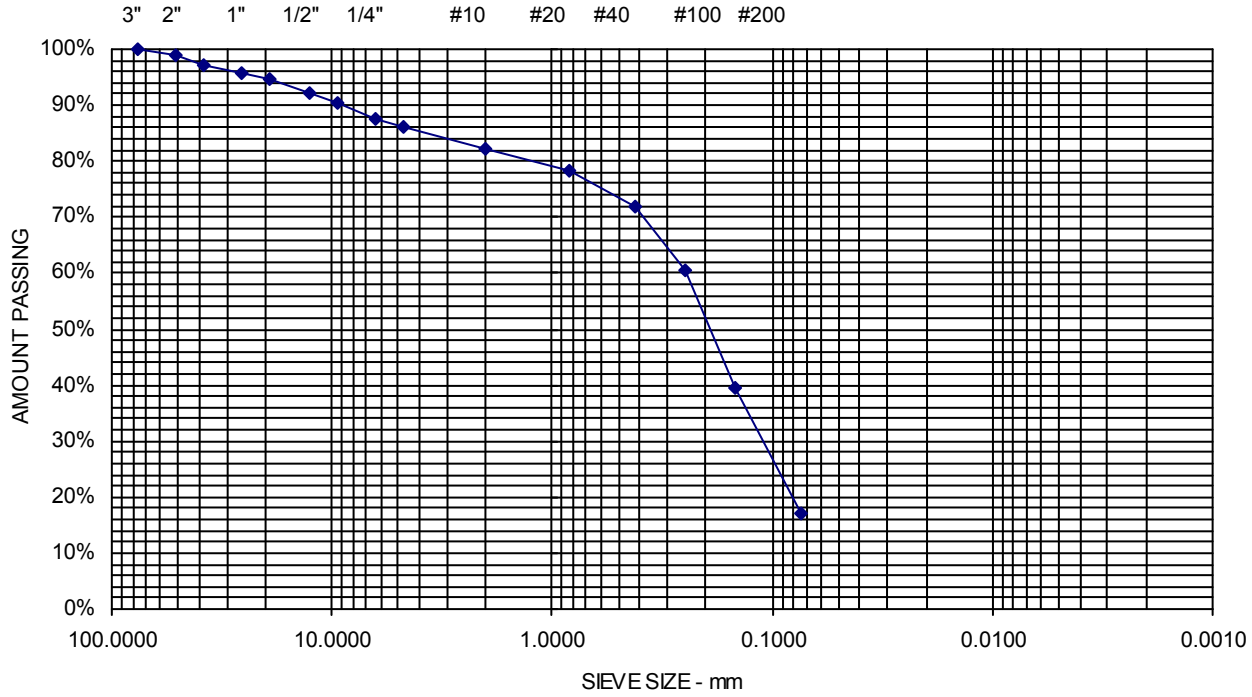
# Report of Gradation

ASTM C-117 & C-136

| | | | |
|---|---|---|---|
| Project Name | NASHUA NH - BURKE STREET RECONSTRUCTION - PAVEMENT EXPLORATIONS AND EVALUATION SERVICES | Project Number | 14-0420 |
| Client | HAYNER/SWANSON, INC. | Lab ID | 473M |
| Exploration | **HB-2** | Date Received | 10/27/2014 |
| Material Source | **HB-2 (0.8 FT TO 3.0 FT)** | Date Completed | 10/30/2014 |
| | | Tested By | CHRISTOPHER WILDES |

| STANDARD DESIGNATION (mm/µm) | SIEVE SIZE | AMOUNT PASSING (%) | |
|---|---|---|---|
| 75 mm | **3"** | **100** | |
| 50 mm | **2"** | **99** | |
| 38.1 mm | **1-1/2"** | **97** | |
| 25.0 mm | **1"** | **96** | |
| 19.0 mm | **3/4"** | **95** | |
| 12.5 mm | **1/2"** | **92** | |
| 9.5 mm | **3/8"** | **90** | |
| 6.3 mm | **1/4"** | **88** | |
| 4.75 mm | **No. 4** | **86** | 14.1% Gravel |
| 2.00 mm | **No. 10** | **82** | |
| 850 um | **No. 20** | **78** | |
| 425 um | **No. 40** | **72** | 68.7% Sand |
| 250 um | **No. 60** | **61** | |
| 150 um | **No. 100** | **40** | |
| 75 um | **No. 200** | **17.2** | 17.2% Fines |

**GRAVELLY SILTY SAND**




Comments: %M = 8.3

S.W.COLE ENGINEERING, INC.

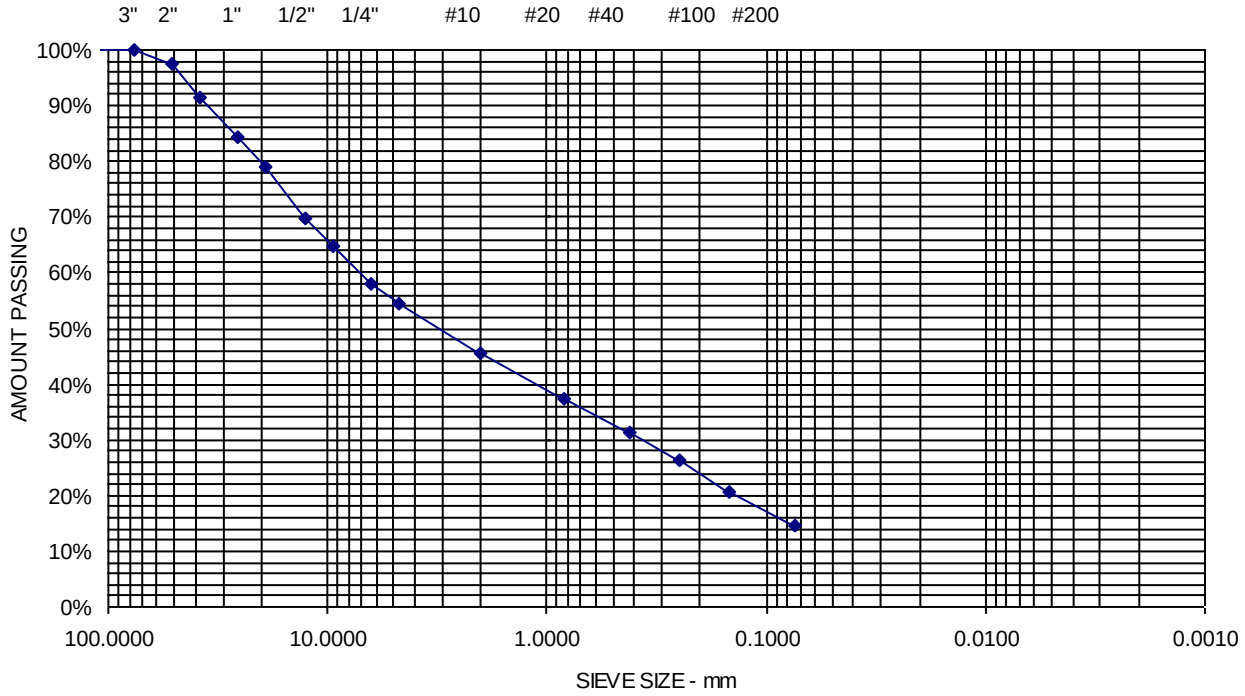
# Report of Gradation

ASTM C-117 & C-136

| | | | |
|---|---|---|---|
| Project Name | NASHUA NH - BURKE STREET RECONSTRUCTION - PAVEMENT EXPLORATIONS AND EVALUATION SERVICES | Project Number | 14-0420 |
| Client | HAYNER/SWANSON, INC. | Lab ID | 1630K |
| Exploration | **HB-3** | Date Received | 10/27/2014 |
| Material Source | **HB-3 (0.75 FT TO 1.8 FT)** | Date Completed | 10/31/2014 |
| | | Tested By | JEREMY ASCANI |

| STANDARD DESIGNATION (mm/µm) | SIEVE SIZE | AMOUNT PASSING (%) | |
|---|---|---|---|
| 150 mm | **6"** | **100** | |
| 100 mm | **4"** | **100** | |
| 75 mm | **3"** | **100** | |
| 50 mm | **2"** | **97** | |
| 38.1 mm | **1-1/2"** | **91** | |
| 25.0 mm | **1"** | **84** | |
| 19.0 mm | **3/4"** | **79** | |
| 12.5 mm | **1/2"** | **70** | |
| 9.5 mm | **3/8"** | **65** | |
| 6.3 mm | **1/4"** | **58** | |
| 4.75 mm | **No. 4** | **54** | 45.7% Gravel |
| 2.00 mm | **No. 10** | **45** | |
| 850 um | **No. 20** | **38** | |
| 425 um | **No. 40** | **31** | 39.9% Sand |
| 250 um | **No. 60** | **26** | |
| 150 um | **No. 100** | **21** | |
| 75 um | **No. 200** | **14.5** | 14.5% Fines |

**SILTY GRAVEL AND SAND**




Comments: %M = 5.2

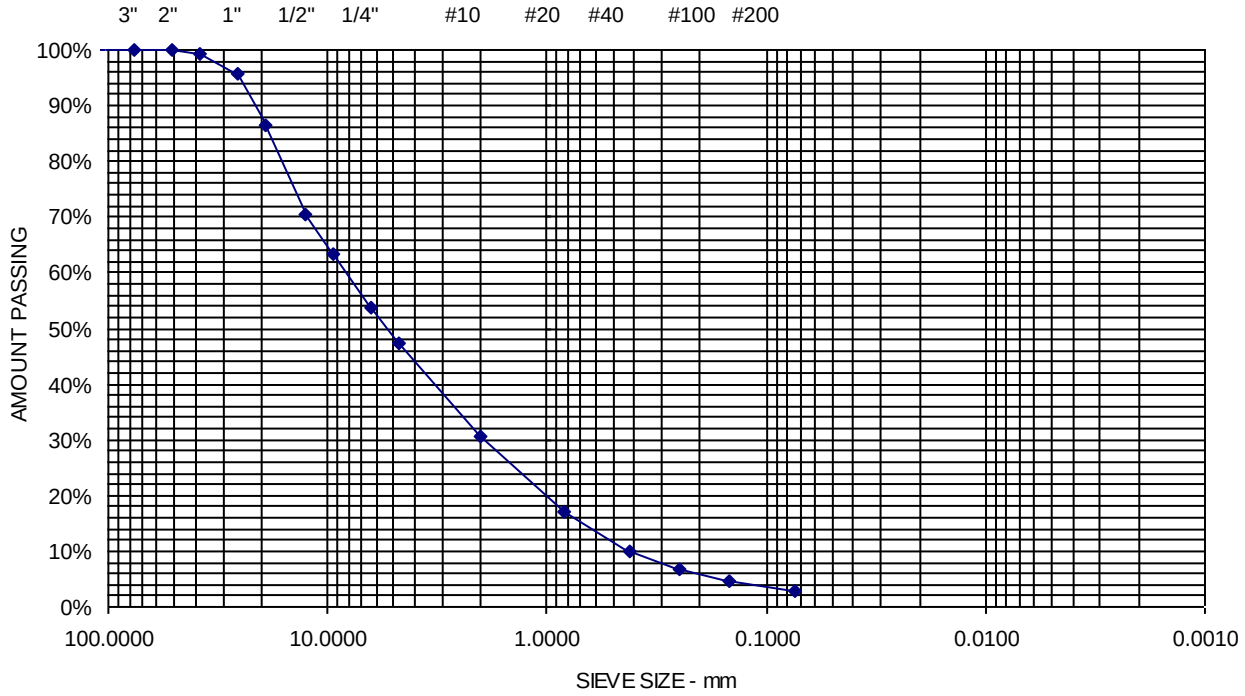
# Report of Gradation

ASTM C-117 & C-136

| | | | |
|---|---|---|---|
| Project Name | NASHUA NH - BURKE STREET RECONSTRUCTION - PAVEMENT EXPLORATIONS AND EVALUATION SERVICES | Project Number | 14-0420 |
| Client | HAYNER/SWANSON, INC. | Lab ID | 1631K |
| Exploration | **HB-5** | Date Received | 10/27/2014 |
| Material Source | **HB-5 (0.3 FT TO 0.8 FT)** | Date Completed | 10/31/2014 |
| | | Tested By | JEREMY ASCANI |

| STANDARD DESIGNATION (mm/µm) | SIEVE SIZE | AMOUNT PASSING (%) | |
|---|---|---|---|
| 150 mm | **6"** | **100** | |
| 100 mm | **4"** | **100** | |
| 75 mm | **3"** | **100** | |
| 50 mm | **2"** | **100** | |
| 38.1 mm | **1-1/2"** | **99** | |
| 25.0 mm | **1"** | **96** | |
| 19.0 mm | **3/4"** | **86** | |
| 12.5 mm | **1/2"** | **70** | |
| 9.5 mm | **3/8"** | **63** | |
| 6.3 mm | **1/4"** | **54** | |
| 4.75 mm | **No. 4** | **47** | 52.7% Gravel |
| 2.00 mm | **No. 10** | **31** | |
| 850 um | **No. 20** | **17** | |
| 425 um | **No. 40** | **10** | 44.4% Sand |
| 250 um | **No. 60** | **7** | |
| 150 um | **No. 100** | **5** | |
| 75 um | **No. 200** | **2.9** | 2.9% Fines |

**GRAVEL AND SAND WITH TRACE SILT**




Comments: %M = 5.8

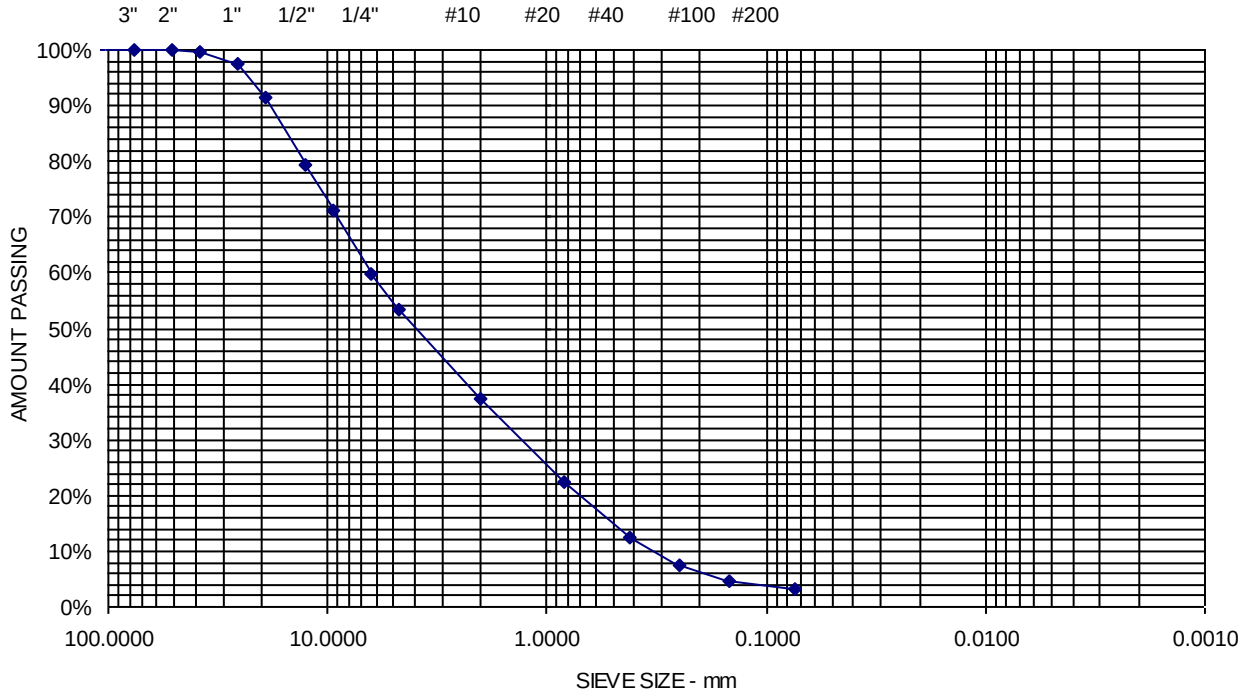
# Report of Gradation

ASTM C-117 & C-136

| | | | |
|---|---|---|---|
| Project Name | NASHUA NH - BURKE STREET RECONSTRUCTION - PAVEMENT EXPLORATIONS AND EVALUATION SERVICES | Project Number | 14-0420 |
| Client | HAYNER/SWANSON, INC. | Lab ID | 1632K |
| Exploration | **HB-9** | Date Received | 10/27/2014 |
| Material Source | **HB-9 (0.25 FT TO 0.8 FT)** | Date Completed | 10/31/2014 |
| | | Tested By | JEREMY ASCANI |

| STANDARD DESIGNATION (mm/µm) | SIEVE SIZE | AMOUNT PASSING (%) | |
|---|---|---|---|
| 150 mm | **6"** | **100** | |
| 100 mm | **4"** | **100** | |
| 75 mm | **3"** | **100** | |
| 50 mm | **2"** | **100** | |
| 38.1 mm | **1-1/2"** | **99** | |
| 25.0 mm | **1"** | **98** | |
| 19.0 mm | **3/4"** | **92** | |
| 12.5 mm | **1/2"** | **79** | |
| 9.5 mm | **3/8"** | **71** | |
| 6.3 mm | **1/4"** | **60** | |
| 4.75 mm | **No. 4** | **53** | 46.6% Gravel |
| 2.00 mm | **No. 10** | **37** | |
| 850 um | **No. 20** | **23** | |
| 425 um | **No. 40** | **12** | 50.3% Sand |
| 250 um | **No. 60** | **7** | |
| 150 um | **No. 100** | **5** | |
| 75 um | **No. 200** | **3.2** | 3.2% Fines |

**SAND AND GRAVEL WITH TRACE SILT**




Comments: %M = 4.8

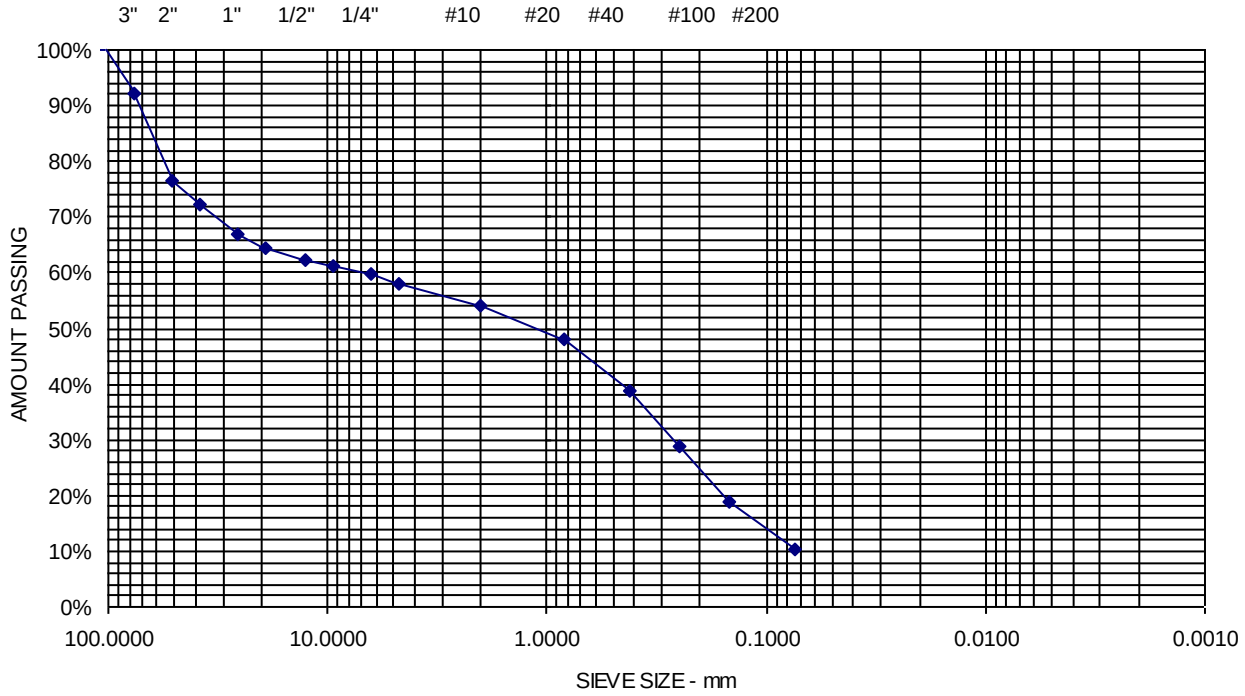
# Report of Gradation

ASTM C-117 & C-136

| | | | |
|---|---|---|---|
| Project Name | NASHUA NH - BURKE STREET RECONSTRUCTION - PAVEMENT EXPLORATIONS AND EVALUATION SERVICES | Project Number | 14-0420 |
| Client | HAYNER/SWANSON, INC. | Lab ID | 1633K |
| Exploration | **HB-12** | Date Received | 10/27/2014 |
| Material Source | **HB-12 (1.0 FT TO 2.2 FT)** | Date Completed | 10/31/2014 |
| | | Tested By | JEREMY ASCANI |

| STANDARD DESIGNATION (mm/µm) | SIEVE SIZE | AMOUNT PASSING (%) | |
|---|---|---|---|
| 150 mm | **6"** | **100** | |
| 100 mm | **4"** | **100** | |
| 75 mm | **3"** | **92** | |
| 50 mm | **2"** | **76** | |
| 38.1 mm | **1-1/2"** | **72** | |
| 25.0 mm | **1"** | **67** | |
| 19.0 mm | **3/4"** | **64** | |
| 12.5 mm | **1/2"** | **62** | |
| 9.5 mm | **3/8"** | **61** | |
| 6.3 mm | **1/4"** | **60** | |
| 4.75 mm | **No. 4** | **58** | 41.8% Gravel |
| 2.00 mm | **No. 10** | **54** | |
| 850 um | **No. 20** | **48** | |
| 425 um | **No. 40** | **39** | 47.9% Sand |
| 250 um | **No. 60** | **29** | |
| 150 um | **No. 100** | **19** | |
| 75 um | **No. 200** | **10.2** | 10.2% Fines |

**SAND AND GRAVEL WITH SOME SILT**




Comments: %M = 5.0

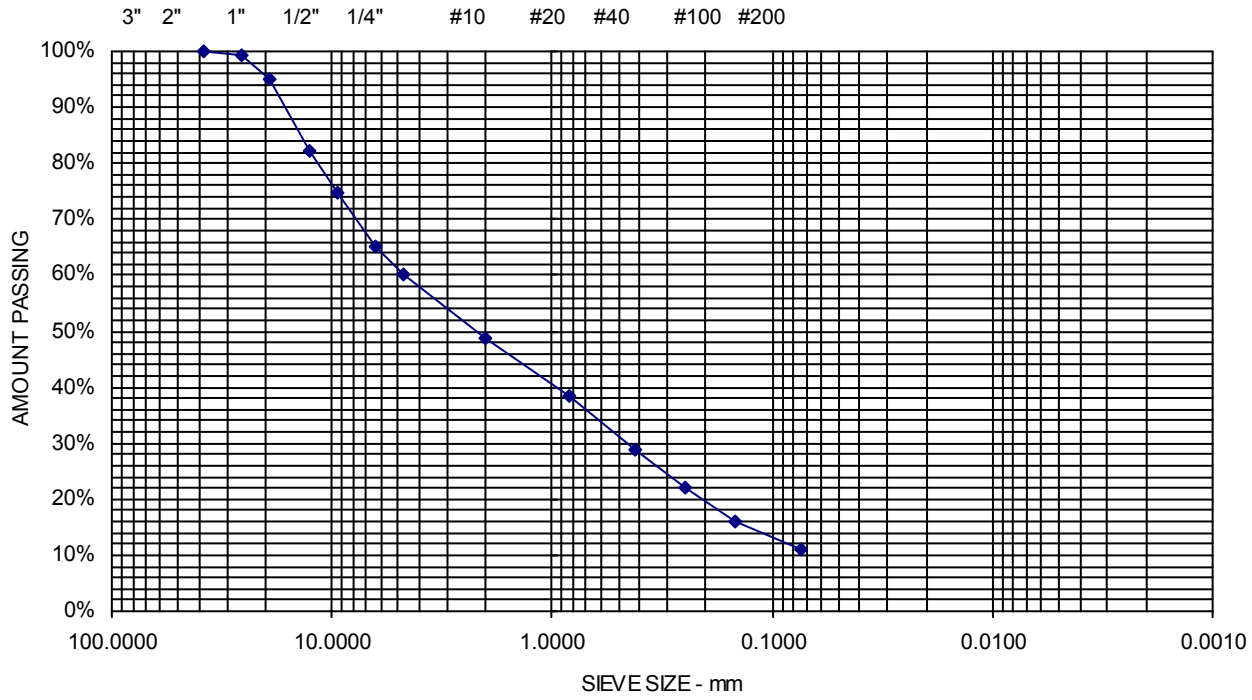
# Report of Gradation

ASTM C-117 & C-136

| | | | |
|---|---|---|---|
| Project Name | NASHUA NH - BURKE STREET RECONSTRUCTION - PAVEMENT EXPLORATIONS AND EVALUATION SERVICES | Project Number | 14-0420 |
| Client | HAYNER/SWANSON, INC. | Lab ID | 472M |
| Exploration | **HB-1** | Date Received | 10/27/2014 |
| Material Source | **HB-1 (0.25 FT TO 0.7 FT)** | Date Completed | 10/30/2014 |
| | | Tested By | CHRISTOPHER WILDES |

| STANDARD DESIGNATION (mm/µm) | SIEVE SIZE | AMOUNT PASSING (%) | |
|---|---|---|---|
| 38.1 mm | **1-1/2"** | **100** | |
| 25.0 mm | **1"** | **99** | |
| 19.0 mm | **3/4"** | **95** | |
| 12.5 mm | **1/2"** | **82** | |
| 9.5 mm | **3/8"** | **75** | |
| 6.3 mm | **1/4"** | **65** | |
| 4.75 mm | **No. 4** | **60** | 39.7% Gravel |
| 2.00 mm | **No. 10** | **49** | |
| 850 um | **No. 20** | **38** | |
| 425 um | **No. 40** | **29** | 49.3% Sand |
| 250 um | **No. 60** | **22** | |
| 150 um | **No. 100** | **16** | |
| 75 um | **No. 200** | **11.0** | 11% Fines |

**SAND AND GRAVEL SOME SILT**




Comments: %M = 9.7

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