COPY NO. _____

MAIN ELECTRICAL SYSTEM UPGRADE
AT THE FRANKLIN
WASTEWATER TREATMENT PLANT
SRF PROJECT No. CS-330203-09

WINNIPESAUKEE RIVER BASIN PROGRAM
NEW HAMPSHIRE DEPARTMENT OF
ENVIRONMENTAL SERVICES

FRANKIN, NEW HAMPSHIRE

BIDDING AND CONTRACT REQUIREMENTS AND SPECIFICATIONS

MARCH 2015

12688G

WRIGHT-PIERCE
Engineering a Better Environment

BIDDING AND CONTRACT REQUIREMENTS AND SPECIFICATIONS

FOR

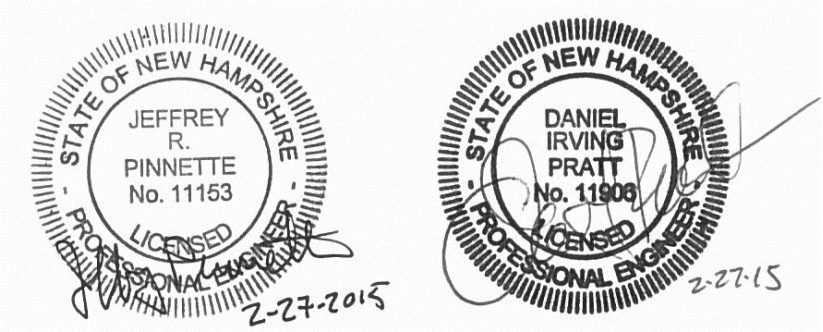
NEW HAMPSHIRE DEPARTMENT OF ENVIRONMENTAL SERVICES
WINNIPESAUKEE RIVER BASIN PROGRAM
MAIN ELELCTRICAL SYSTEMS UPGRADE

AT THE

FRANKLIN WASTEWATER TREATMENT PLANT
FRANKLIN, NEW HAMPSHIRE

SRF PROJECT No. CS-330203-09

MARCH 2015



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A. BIDDING REQUIREMENTS

ADVERTISEMENT FOR BIDS

New Hampshire Department of Environmental Services
Winnipesauke River Basin Program
Owner

Franklin Wastewater Treatment Plant
528 River Street
P.O. Box 68
Franklin, NH 03235
Address

Separate sealed BIDS for the construction of:

Main Electrical System Upgrade at the Franklin Wastewater Treatment Plant

will be received by The State of New Hampshire Department of Environmental Services Winnipesaukee River Basin Program

at the office of Franklin Wastewater Treatment Plant, 528 River Street, P.O. Box 68 Franklin, NH 03235

until 1:00 pm, (Standard Time-Daylight Savings Time) April 1, 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:

   210 calendar days for substantial completion.

   60 calendar days for final completion.

   Liquidated damages will be in the amount of $ 1000.00 for each calendar day of delay from the date established for substantial completion, and $ 1000.00 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:

   [X] 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)
   [ ] 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. The successful Bidder on this work is required to comply with the President's Executive Order No. 11246 entitled "Equal Employment Opportunity" as amended by Executive Order 11375, and amendments or supplements thereto, and as supplemented in Department of Labor Regulations (41 CFR Part 80). The requirements for bidders and contractors under this order are explained in the Information For Bidders**.**

6. Utilization of Minority and Women's Business Enterprises (MBEs and WBEs)
   The successful Bidder on this work must demonstrate compliance with the U.S. Environmental Protection Agency's MBE/WBE policy in order to be deemed a responsible bidder. The requirements for bidders and contractors covered by this policy are explained in the Information for Bidders.

7. The successful Bidder on this work is subject to U.S. Department of Labor's Davis Bacon wage provisions.

8. The successful bidder on this work is subject to the "American Iron and Steel (AIS)" requirements of P.L. 113-76, Consolidated Appropriation Act, 2014 (Act), section 436, which requires the use of iron and steel products that are produced in the United States.

9. No Bidder may withdraw a Bid within 90 days after the actual date of opening thereof.

10. There will be a non-mandatory pre-bid meeting for all prospective bidders to be held at the:

    Winnipesaukee River Basin Program
    Franklin WWTP
    528 River Street
    Franklin, NH 03235

    on Tuesday, March 17, 2015 at 1:00 am. Representatives of the Owner and Engineer will be present to discuss the project.

The Contract Documents may be examined at the following locations:

1. State of New Hampshire Purchase & Property website (downloadable pdf documents) at http://das.nh.gov/purchasing/bids_posteddte.asp?sort=PostedDate
2. Wright-Pierce, 99 Main Street, Topsham, ME 04086.Website: www.wright-pierce.com/projects.aspx
3. Associated General Contractors of NH, 48 Grandview Rd., Bow, NH 03304; (603)-225-2701
4. Spiller's Reprographics (Dodge), 880 Second Street, Manchester, NH 03102; (603)-644-3336

Copies of the Contract Documents may be examined after 1 pm on March 4, 2015 at the locations above or hard copies of the Contract Documents may be obtained after 1 pm on March 4, 2015 from Wright-Pierce at 603 430-3728 at a cost of $100.00 per set.

It is the responsibility of prospective bidders to check for Addenda on the State website indicated above or by calling the Franklin WWTP at 603-934-4032.

INFORMATION FOR BIDDERS

BIDS will be received by The State of New Hampshire Department of Environmental Services Winnipesaukee River Basin Program

(herein called the "OWNER"), at Franklin Wastewater Treatment Plant, 528 River Street, P.O. Box 68, Franklin, NH 03235

until 2:00 pm March 10, 2015 and then at said office publicly opened and read aloud.

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

The State of New Hampshire Department of Environmental Services Winnipesaukee River Basin Program at Franklin Wastewater Treatment Plant, 528 River Street, P.O. Box 68 Franklin, NH 03235

Each sealed envelope containing a BID must be plainly marked on the outside as BID for Main Electrical System Upgrade at the Franklin Wastewater Treatment Plant 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:

The State of New Hampshire Department of Environmental Services, Winnipesaukee River Basin Program, Franklin Wastewater Treatment Plant, 528 River Street, P.O. Box 68, Franklin, NH 03235

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 90 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 PERFORMANCE BOND and PAYMENT 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 ninety (90) days of receipt of acceptable PAYMENT BOND, PERFORMANCE BOND and AGREEMENT signed by the party to whom the AGREEMENT was awarded shall execute the AGREEMENT via the New Hampshire Governor and the Council approval 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 deemed 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 not 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.

SRF 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 obligate the contractors and sub-contractors not to discriminate in employment practices.

Bidders shall, if requested, submit a compliance report concerning their employment practices and policies in order to maintain their eligibility to receive the award of contract.

Successful bidders shall, if requested, submit a list of all subcontractors who will perform work on the project, and written signed statements from authorized agents of labor pools with which they

will or may deal for employees on the work together with supporting information to the effect that such labor pools' practices and policies are in conformity with Executive Order No. 11246; that they will affirmatively cooperate in or offer no hindrance to the recruitment, employment, and equal treatment of employees seeking employment and performing work under the contract or, a certification as to what efforts have been made to secure such statements when such agents or labor pools have failed or refused to furnish them prior to award of the contract.

Successful bidders must be prepared to comply in all respects with the contract provisions regarding non-discrimination.

DAVIS BACON WAGE RATES

This project is funded in whole or in part by a loan available through NHDES's Clean Water and/or Drinking Water SRF programs, and hence is subject to federal Davis Bacon wage provisions.

All laborers and mechanics employed by contractors or subcontractors on this project shall be paid wages at rates not less than those prevailing on projects of a character similar in the locality as determined by the U.S. Department of Labor (DOL) in accordance with Subchapter IV of Chapter 31 of Title 40, United States Code.

A copy of the applicable DOL wage determination(s) is included in the approved project documents. Note that any wage modifications posted by DOL to web site http://wdol.gov before the date of bid opening are effective, unless DES determines there is insufficient time to notify bidders of the change.

Bidders shall refer to PART D - FEDERAL PROVISIONS, RULES, REGULATIONS AND FORMS for additional information.

AMERICAN IRON AND STEEL (AIS) PROVISIONS

The successful bidder on this work is subject to the "American Iron and Steel (AIS)" requirements of P.L. 113-76, Consolidated Appropriation Act, 2014 (Act), section 436, which requires the use of iron and steel products that are produced in the United States.

The BIDDER'S AMERICAN IRON AND STEEL ACKNOWLEDGEMENT shall be completed and signed by each Bidder, and included with each bid. Additionally, CONTRACTOR shall certify and document to OWNER with each Application for Payment, and upon completion of the project that all iron and steel goods subject to this provision have been produced in the United States.

Bidders shall refer to PART D - FEDERAL PROVISIONS, RULES, REGULATIONS AND FORMS for additional information.

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 NH 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.

DBE RULE PROGRAM REQUIREMENTS (MBEs and WBEs)

Bidders on this project are required to demonstrate compliance with the United States Environmental Protection Agency's MBE/WBE policy in order to be deemed responsive. The existing Fair Share Goals are 1.45% MBE and 6.62% WBE (8.07% total). The MBE/WBE documentation, DBE Subcontractor Utilization Form and DBE Subcontractor Performance Forms (EPA Forms 6100-4 and 6100-3), shall be submitted with the bid. The requirements for bidders

and contractors are as follows:

State Revolving Fund loan recipients and their contractors must comply with the following DBE Rule Program requirements until the project period for the SRF loan has ended:

1) Fair share objectives (MBE/WBE goals);
2) Good Faith Efforts;
3) Annual Reporting;
4) Contract Administration Requirements and Forms;
5) Bidders List Requirements; and
6) Record Keeping.

Bidders shall refer to PART D - FEDERAL PROVISIONS, RULES, REGULATIONS AND FORMS for additional information.

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 transact 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.

SUSPENSION AND DEBARMENT

The Contractor shall not knowingly award a subcontract to any entity which has been debarred or suspended by the federal government. The Contractor shall compare the names of its proposed subcontractors against the searchable list in the federal "System For Award Management (SAM)" database, which can be found at https://www.sam.gov/portal/public/SAM.

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.

BID

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

To the The State of New Hampshire Department of Environmental Services, Winnipesaukee River Basin Program (hereinafter called "OWNER").

In compliance with your Advertisement for Bids, BIDDER hereby proposes to perform all WORK For the construction of Main Electrical System Upgrade at the Franklin Wastewater Treatment Plant 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:

210 consecutive calendar days for substantial completion.

60 consecutive calendar days for final completion.

Liquidated damages will be in the amount of $ 1000.00 for each calendar day of delay from the date established for substantial completion and $ 1000.00 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. Electrical Subcontractor_____
    b. Building Subcontractor_____

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 total bid:

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

BID SCHEDULE

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

BID SCHEDULE

Item No.	Approximate Quantity	Brief Description of Item With Bid Price in Words	Amount In Figures
1	1 LS	Main Electrical System Upgrade, complete. The Sum of _____ _____ Lump Sum (words)	**$**_____
2	Cash Allowance	Fee charged by the PSNH to install the new electrical service, to remove the existing service and other work required to be done by the utility company. The Sum of Twenty Thousand Dollars _____ Cash Allowance (words)	$20,000.00

TOTAL BID: TOTAL OF ITEMS 1 THROUGH 2 ABOVE

_____ ($_____)
(Use Words) (Figures)

The BIDDER hereby certifies, by checking the boxes below, that the following documents are included with this bid proposal

☐ DBE Subcontractor Utilization Form (EPA Form 6100-4)

☐ DBE Subcontractor Performance Forms (EPA Form 6100-3) **Submit one form for each DBE subcontractor**

☐ Bidder's **American Iron and Steel** acknowledgement

BID BOND

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned, _____ _____ as Principal, and _____ as Surety, are hereby held and firmly bound unto New Hampshire Department of Environmental Services, Winnipesaukee River Basin Program 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 Main Electrical System Upgrade at the Franklin Wastewater Treatment

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

NOTICE OF AWARD

Dated _____ , 20 ____

TO: _____
(BIDDER)

ADDRESS: _____

OWNER'S PROJECT NO: _____

PROJECT: Main Electrical System Upgrade at the Franklin Wastewater Treatment Plant

OWNER'S CONTRACT NO: _____

CONTRACT FOR: Main Electrical System Upgrade at the Franklin Wastewater Treatment Plant

_____
(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:

_____

_____
(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) (every) 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).

Execute P-37 Agreement (4 pages and notarized),

Original Certificate of Good Standing from The NH Secretary of State,

Insurance certificates as specified,

Corporate resolution citing that signatory has the authority to enter into the contract on behalf of the Contractor (notarized)

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 ninety 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.

NH Dept. of Environmental Services
Winnipesaukee River Basin Program
(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)

AGREEMENT

THIS AGREEMENT, made this _____ day of _____ ,20 _____ by and between NH Dept. of Environmental Services Winnipesaukee River Basin Program (Name of Owner) , hereinafter called **"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

Main Electrical System Upgrade at the Franklin Wastewater Treatment Plant
(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 _____ 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:

210 calendar days for substantial completion.
60 calendar days for final completion.

Liquidated damages will be in the amount of $ 1000.00 for each calendar day of delay from the date established for substantial completion and $ 1000.00 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) CERTIFICATE OF INSURANCE
(J) NOTICE TO PROCEED
(K) CHANGE ORDER(S)
(L) CERTIFICATON OF SUBSTANTIAL COMPLETION
(M) CERTIFICATION OF FINAL COMPLETION
(N) CONTRACTOR'S AFFIDAVIT
(O) CONTRACTOR'S RELEASE
(P) GENERAL CONDITIONS
(Q) SUPPLEMENTAL GENERAL CONDITIONS
(R) SPECIAL CONDITIONS
(S) FEDERAL PROVISIONS, RULES, REGULATIONS AND FORMS
(T) DRAWINGS prepared by:

_____

numbered _____ through _____ , and dated _____ , 20 _____

(U) SPECIFICATIONS prepared or issued by:

_____

_____ , and dated _____ , 20 _____

(V) ADDENDA:

No. _____ , dated _____ , 20 _____
No. _____ , dated _____ , 20 _____
No. _____ , dated _____ , 20 _____
No. _____ , dated _____ , 20 _____

(W) AGRREMENT P-37

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: NH Dept. of Environmental Services
Winnipesaukee River Basin Program

By: _____

Name: _____
(Please type)

Acknowledging approval by the New Hampshire Governor and the Executive Council only

CONTRACTOR: _____

By: _____

Name: _____

Address: _____

_____

(SEAL)

ATTEST: _____

Name: _____

Title: _____

Print Form

Subject: FORM NUMBER P-37 (version 1/09)

AGREEMENT

The State of New Hampshire and the Contractor hereby mutually agree as follows:

GENERAL PROVISIONS

1. IDENTIFICATION.

1.1 State Agency Name	1.2 State Agency Address
1.3 Contractor Name	1.4 Contractor Address
1.5 Contractor Phone Number / 1.6 Account Number	1.7 Completion Date / 1.8 Price Limitation
1.9 Contracting Officer for State Agency	1.10 State Agency Telephone Number
1.11 Contractor Signature	1.12 Name and Title of Contractor Signatory

1.13 Acknowledgement: State of _____, County of _____

On _____, before the undersigned officer, personally appeared the person identified in block 1.12, or satisfactorily proven to be the person whose name is signed in block 1.11, and acknowledged that s/he executed this document in the capacity indicated in block 1.12.

1.13.1 Signature of Notary Public or Justice of the Peace

[Seal]

1.13.2 Name and Title of Notary or Justice of the Peace

1.14 State Agency Signature	1.15 Name and Title of State Agency Signatory

1.16 Approval by the N.H. Department of Administration, Division of Personnel *(if applicable)*

By: Director, On:

1.17 Approval by the Attorney General (Form, Substance and Execution)

By: On:

1.18 Approval by the Governor and Executive Council

By: On:

2. EMPLOYMENT OF CONTRACTOR/SERVICES TO BE PERFORMED. The State of New Hampshire, acting through the agency identified in block 1.1 ("State"), engages contractor identified in block 1.3 ("Contractor") to perform, and the Contractor shall perform, the work or sale of goods, or both, identified and more particularly described in the attached EXHIBIT A which is incorporated herein by reference ("Services").

3. EFFECTIVE DATE/COMPLETION OF SERVICES.
3.1 Notwithstanding any provision of this Agreement to the contrary, and subject to the approval of the Governor and Executive Council of the State of New Hampshire, this Agreement, and all obligations of the parties hereunder, shall not become effective until the date the Governor and Executive Council approve this Agreement ("Effective Date").
3.2 If the Contractor commences the Services prior to the Effective Date, all Services performed by the Contractor prior to the Effective Date shall be performed at the sole risk of the Contractor, and in the event that this Agreement does not become effective, the State shall have no liability to the Contractor, including without limitation, any obligation to pay the Contractor for any costs incurred or Services performed. Contractor must complete all Services by the Completion Date specified in block 1.7.

4. CONDITIONAL NATURE OF AGREEMENT.
Notwithstanding any provision of this Agreement to the contrary, all obligations of the State hereunder, including, without limitation, the continuance of payments hereunder, are contingent upon the availability and continued appropriation of funds, and in no event shall the State be liable for any payments hereunder in excess of such available appropriated funds. In the event of a reduction or termination of appropriated funds, the State shall have the right to withhold payment until such funds become available, if ever, and shall have the right to terminate this Agreement immediately upon giving the Contractor notice of such termination. The State shall not be required to transfer funds from any other account to the Account identified in block 1.6 in the event funds in that Account are reduced or unavailable.

5. CONTRACT PRICE/PRICE LIMITATION/ PAYMENT.
5.1 The contract price, method of payment, and terms of payment are identified and more particularly described in EXHIBIT B which is incorporated herein by reference.
5.2 The payment by the State of the contract price shall be the only and the complete reimbursement to the Contractor for all expenses, of whatever nature incurred by the Contractor in the performance hereof, and shall be the only and the complete compensation to the Contractor for the Services. The State shall have no liability to the Contractor other than the contract price.
5.3 The State reserves the right to offset from any amounts otherwise payable to the Contractor under this Agreement those liquidated amounts required or permitted by N.H. RSA 80:7 through RSA 80:7-c or any other provision of law.
5.4 Notwithstanding any provision in this Agreement to the contrary, and notwithstanding unexpected circumstances, in no event shall the total of all payments authorized, or actually made hereunder, exceed the Price Limitation set forth in block 1.8.

6. COMPLIANCE BY CONTRACTOR WITH LAWS AND REGULATIONS/ EQUAL EMPLOYMENT OPPORTUNITY.
6.1 In connection with the performance of the Services, the Contractor shall comply with all statutes, laws, regulations, and orders of federal, state, county or municipal authorities which impose any obligation or duty upon the Contractor, including, but not limited to, civil rights and equal opportunity laws. In addition, the Contractor shall comply with all applicable copyright laws.
6.2 During the term of this Agreement, the Contractor shall not discriminate against employees or applicants for employment because of race, color, religion, creed, age, sex, handicap, sexual orientation, or national origin and will take affirmative action to prevent such discrimination.
6.3 If this Agreement is funded in any part by monies of the United States, the Contractor shall comply with all the provisions of Executive Order No. 11246 ("Equal Employment Opportunity"), as supplemented by the regulations of the United States Department of Labor (41 C.F.R. Part 60), and with any rules, regulations and guidelines as the State of New Hampshire or the United States issue to implement these regulations. The Contractor further agrees to permit the State or United States access to any of the Contractor's books, records and accounts for the purpose of ascertaining compliance with all rules, regulations and orders, and the covenants, terms and conditions of this Agreement.

7. PERSONNEL.
7.1 The Contractor shall at its own expense provide all personnel necessary to perform the Services. The Contractor warrants that all personnel engaged in the Services shall be qualified to perform the Services, and shall be properly licensed and otherwise authorized to do so under all applicable laws.
7.2 Unless otherwise authorized in writing, during the term of this Agreement, and for a period of six (6) months after the Completion Date in block 1.7, the Contractor shall not hire, and shall not permit any subcontractor or other person, firm or corporation with whom it is engaged in a combined effort to perform the Services to hire, any person who is a State employee or official, who is materially involved in the procurement, administration or performance of this Agreement. This provision shall survive termination of this Agreement.
7.3 The Contracting Officer specified in block 1.9, or his or her successor, shall be the State's representative. In the event of any dispute concerning the interpretation of this Agreement, the Contracting Officer's decision shall be final for the State.

Contractor Initials _____
Date_____

8. EVENT OF DEFAULT/REMEDIES.
8.1 Any one or more of the following acts or omissions of the Contractor shall constitute an event of default hereunder ("Event of Default"):
8.1.1 failure to perform the Services satisfactorily or on schedule;
8.1.2 failure to submit any report required hereunder; and/or
8.1.3 failure to perform any other covenant, term or condition of this Agreement.
8.2 Upon the occurrence of any Event of Default, the State may take any one, or more, or all, of the following actions:
8.2.1 give the Contractor a written notice specifying the Event of Default and requiring it to be remedied within, in the absence of a greater or lesser specification of time, thirty (30) days from the date of the notice; and if the Event of Default is not timely remedied, terminate this Agreement, effective two (2) days after giving the Contractor notice of termination;
8.2.2 give the Contractor a written notice specifying the Event of Default and suspending all payments to be made under this Agreement and ordering that the portion of the contract price which would otherwise accrue to the Contractor during the period from the date of such notice until such time as the State determines that the Contractor has cured the Event of Default shall never be paid to the Contractor;
8.2.3 set off against any other obligations the State may owe to the Contractor any damages the State suffers by reason of any Event of Default; and/or
8.2.4 treat the Agreement as breached and pursue any of its remedies at law or in equity, or both.

9. DATA/ACCESS/CONFIDENTIALITY/ PRESERVATION.
9.1 As used in this Agreement, the word "data" shall mean all information and things developed or obtained during the performance of, or acquired or developed by reason of, this Agreement, including, but not limited to, all studies, reports, files, formulae, surveys, maps, charts, sound recordings, video recordings, pictorial reproductions, drawings, analyses, graphic representations, computer programs, computer printouts, notes, letters, memoranda, papers, and documents, all whether finished or unfinished.
9.2 All data and any property which has been received from the State or purchased with funds provided for that purpose under this Agreement, shall be the property of the State, and shall be returned to the State upon demand or upon termination of this Agreement for any reason.
9.3 Confidentiality of data shall be governed by N.H. RSA chapter 91-A or other existing law. Disclosure of data requires prior written approval of the State.

10. TERMINATION. In the event of an early termination of this Agreement for any reason other than the completion of the Services, the Contractor shall deliver to the Contracting Officer, not later than fifteen (15) days after the date of termination, a report ("Termination Report") describing in detail all Services performed, and the contract price earned, to and including the date of termination. The form, subject matter, content, and number of copies of the Termination Report shall be identical to those of any Final Report described in the attached EXHIBIT A.

11. CONTRACTOR'S RELATION TO THE STATE. In the performance of this Agreement the Contractor is in all respects an independent contractor, and is neither an agent nor an employee of the State. Neither the Contractor nor any of its officers, employees, agents or members shall have authority to bind the State or receive any benefits, workers' compensation or other emoluments provided by the State to its employees.

12. ASSIGNMENT/DELEGATION/SUBCONTRACTS.
The Contractor shall not assign, or otherwise transfer any interest in this Agreement without the prior written consent of the N.H. Department of Administrative Services. None of the Services shall be subcontracted by the Contractor without the prior written consent of the State.

13. INDEMNIFICATION. The Contractor shall defend, indemnify and hold harmless the State, its officers and employees, from and against any and all losses suffered by the State, its officers and employees, and any and all claims, liabilities or penalties asserted against the State, its officers and employees, by or on behalf of any person, on account of, based or resulting from, arising out of (or which may be claimed to arise out of) the acts or omissions of the Contractor. Notwithstanding the foregoing, nothing herein contained shall be deemed to constitute a waiver of the sovereign immunity of the State, which immunity is hereby reserved to the State. This covenant in paragraph 13 shall survive the termination of this Agreement.

14. INSURANCE.
14.1 The Contractor shall, at its sole expense, obtain and maintain in force, and shall require any subcontractor or assignee to obtain and maintain in force, the following insurance:
14.1.1 comprehensive general liability insurance against all claims of bodily injury, death or property damage, in amounts of not less than $250,000 per claim and $2,000,000 per occurrence; and
14.1.2 fire and extended coverage insurance covering all property subject to subparagraph 9.2 herein, in an amount not less than 80% of the whole replacement value of the property.
14.2 The policies described in subparagraph 14.1 herein shall be on policy forms and endorsements approved for use in the State of New Hampshire by the N.H. Department of Insurance, and issued by insurers licensed in the State of New Hampshire.
14.3 The Contractor shall furnish to the Contracting Officer identified in block 1.9, or his or her successor, a certificate(s) of insurance for all insurance required under this Agreement. Contractor shall also furnish to the Contracting Officer identified in block 1.9, or his or her successor, certificate(s) of insurance for all renewal(s) of insurance required under this Agreement no later than fifteen (15) days prior to the expiration date of each of the insurance policies. The certificate(s) of insurance and any renewals thereof shall be

Contractor Initials _____
Date_____

attached and are incorporated herein by reference. Each certificate(s) of insurance shall contain a clause requiring the insurer to endeavor to provide the Contracting Officer identified in block 1.9, or his or her successor, no less than ten (10) days prior written notice of cancellation or modification of the policy.

15. WORKERS' COMPENSATION.
15.1 By signing this agreement, the Contractor agrees, certifies and warrants that the Contractor is in compliance with or exempt from, the requirements of N.H. RSA chapter 281-A *("Workers' Compensation").*
15.2 To the extent the Contractor is subject to the requirements of N.H. RSA chapter 281-A, Contractor shall maintain, and require any subcontractor or assignee to secure and maintain, payment of Workers' Compensation in connection with activities which the person proposes to undertake pursuant to this Agreement. Contractor shall furnish the Contracting Officer identified in block 1.9, or his or her successor, proof of Workers' Compensation in the manner described in N.H. RSA chapter 281-A and any applicable renewal(s) thereof, which shall be attached and are incorporated herein by reference. The State shall not be responsible for payment of any Workers' Compensation premiums or for any other claim or benefit for Contractor, or any subcontractor or employee of Contractor, which might arise under applicable State of New Hampshire Workers' Compensation laws in connection with the performance of the Services under this Agreement.

16. WAIVER OF BREACH. No failure by the State to enforce any provisions hereof after any Event of Default shall be deemed a waiver of its rights with regard to that Event of Default, or any subsequent Event of Default. No express failure to enforce any Event of Default shall be deemed a waiver of the right of the State to enforce each and all of the provisions hereof upon any further or other Event of Default on the part of the Contractor.

17. NOTICE. Any notice by a party hereto to the other party shall be deemed to have been duly delivered or given at the time of mailing by certified mail, postage prepaid, in a United States Post Office addressed to the parties at the addresses given in blocks 1.2 and 1.4, herein.

18. AMENDMENT. This Agreement may be amended, waived or discharged only by an instrument in writing signed by the parties hereto and only after approval of such amendment, waiver or discharge by the Governor and Executive Council of the State of New Hampshire.

19. CONSTRUCTION OF AGREEMENT AND TERMS. This Agreement shall be construed in accordance with the laws of the State of New Hampshire, and is binding upon and inures to the benefit of the parties and their respective successors and assigns. The wording used in this Agreement is the wording chosen by the parties to express their mutual intent, and no rule of construction shall be applied against or in favor of any party.

20. THIRD PARTIES. The parties hereto do not intend to benefit any third parties and this Agreement shall not be construed to confer any such benefit.

21. HEADINGS. The headings throughout the Agreement are for reference purposes only, and the words contained therein shall in no way be held to explain, modify, amplify or aid in the interpretation, construction or meaning of the provisions of this Agreement.

22. SPECIAL PROVISIONS. Additional provisions set forth in the attached EXHIBIT C are incorporated herein by reference.

23. SEVERABILITY. In the event any of the provisions of this Agreement are held by a court of competent jurisdiction to be contrary to any state or federal law, the remaining provisions of this Agreement will remain in full force and effect.

24. ENTIRE AGREEMENT. This Agreement, which may be executed in a number of counterparts, each of which shall be deemed an original, constitutes the entire Agreement and understanding between the parties, and supersedes all prior Agreements and understandings relating hereto.

Contractor Initials _____
Date_____

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

NH Department of Environmental Services, Winnipesaukee River Basin Program
(Name of Owner)

528 River Street, PO Box 86, Franklin, NH 03235
(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:

WRPB Main Electrical Systems Upgrade at the Franklin Wastewater Treatment Plant

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 materialman 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.

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

NH Department of Environmental Services, Winnipesaukee River Basin Program
(Name of Owner)

528 River Street, PO Box 86, Franklin, NH 03235
(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:

Main Electrical System Upgrade at the Franklin Wastewater Treatment Plant

_____

_____

_____

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

NOTICE TO PROCEED

Dated _____ , 20 _____

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

ADDRESS: _____

_____

OWNER'S PROJECT NO. _____

PROJECT: _____

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: _____

_____

_____

B-6.1

CHANGE ORDER

No. _____

PROJECT: _____ DATE OF ISSUANCE: _____

OWNER: _____

_____
(Address)

CONTRACTOR: _____ OWNER's Project No. _____

CONTRACT FOR: _____ ENGINEER _____

_____ ENGINEER's Project No. _____

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 $ _____	Original Contract Time _____ (days or date)
Previous Change Orders $ _____	Net change from previous Change Orders _____ (days)
Contract Price prior to this Change Order $ _____	Contract Time prior to this Change Order _____ (days or date)
Net Increase (Decrease) of this Change Order $ _____	Net Increase (decrease) this Change Order _____ (days)
Contract Price with all approved Change Orders $ _____	Contract Time with all Change Orders _____ (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

CERTIFICATE OF SUBSTANTIAL COMPLETION

OWNER's Project No.: _____ ENGINEER's Project No.: _____

Project: _____

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: _____
(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: _____

CERTIFICATE OF FINAL COMPLETION

Owner's Project No. _____ Engineer's Project No. _____
Project _____
Owner: _____
Contractor: _____
Engineer: _____

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:_____

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

NH Department of Environmental Services, Winnipesaukee River Basin Program
(Owner)

and _____ of _____
(Contractor) (Address)

dated _____ for the construction of the _____

Main Electrical System Upgrade at the Franklin Wastewater Treatment Plant
(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

B-10.1

CONTRACTOR'S FINAL RELEASE AND WAIVER OF LIEN

Project/Owner	Contractor
Project: _____	Name_____
Address:_____	Address:_____
_____ City State Zip	_____ City State Zip
Owner_____	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_____

STATE OF NEW HAMPSHIRE DEPARTMENT OF ENVIRONMENTAL SERVICES
CLEAN WATER STATE REVOLVING FUND (CWSRF) AND
DRINKING WATER STATE REVOLVING FUND (DWSRF)

AMERICAN IRON AND STEEL CERTIFICATION

Instructions

This certification must be completed and signed by the authorized representative of the Contractor, acknowledged by the authorized representative of the Owner, and submitted to the New Hampshire Department of Environmental Services upon substantial completion of the project.

Project Name: _____

City/Town/Entity: _____

Contractor Name: _____

Contractor Address: _____

Name/Title of Contractor Certifying Representative: _____

I hereby certify on behalf of the above named Contractor,

(please check one of the following and provide documentation as necessary)

☐ That the "American Iron and Steel" provisions of P.L. 113-76, Consolidated Appropriation Act, 2014, section 436 (Iron and Steel Requirement) **have been met** and that all iron and steel used in the project named above have been produced in the United States in a manner that complies with the American Iron And Steel Requirement.

OR

☐ That the "American Iron and Steel" provisions of P.L. 113-76, Consolidated Appropriation Act, 2014, section 436 (Iron and Steel Requirement) **were unable to be met**. Not all of the iron and steel used in the project named above have been produced in the United States.

Attach all documentation including EPA approved waivers for all iron and steel that do not meet the Iron and Steel Requirement

Signature of Certifying Contractor Representative: _____

Date: _____

Acknowledged by Authorized Owner Representative: _____

Date: _____

C. GENERAL CONDITIONS

JUNE 2012

GENERAL CONDITIONS

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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.

SPECIAL CONDITIONS

Supplements

The following supplements 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.

Section No.	Section Title	Page No.
SC-2	Definitions; Supplement to GC2	C-2.2
SC-24	Retainage by Owner; Supplement to GC24	C-2.2
SC-27	Insurance; Supplement to GC27	C-2.3
SC-52	Project Sign; Supplement to GC52	C-2.3
SC-57	Cooperation with Utilities; Supplement to GC57	C-2.3
SC-58	Work Performed at Night, on Sundays, and on Holidays Supplement to GC58	C-2.4
SC-60	Permits	C-2.4
SC-66	Wage Rate	C-2.4

SPECIAL CONDITIONS

SGC-2 Definitions (Supplement to GC2)

Insert the following after 2.1 Addenda:

Such written or graphic instruments will be issued no less than five working days before the Bid Opening.

SGC-2 Definitions (Supplement to GC2)

Insert the following after 2.24 Substantial Completion:

"Final Completion" means that date as certified by the Engineer when all work described in the Contract Documents is complete, including receipt of all Shop Drawing, Operations and Maintenance Manuals, Certifications and Record Drawings and that all training has been completed and all punch list items have been addressed by the Contractor.

SGC-24 Retainage By Owner (Supplement to GC24)

Delete paragraph 24.2 in its entirety and **replace** with the following:

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

a. Until the work is 50% complete, as determined by the Engineer, retainage shall be 10% of the monthly payments claimed.

b. 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, and the retained amount 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.

c. Upon substantial or final completion (as defined in article 25), the amount of retainage will be reduced to 2% of the total amount due the Contractor 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 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 project has been accepted by the Owner.

SPECIAL CONDITIONS

SGC-27 Insurance (Supplement to GC27)

The minimum limits of liability of such insurance shall be as follows:

a. General (Comprehensive) Liability and Owners Protective Liability:
$250,000 per claim;
$2,000,000 each occurrence bodily injury and property damage
$2,000,000 general aggregate

Refer to the Agreement, Attachment Form P-37 for additional insurance requirement.

Add the following after Paragraph 27.8 of the General Conditions:

27.9 The Contractor shall name the following entities as an additional insured for their general liability and automobile liability policies:

- New Hampshire Department of Environmental Services, Winnipesauke River Basin Program
- Wright-Pierce and Wright-Pierce Subconsultants

SC-52 PROJECT SIGN (SUPPLEMENT TO GC-52)

Delete "See Exhibit 1 for details of construction."

Add "See Specification Section 01580 for details of construction."

SC-57 Cooperation with Utilities (Supplement to GC57)

Delete paragraphs 57.1, 57.2 and 57.3 in their entirety and **replace** with the following:

"57.1 The Contractor 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 Contractor.."

"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 cost of moving them."

General Decision Number: NH150010 01/02/2015 NH10

Superseded General Decision Number: NH20140010

State: New Hampshire

Construction Type: Building

County: Merrimack County in New Hampshire.

BUILDING CONSTRUCTION PROJECTS (does not include single family homes or apartments up to and including 4 stories).

Note: Executive Order (EO) 13658 establishes an hourly minimum wage of $10.10 for 2015 that applies to all contracts subject to the Davis-Bacon Act for which the solicitation is issued on or after January 1, 2015. If this contract is covered by the EO, the contractor must pay all workers in any classification listed on this wage determination at least $10.10 (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract. The EO minimum wage rate will be adjusted annually. Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/02/2015

* CARP0118-004 10/01/2014

	Rates	Fringes
CARPENTER (Acoustical Ceiling Installation Only)	$ 25.91	18.37

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* CARP0118-013 10/01/2014

	Rates	Fringes
CARPENTER (Including formwork Industrial Only)	$ 25.91	18.37

ELEC0490-004 06/01/2014

	Rates	Fringes
ELECTRICIAN		
Electrician	$ 27.75	17.45

Low Voltage Wiring
Installer.....$ 20.06 14.60

IRON0007-007 03/16/2014

	Rates	Fringes
IRONWORKER (Reinforcing and Structural)	$ 22.65	20.17

LABO0976-005 06/01/2013

	Rates	Fringes
LABORER: Common or General (Industrial Work Only) (Concrete Worker removing forms demolition and removal of concrete, pouring and leveling of concrete)	$ 19.71	16.42

SHEE0017-013 01/01/2013

	Rates	Fringes
SHEET METAL WORKER (HVAC Duct Work Only)	$ 28.35	23.52

TEAM0633-001 05/01/2013

	Rates	Fringes
Truck Driver, Dump (Industrial Work; Excluding Regular Dump Truck)	$ 28.95	18.28

SUNH2011-006 02/22/2011

	Rates	Fringes
BRICKLAYER	$ 27.48	7.37
CARPENTER (Drywall Hanging Only)	$ 22.33	8.51
CARPENTER (Form Work Only)	$ 18.35	0.00
CARPENTER, Excludes Acoustical Ceiling Installation, Drywall		

Hanging, and Form Work	$ 20.43	7.88
CEMENT MASON/CONCRETE FINISHER	$ 20.53	10.63
LABORER: Landscape	$ 12.00	0.35
LABORER: Pipelayer	$ 17.17	2.49
LABORER: Common or General, Including Brick Mason Tenders	$ 14.63	4.61
OPERATOR: Backhoe	$ 16.19	2.48
OPERATOR: Bulldozer	$ 17.63	1.24
OPERATOR: Crane	$ 25.19	4.05
OPERATOR: Excavator	$ 17.93	5.20
OPERATOR: Grader/Blade	$ 26.00	11.62
OPERATOR: Loader	$ 18.67	2.69
OPERATOR: Roller	$ 18.08	5.52
PAINTER: Brush Only	$ 15.46	2.21
PLUMBER/PIPEFITTER, Includes HVAC Pipe Work	$ 20.68	3.85
ROOFER	$ 17.86	2.31
TRUCK DRIVER: Dump Truck	$ 16.45	1.68

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of "identifiers" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than "SU" or "UAVG" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the "SU" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an

interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISION

SPECIAL CONDITIONS

SC-58 Work Performed at Night and on Sundays and Holidays

Add "Saturdays" to the Section Title.

Delete Paragraph 58.1 in its entirety and **replace** with the following:

> "58.1 No work will be permitted at night or on Saturdays, Sundays or State 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."

SC-60 PERMITS (SUPPLEMENT TO GC-60)

Add the following to Paragraph 60.1:

The Contractor is required to obtain all necessary Town permits, including but not limited to electrical, plumbing and building permits. The Contractor is required to obtain the building permit from the State Fire Marshal's office. The Contractor shall pay all fees required to obtain the state and local permits.

SC-66 WAGE RATES

Davis-Bacon wage rates apply to this project. The wage rates are attached to these specifications. It is the responsibility of the Contractor, before bid opening, to request, if necessary, any additional information on wage rates for those people who are not covered by the attached wage rates, but who may be employed for the proposed work under this contract.

END OF SECTION

D. FEDERAL PROVISIONS, RULES REGULATIONS AND FORMS

(SRF)

MAY 2014

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FP-1 Pertinent Federal Acts

The Contractor shall comply with the regulations of the Davis-Bacon Act, Executive Order 11246 (Standard Federal Equal Employment Opportunity), the Contract Work Hours Standards Act, the Consolidated Appropriations Act, 2014 (Use American Iron and Steel), and Title X of the Clean Air Act Amendments of 1990 (Disadvantage Business Enterprise), and any amendments or modifications thereto, and shall cause appropriate provisions to be inserted in subcontracts to insure compliance therewith by all Subcontractors subject thereto.

FP-2 Labor Standards – Contractor Responsibilities

Postings A legible copy of the wage determination (including any additional classification and wage rates conformed) and the Davis-Bacon poster (WH-1321) shall be posted and maintained by the Contractor at the site of the work in a prominent and accessible place where it can be easily seen by the workers. The "Notice to Labor Unions or Other Organizations of Workers" on contract page D-3.1 must also be posted at the same location.

Payment of Employees Each employee must be paid weekly in the full amount for the particular trade classification in the Wage Determination and in accordance with overtime and fringe benefit requirements.

Submittal of Payrolls Each Contractor or Subcontractor performing work on site shall submit payrolls to the Owner on a weekly basis. Payrolls are due no later than 7 calendar days from the actual pay date. The Prime Contractor is responsible for the submission of copies of certified payrolls by all Subcontractors. The payrolls shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that *full social security numbers and home addresses shall not be included on the weekly payrolls*. Instead the payrolls need include only an individual identifying number for each employee (e.g. the last four digits of the employee's social security number).

FP-3 Payroll Forms and Certification

Contractors are requested to use the DOL Payroll Form (WH-347), which includes on its reverse side the required Statement of Compliance. These forms and instructions may be obtained online at http://www.dol.gov/whd/forms. Contractors are not required to use form WH-347 and may substitute other payroll formats, including computer-generated forms, *provided* that all of the required information and the exact language of the Statement of Compliance (reverse side of the WH-347) is included.

FP-4 Fringe Benefits

Fringe benefits, if any, indicated on the wage determination must be paid either to a "fund" or "program" or be paid to the employee in cash if the Contractor does not contribute to bona fide fringe plans on the employees behalf.

For NH SRF Projects, when completing payroll certifications (SIDE B), the employer must ensure he/she has checked either 4a or 4b to indicate how fringe benefits were paid to employees. Remember…if block 4a is *checked*, a Fringe Benefit Report/Breakout must be included with each payroll for each employee who worked on-site.

FP-5 Apprentices

All Apprentices employed by the Contractor/Subcontractor must be registered under an approved Apprenticeship Training Program as described under paragraph 4 of the Federal Labor Standards Provisions. Documentation of such registration must be provided along with any weekly certified payroll that identifies an Apprentice as having worked on-site.

FP-6 Overall Payroll Certification by Prime Contractors

Prior to a federal inspection or review, and at the request of the Owner, each prime Contractor employing mechanics and laborers at the site of the work in which there is federal participation must execute the certificate on contract page D-2.4. The state cannot make a payment on the loan unless this certificate is on file with the Owner. The certificate is in addition to the weekly certificates on the payroll.

FP-7 Retention of Payroll Records

Payroll records and original field notes shall be maintained by the Contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work.

FP-8 Subcontracts

The Contractor shall include the applicable wage decision(s) and Federal Labor Standards Provisions in all subcontracts.

FP-9 Availability of Records

The Contractor shall make employment records available for inspection by authorized representatives of the DOL and the State of NH, and shall permit employees to be interviewed during working hours by these representatives and by the owner's representative.

FP-10 Suspension of Payments or Termination of Contract

In the event of a violation of the Labor Standards Provisions of the contract by the general Contractor or a Subcontractor, the Owner may, after notice to the Contractor, suspend further payments or proceed to terminate the contract as provided in the Labor Standards Section of the contract.

FP-11 Labor Standards-Owner's Responsibilities

In the event of a violation of the Labor Standards provision of the contract, the Owner, after written notice to the Contractor, may withhold so much of the accrued payments as may be considered necessary to pay laborers and mechanics employed by the Contractor, or Subcontractor, the full amount of wages required by the contract plus penalties. The Owner also has the option of terminating the contract in accordance with the provisions of the Labor Standards. U.S. DOL may assess liquidated damages in the amount of $10.00 for each man day in which an employee was underpaid for overtime.

FP-12 Questions regarding the Federal Labor Standards Provisions

For additional information, visit the Wage and Hour Division Website: http://www.wagehour.dol.gov and/or call the toll-free information and helpline, available 8 a.m. to 5 p.m. in your time zone, 1-866-4USWAGE (1-866-487-9243).

FP-13 Standard Forms

The standard forms to be used in conjunction with the other requirements of federal labor standards are listed below and copies are attached:

A. Federal Labor Standards Provisions
B. Notice to Unions or Other Organizations of Workers (Nondiscrimination in Employment)
C. Certification of Non-segregated Facilities
D. Certified Payroll and Statement of Compliance (WH-347)

DBRA Resources:

- U.S. DOL General Wage Determinations - http://www.wdol.gov.
- U.S. DOL Field Operations Handbook Davis-Bacon and Related Acts & Contract Work Hours and Safety Standards Act 10/25/10 -http://www.dol.gov/whd/FOH/FOH_Ch15.pdf
- U.S. DOL Certified Payroll Form WH-347 - http://www.dol.gov/whd/forms/wh347.pdf.
- WH-1321 “Employee Rights Under the Davis-Bacon Act” poster - http://www.dol.gov/whd/regs/compliance/posters/fedprojc.pdf.
- U.S.DOL Prevailing Wage Resources Book - http://www.dol.gov/whd/recovery/pwrb/toc.htm

PRIME CONTRACTOR'S OVERALL PAYROLL CERTIFICATION

(To be submitted with each pay requisition)

Name of Contractor: _____

Address of Contractor: _____

Project Name: _____

Project Number: _____

Project Location: _____

Date: _____

I hereby certify that all of the contract requirements as specified under the Labor Standards Provision for Federal and Federally Assisted Contracts have been complied with by _____ Contractor, and by each Subcontractor employing Laborers or Mechanics at the site or the work, or there is an honest dispute with respect to the required provisions.

_____
Name of Responsible Official

_____
Title

_____
Signature

_____
Date

NOTICE TO LABOR UNIONS OR OTHER ORGANIZATIONS OF WORKERS

NONDISCRIMINATION IN EMPLOYMENT

To: _____
(Name of union or organization of workers)

The undersigned currently holds contract(s) with _____
(Name of Applicant)

_____ involving funds or credit of the U.S. Government or (a) subcontract(s) with a prime contractor holding such contract(s).

You are advised that under the provisions of the above contract(s) or subcontract(s) and in accordance with Executive Order 11246, dated September 24, 1965, the undersigned is obliged not to discriminate against any employee or applicant for employment because of race, color, creed, or national origin. This obligation not to discriminate in employment includes, but is not limited to, the following:

HIRING, PLACEMENT, UPGRADING, TRANSFER, OR DEMOTION
RECRUITMENT, ADVERTISING, OR SOLICITATION FOR EMPLOY-
MENT TRAINING DURING EMPLOYMENT, RATES OF PAY OR OTHER FORMS
OF COMPENSATION, SELECTION FOR TRAINING INCLUDING
APPRENTICESHIP, LAYOFF, OR TERMINATION.

This notice is furnished you pursuant to the provisions of the above contract(s) or subcontract(s) and Executive Order 11246.

COPIES OF THIS NOTICE WILL BE POSTED BY THE UNDERSIGNED IN CONSPICUOUS PLACES AVAILABLE TO EMPLOYEES OR APPLICANTS FOR EMPLOYMENT.

_____

_____

_____

C/S/ _____
(Contractor or Subcontractor)

_____
Date

Standard Federal Equal Employment Opportunity
Construction Contract Specifications
(Executive Order 11246)

1. As used in these specifications:

   a. "Covered area" means the geographical area described in the solicitation from which this contract resulted;

   b. "Director" means Director, Office of Federal Contract Compliance Programs, United States Department of Labor, or any person to whom the Director delegates authority;

   c. "Employer identification number" means the Federal Social Security number used on the employer's Quarterly Federal Tax Return, U.S. Treasury Department Form 941.

   d. "Minority" includes:

      (I) Black (all persons having origins in any of the Black African racial groups not of Hispanic origin);

      (ii) Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American or other Spanish Culture or origin, regardless of race);

      (iii) Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian subcontinent, or the Pacific Islands); and

      (iv) American Indian or Alaskan Native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).

2. Whenever the Contractor, or any subcontractor at any tier, subcontracts a portion of the work involving any construction trade, it shall physically include in each subcontract in excess of $10,000.00 the provisions of these specifications and the Notice which contains the applicable goals for minority and female participation and which is set forth in the solicitations from which this contract resulted.

3. If the Contractor is participating (pursuant to 41 CFR 60-4.5) in a Hometown Plan approved by the U.S. Department of Labor in the covered area either individually or through an association, its affirmative action obligations on all work in the Plan area (including goals and timetables) shall be in accordance with that Plan for those trades which have unions participating in the Plan. Contractors must be able to demonstrate their participation in and compliance with the provisions of any such Hometown Plan. Each Contractor or Subcontractor participating in an approved Plan is individually required to comply with its obligations under the EEO clause, and to make a good faith effort to achieve each goal under the Plan in each trade in which it has employees. The overall good faith performance by other Contractors or Subcontractors toward a goal in an approved plan does not excuse any covered Contractor's or Subcontractor's failure to take good faith efforts to achieve the Plan goals and timetables.

4. The Contractor shall implement the specific affirmative action standards provided in paragraphs 7a through p of these specifications. The Goals set forth in the solicitation from which this contract resulted are expressed as percentages of the total hours of employment and training of minority and female utilization the Contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area. Covered Construction Contractors performing construction work in geographical areas where they do not have a Federal or federally-assisted construction contract shall apply the minority and female goals established for the geographical area where the work is being performed. Goals are published periodically in the *Federal Register* in notice form, and such notices may be obtained from any Office of Federal Contract Compliance Programs office or from Federal procurement contracting officers. The Contractor is expected to make substantially uniform progress in meeting its goals in each craft during the period specified.

5. Neither the provisions of any collective bargaining agreement, nor the failure by a union with whom the Contractor has a collective bargaining agreement, to refer either minorities or women shall excuse the Contractor's obligations under these specifications, Executive Order 11246, or the regulations promulgated pursuant thereto.

6. In order for the nonworking training hours of apprentices and trainees to be counted in meeting the goals, such apprentices and trainees must be employed by the Contractor during the training period, and the Contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U.S. Department of Labor.

7. The Contractor shall take specific affirmative actions to ensure equal employment opportunity. The evaluation of the Contractor's compliance with these specifications shall be based upon its effort to achieve maximum results from its actions. The Contractor shall document these efforts fully, and shall implement affirmative action steps at least as extensive as the following:

    a. Ensure and maintain a working environment free of harassment, intimidation and coercion at all sites, and in all facilities at which the Contractor's employees are assigned to work. The Contractor, where possible, will assign two or more women to each construction project. The Contractor shall specifically ensure that all foremen, superintendents, and other on-site supervisory personnel are aware of and carry out the Contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at such sites or in such facilities.

    b. Establish and maintain a current list of minority and female recruitment sources, provide written notification to minority and female recruitment sources and to community organizations when the Contractor or its unions have employment opportunities available, and maintain a record of the organization responses.

c. Maintain a current file of the names, addresses and telephone numbers of each minority and female off-the-street applicant and minority or female referral from a union, a recruitment source or community organization and of what action was taken with respect to each such individual. If such individual was sent to the union hiring hall for referral and was not referred back to the Contractor by the union or, if referred, not employed by the Contractor, this shall be documented in the file with the reason therefore, along with whatever additional actions the Contractor may have taken.

d. Provide immediate written notification to the Director when the union or unions with which the Contractor has a collective bargaining agreement has not referred to the Contractor a minority person or woman sent by the Contractor, or when the Contractor has other information that the union referral process has impeded the Contractor's efforts to meet its obligation.

e. Develop on-the-job training opportunities and/or participate in training programs for the area which expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the Contractor's employment needs, especially those programs funded or approved by the Department of Labor. The Contractor shall provide notice of these programs to the sources compiled under 7b above.

f. Disseminate the Contractor's EEO policy by providing notice of the policy to unions and training programs and requesting their cooperation in assisting the Contractor in meeting its EEO obligations; by including it in any policy manual and collective bargaining agreement; by publicizing it in the company newspaper, annual report, etc.; by specific review of the policy with all management personnel and with all minority and female employees at least once a year; and by posting the company EEO policy on bulletin boards accessible to all employees at each location where construction work is performed.

g. Review, at least annually, the company's EEO policy and affirmative action obligations under these specifications with all employees having any responsibility for hiring, assignment, layoff, termination or other employment decisions including specific review of these items with on-site supervisory personnel such as Superintendents, General Foremen, etc., prior to the initiation of construction work at any job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.

h. Disseminate the Contractor's EEO policy externally by including it in any advertising in the news media, specifically including minority and female news media, and providing written notification to an discussing the Contractor's EEO policy with other Contractors and Subcontractors with whom the Contractor does or anticipates doing business.

i. Direct its recruitment efforts, both oral and written, to minority, female and community organizations, to schools with minority and female students, and to minority and female recruitment and training organizations serving the Contractor's recruitment area and employment needs. Not later than one month prior to the date for the acceptance of applications for apprenticeship or other training by any recruitment source, the Contractor shall send written notification to organizations such as the above, describing the openings, screening procedures, and tests to be used in the selection process.

j. Encourage present minority and female employees to recruit other minority persons and women and, where reasonable, provide after school, summer and vacation employment to minority and female youth both on the site and in other areas of a Contractor's work force.

k. Validate all tests and other selection requirements where there is an obligation to do so under 41 CFR Part 60-3.

l. Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel for promotional opportunities and encourage these employees to seek or to prepare for, through appropriate training, etc., such opportunities.

m. Ensure that seniority practices, job classifications, work assignments and other personnel practices do not have a discriminatory effect by continually monitoring all personnel and employment-related activities to ensure that the EEO policy and the Contractor's obligations under these specifications are being carried out.

n. Ensure that all facilities and company activities are non-segregated, except that separate or single-user toilet and necessary changing facilities shall be provided to assure privacy between the sexes.

o. Document and maintain a record of all solicitations of offers for subcontracts from minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.

p. Conduct a review, at least annually, of all supervisors' adherence to and performance under the Contractor's EEO policies and affirmative action obligations.

8. Contractors are encouraged to participate in voluntary associations which assist in fulfilling one or more of their affirmative action obligations (7a through p). The efforts of a contractor association, joint contractor-union, contractor-community, or other similar group of which the contractor is a member and participant, may be asserted as fulfilling any one or more of its obligations under 7a through p of these Specifications provided that the Contractor actively participates in the group, makes every effort to assure that the group has a positive impact on the employment of minorities and women in the industry, ensures that the concrete benefits of the program are reflected in the Contractor's minority and female work force participation, makes a good faith effort to meet its individual goals and timetables, and can provide access to documentation which demonstrates the effectiveness of actions taken on behalf of the Contractor. The obligation to comply, however, is the Contractor's and failure of such a group to fulfill an obligation shall not be a defense for the Contractor's noncompliance.

9. A single goal for minorities and a separate single goal for women have been established. The Contractor, however, is required to provide equal employment opportunity and to take affirmative action for all minority groups, both make and female, and all women, both minority and non-minority. Consequently, the Contractor may be in violation of the Executive Order if a particular group is employed in a substantially disparate manner (for example, even though the Contractor has achieved its goals for women generally, the Contractor may be in violation of the Executive Order if a specific minority group of women is underutilized).

10. The Contractor shall not use the goals and timetables or affirmative action standards to discriminate against any person because of race, color, religion, sex, or national origin.

11. The Contractor shall not enter into any subcontract with any person or firm debarred from Government contracts pursuant to Executive Order 11246.

12. The Contractor shall carry out such sanctions and penalties for violation of these specifications and of the Equal Opportunity Clause, including suspension, termination and cancellation of existing subcontracts as may be imposed or ordered pursuant to Executive Order 11246, as amended, and its implementing regulations, by the Office of Federal Contract Compliance Programs. Any Contractor who fails to carry out such sanctions and penalties shall be in violation of these specifications and Executive Order 11246, as amended.

13. The Contractor, in fulfilling its obligations under these specifications, shall implement specific affirmative action steps, at least as extensive as those standards prescribed in paragraph 7 of these specifications, so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the Contractor fails to comply with the requirements of the Executive Order, the implementing regulations, or these specifications, the Director shall proceed in accordance with 41 CFR 60-4.8.

14. The Contractor shall designate a responsible official to monitor all employment-related activity to insure that the company EEO policy is being carried out, to submit reports relating to the provisions hereof as may be required by the Government and to keep records. Records shall at least include for each employee the name, address, telephone numbers, construction trade, union affiliation if any, employee identification number when assigned, social security number, race, sex, status (e.g., mechanic, apprentice, trainee, helper, or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily understandable and retrievable form; however, to the degree that existing records satisfy this requirement, Contractors shall not be required to maintain separate records.

15. Nothing herein provided shall be construed as a limitation upon application of other laws which establish different standards of compliance or upon the application of requirements for the hiring of local or other area residents (e.g., those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).

ENVIRONMENTAL PROTECTION AGENCY

OFFICE OF WATER PROGRAMS OPERATIONS

CERTIFICATION OF NONSEGREGATED FACILITIES

(Applicable to federally assisted construction contracts and related subcontracts exceeding $10,000 which are not exempt from the Equal Opportunity clause.*)

The federally assisted construction contractor certifies that he does not maintain or provide for his employees any segregated facilities at any of his establishments, and that he does not permit his employees to perform their services at any location, under his control, where segregated facilities are maintained.

The federally assisted construction contractor certifies further that he will not maintain or provide for his employees any segregated facilities at any of his establishments, and that he will not permit his employees to perform their services at any location, under his control, where segregated facilities are maintained.

The federally assisted construction contractor agrees that a breach of this certification is a violation of the Equal Opportunity clause in this contract.

As used in this certification, the term "segregated facilities" means any waiting rooms, work area, rest rooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms, and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation and housing facilities provided for employees which are segregated by explicit directive or are in fact segregated on the basis of race, creed, color, or national origin, because of habit, local custom, or otherwise.

The federally assisted construction contractor agrees that (except where he had obtained identical certifications from proposed subcontractors for specific time periods) he will obtain identical certifications from proposed subcontractors prior to the award of subcontracts exceeding $10,000 which are not exempt from the provisions of the Equal Opportunity clause, and that he will retain such certification in his files.

_____

Signature Date

_____

Name and Title of Signer (Please Type)

NOTE: The penalty for making false statements in offers is prescribed in 18 U.S.C. 1001.

***This document must be completed by the successful bidder and bound in the executed contract.**

DBE Rule- Program Requirements

Purpose

The Environmental Protection Agency's (EPA) Disadvantaged Business Enterprise (DBE) rule became effective on May 27, 2008. The DBE rule sets forth an EPA program that serves the compelling government interest to increase and encourage the utilization and participation of DBEs in procurements funded by EPA assistance agreements. Although the DBE rule revises and replaces EPA's Minority and Women Business Enterprise (MBE/WBE) Program, MBEs and WBEs are an integral part of the DBE rule. Because the New Hampshire State Revolving Fund (SRF) Loan Program is partially funded by EPA, the state has applied the DBE rule requirements to all SRF funded projects.

The DBE rule, 40 Code of Federal Regulations (CFR), 33 can be downloaded at:
http://www.ecfr.gov/cgi-bin/retrieveECFR?gp=&SID=cfa469998ede0f93cfcace9706a301d9&r=PART&n=40y1.0.1.2.30

State Revolving Fund loan recipients **and their contractors** must comply with the following DBE Rule Program requirements until the project period for the SRF loan has ended:

1) Fair share objectives (MBE/WBE goals);
2) Good Faith Efforts;
3) Annual Reporting of MBE/WBE accomplishments;
4) Contract Adminstration Requirements and Forms;
5) Bidders List Requirements; and
6) Reporting

The NHDES SRF programs must ensure that contracts and subcontracts that are funded with SRF loans comply with these federal requirements and must report to EPA on DBE accomplshments.

Fair Share Objectives (MBE/WBE goals)

A fair share objective is a goal based on the capacity and availability of qualified, certified MBEs and WBEs in the relevant geographic market for the procurement categories of construction, equipment, services, and supplies. The goal accounts for the number of all qualified entities in the same market for the procurement categories, adjusted, as appropriate, to reflect the level of MBE and WBE participation expected absent the effects of discrimination. A fair share objective is not a quota.

Current Fair Share Objective/Goal:

The current Fair Share Goal is 1.45% for MBEs and 6.62% for WBEs.

6 Good Faith Efforts

1. Ensure DBEs are made aware of contracting opportunities to the fullest extent practicable through outreach and recruitment activities; including placing DBEs on solicitation lists and soliciting them whenever they are potential sources.

2. Make information on forthcoming opportunities available to DBEs and arrange time frames for contracts and establish delivery schedules, where the requirements permit, in a way that encourages and facilitates participation by DBEs in the competitive process. This includes, whenever possible, posting solicitation for bids or proposals for a minimum of 30 calendar days before the bid or proposal closing date.

3. Consider in the contracting process whether firms competing for large contracts could be contracted with DBEs. This will include dividing total requirements when economically feasible into smaller tasks or quantities to permit maximum participation by DBEs in the competitive process.

4. Encourage contracting with a consortium of DBEs when a contract is too large for one of these firms to handle individually.

5. Use the services and assistance of the Small Business Administration and the Minority Business Development Agency of the U. S. Department of Commerce.

6. If the prime contractor awards subcontracts, require the prime contractor to take the steps in numbers 1 through 5 above.

Bidders List Requirements

The Loan Recipient is required to maintain a bidders list. The purpose of a bidders list is to provide loan recipients who conduct competitive bidding and the SRF Programs with as accurate a database as possible about the universe of MBE/WBE and non-MBE/WBE prime and subcontractors. The list must include all firms that bid or quote on prime contracts or bid or quote on subcontracts under EPA assisted projects, including both MBE/WBEs and non-MBE/WBEs.

The following information must be provided by the prime contractor for himself and all subcontractors who submit bids for subcontract work:

(1) Entity's name with point of contact;
(2) Entity's mailing address, telephone number, and e-mail address;
(3) The procurement on which the entity bid or quoted, and when; and
(4) Entity's status as an MBE/WBE or non-MBE/WBE.

A loan recipient whose financial assistance agreement is in the amount of $250,000 or less for any single assistance agreement, or of more than one financial assistance agreement with a combined total of $250,000 or less in any one fiscal year, is exempt from the requirement to create and maintain a bidders list.

Reporting

The Prime Contractor must provide the completed DBE Subcontractor Utilization Form and DBE Subcontractor Performance Form (EPA Forms 6100-4 and 6100-3) and shall be submitted with the bid. The Owner is required to submit these documents to NH DES when authorization to award the contract to lowest responsive and responsible BIDDER is requested.

The Loan Recipient must complete and submit a modifed version of EPA Form 5700-52A, " MBE/WBE Utilization Under Federal Grants, Coorperative Agreements and Interagency Agreements" to NHDES beginning with the federal fiscal year reporting period the Loan recipient recieves the award and continuing until the project is completed. The form has been modified to conform to NH SRF reporting requirements. **Only procurements with certified MBE/WBE's are counted toward a recipients MBE/WBE accomplishments.** The reporting period is annual, ending September 30th. The report must be submitted to the State SRF Program Administrator within 15 days of the end of the annual reporting period, October 15th.

The Contractor shall provide its MBE/WBE accomplishments to the Owner in a timely manner to allow the Owner to submit the MBE/WBE report within 15 days of the end of the reporting period.

The Owner must also submit the cumulative bidder's list to NH DES once the project is completed.

Contract Administration Requirements

All projects funded by the SRF program require the contractor to:

1. Pay all subcontractors for satisfactory performance no more than 30 days from the prime contractor's receipt of payment from the loan recipient. (also reference General Conditions article 26.3)

2. Notify the loan recipient in writing prior to the termination of any DBE subcontractor for convenience by the prime contractor.

3. Employ the six good faith efforts when soliciting a replacement subcontractor if a DBE subcontractor fails to complete work under the subcontract for any reason.

4. Employ the six good faith efforts even if the prime contractor has achieved its fair share objectives.

5. Each procurement contract executed by the prime contractor with a supplier or subcontractor must include the following term and condition:

The contractor shall not discriminate on the basis of race, color, national origin or sex in the performance of this contract. The contractor shall carry out applicable requirements of 40 CFR part 33 in the award and administration of contracts awarded under EPA financial assistance agreements. Failure by the contractor to carry out these requirements is a material breach of this contract which may result in the termination of this contract or other legally ava**ilable remedies.** (Appendix A to Part 33—Term and Condition)

United States Environmental Protection Agency

OMB Control No: 2090-0030
Approved: 8/13/2013
Approval Expires: 8/31/2015

Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Participation Form

An EPA Financial Assistance Agreement Recipient must require its prime contractors to provide this form to its DBE subcontractors. This form gives a DBE[1] subcontractor[2] the opportunity to describe work received and/or report any concerns regarding the EPA-funded project (e.g., in areas such as termination by prime contractor, late payments, etc.). The DBE subcontractor can, as an option, complete and submit this form to the EPA DBE Coordinator at any time during the project period of performance.

Subcontractor Name	Project Name	
Bid/ Proposal No.	Assistance Agreement ID No. (if known)	Point of Contact
Address		
Telephone No.	Email Address	
Prime Contractor Name	Issuing/Funding Entity:	

Contract Item Number	Description of Work Received from the Prime Contractor Involving Construction, Services , Equipment or Supplies	Amount Received by Prime Contractor

[1] A DBE is a Disadvantaged, Minority, or Woman Business Enterprise that has been certified by an entity from which EPA accepts certifications as described in 40 CFR 33.204-33.205 or certified by EPA. EPA accepts certifications from entities that meet or exceed EPA certification standards as described in 40 CFR 33.202.

[2] Subcontractor is defined as a company, firm, joint venture, or individual who enters into an agreement with a contractor to provide services pursuant to an EPA award of financial assistance.

United States Environmental Protection Agency

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Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Participation Form

Please use the space below to report any concerns regarding the above EPA-funded project:

Subcontractor Signature	Print Name
Title	**Date**

The public reporting and recordkeeping burden for this collection of information is estimated to average three (3) hours per response. Send comments on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, including through the use of automated collection techniques to the Director, Collection Strategies Division, U.S. Environmental Protection Agency (2822T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460. Include the OMB control number in any correspondence. Do not send the completed form to this address.

United States Environmental Protection Agency

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Approval Expires: 8/31/2015

Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Performance Form

This form is intended to capture the DBE[1] subcontractor's[2] description of work to be performed and the price of the work submitted to the prime contractor. An EPA Financial Assistance Agreement Recipient must require its prime contractor to have its DBE subcontractors complete this form and include all completed forms in the prime contractors bid or proposal package.

Subcontractor Name		Project Name
Bid/ Proposal No.	Assistance Agreement ID No. (if known)	Point of Contact
Address		
Telephone No.		Email Address
Prime Contractor Name		Issuing/Funding Entity:

Contract Item Number	Description of Work Submitted to the Prime Contractor Involving Construction, Services , Equipment or Supplies	Price of Work Submitted to the Prime Contractor

DBE Certified By: ___ DOT ___ SBA ___ Other: _____	Meets/ exceeds EPA certification standards? ___ YES ___ NO ___ Unknown

[1] A DBE is a Disadvantaged, Minority, or Woman Business Enterprise that has been certified by an entity from which EPA accepts certifications as described in 40 CFR 33.204-33.205 or certified by EPA. EPA accepts certifications from entities that meet or exceed EPA certification standards as described in 40 CFR 33.202.

[2] Subcontractor is defined as a company, firm, joint venture, or individual who enters into an agreement with a contractor to provide services pursuant to an EPA award of financial assistance.

United States Environmental Protection Agency

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Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Performance Form

I certify under penalty of perjury that the forgoing statements are true and correct. Signing this form does not signify a commitment to utilize the subcontractors above. I am aware of that in the event of a replacement of a subcontractor, I will adhere to the replacement requirements set forth in 40 CFR Part 33 Section 33.302 (c).

Prime Contractor Signature	Print Name
Title	**Date**

Subcontractor Signature	Print Name
Title	**Date**

The public reporting and recordkeeping burden for this collection of information is estimated to average three (3) hours per response. Send comments on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, including through the use of automated collection techniques to the Director, Collection Strategies Division, U.S. Environmental Protection Agency (2822T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460. Include the OMB control number in any correspondence. Do not send the completed form to this address.

United States Environmental Protection Agency

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Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Utilization Form

This form is intended to capture the prime contractor's actual and/or anticipated use of identified certified DBE[1] subcontractors[2] and the estimated dollar amount of each subcontract. An EPA Financial Assistance Agreement Recipient must require its prime contractors to complete this form and include it in the bid or proposal package. Prime contractors should also maintain a copy of this form on file.

Prime Contractor Name		Project Name
Bid/ Proposal No.	Assistance Agreement ID No. (if known)	Point of Contact
Address		
Telephone No.		Email Address
Issuing/Funding Entity:		

I have identified potential DBE certified subcontractors	☐ YES	☐ NO
If yes, please complete the table below. If no, please explain:		

Subcontractor Name/ Company Name	Company Address/ Phone/ Email	Est. Dollar Amt	Currently DBE Certified?

Continue on back if needed

[1] A DBE is a Disadvantaged, Minority, or Woman Business Enterprise that has been certified by an entity from which EPA accepts certifications as described in 40 CFR 33.204-33.205 or certified by EPA. EPA accepts certifications from entities that meet or exceed EPA certification standards as described in 40 CFR 33.202.

[2] Subcontractor is defined as a company, firm, joint venture, or individual who enters into an agreement with a contractor to provide services pursuant to an EPA award of financial assistance.

United States Environmental Protection Agency

OMB Control No: 2090-0030
Approved: 8/13/2013
Approval Expires: 8/31/2015

Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Utilization Form

I certify under penalty of perjury that the forgoing statements are true and correct. Signing this form does not signify a commitment to utilize the subcontractors above. I am aware of that in the event of a replacement of a subcontractor, I will adhere to the replacement requirements set forth in 40 CFR Part 33 Section 33.302 (c).

Prime Contractor Signature	Print Name
Title	**Date**

The public reporting and recordkeeping burden for this collection of information is estimated to average three (3) hours per response. Send comments on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, including through the use of automated collection techniques to the Director, Collection Strategies Division, U.S. Environmental Protection Agency (2822T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460. Include the OMB control number in any correspondence. Do not send the completed form to this address.

New Hampshire State Revolving Fund
BIDDERS LIST

Prime Contractors must submit a bidders list for SRF-funded projects in accordance with 40 CFR § 33.501. The list must include information regarding all entities that bid or quote on prime contracts or bid or quote on subcontracts under EPA assisted projects, including both DBEs and non-DBEs. Projects with financial assistance agreement totals of $250,000 or less are exempt from this requirement.
Completed form must be submitted once substantial completion of the project has been achieved, and prior to substantial completion upon request by the OWNER.

Firm Name, Contact, & Address	Phone/ E-mail/Fax	Contract Item No. and Description of Work to be Performed	Currently Certified DBE?	Awarded Contract?	Estimated Award Amount
Name & Contact	*Phone*		YES ☐ WBE; or ☐ MBE ☐ NO	☐ YES ☐ NO *Date*	$
Address	*E-mail*				
City State Zip	*Fax*				
Name & Contact	*Phone*		YES ☐ WBE; or ☐ MBE ☐ NO	☐ YES ☐ NO *Date*	$
Address	*E-mail*				
City State Zip	*Fax*				
Name & Contact	*Phone*		YES ☐ WBE; or ☐ MBE ☐ NO	☐ YES ☐ NO *Date*	$
Address	*E-mail*				
City State Zip	*Fax*				
Name & Contact	*Phone*		YES ☐ WBE; or ☐ MBE ☐ NO	☐ YES ☐ NO *Date*	$
Address	*E-mail*				
City State Zip	*Fax*				
Name & Contact	*Phone*		YES ☐ WBE; or ☐ MBE ☐ NO	☐ YES ☐ NO *Date*	$
Address	*E-mail*				
City State Zip	*Fax*				

D-7.1

American Iron and Steel

P.L. 113-76, Consolidated Appropriations Act, 2014 (Act), includes an "American Iron and Steel (AIS)" requirement in section 436 that requires that this project use iron and steel products that are produced in the United States. Section 436 also sets forth certain circumstances under which EPA may waive the AIS requirement.

The Act states:

Sec. 436. (a)(1) None of the funds made available by a State water pollution control revolving fund as authorized by title VI of the Federal Water Pollution Control Act (33 U.S.C. 1381 et seq.) or made available by a drinking water treatment revolving loan fund as authorized by section 1452 of the Safe Drinking Water Act (42 U.S.C. 300j–12) shall be used for a project for the construction, alteration, maintenance, or repair of a public water system or treatment works unless all of the iron and steel products used in the project are produced in the United States.

(2) In this section, the term ''iron and steel products'' means the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and construction materials.

(b) Subsection (a) shall not apply in any case or category of cases in which the Administrator of the Environmental Protection Agency (in this section referred to as the ''Administrator'') finds that—

(1) applying subsection (a) would be inconsistent with the public interest;

(2) iron and steel products are not produced in the United States in sufficient and reasonably available quantities and of a satisfactory quality; or

(3) inclusion of iron and steel products produced in the United States will increase the cost of the overall project by more than 25 percent.

(c) If the Administrator receives a request for a waiver under this section, the Administrator shall make available to the public on an informal basis a copy of the request and information available to the Administrator concerning the request, and shall allow for informal public input on the request for at least 15 days prior to making a finding based on the request. The Administrator shall make the request and accompanying information available by electronic means, including on the official public Internet Website of the Environmental Protection Agency.

(d) This section shall be applied in a manner consistent with United States obligations under international agreements.

(e) The Administrator may retain up to 0.25 percent of the funds appropriated in this Act for the Clean and Drinking Water State Revolving Funds for carrying out the provisions described in subsection (a)(1) for management and oversight of the requirements of this section.

(f) This section does not apply with respect to a project if a State agency approves the engineering plans and specifications for the project, in that agency's capacity to approve such plans and specifications prior to a project requesting bids, prior to the date of the enactment of this Act.

D-7.2

American Iron and Steel

The following questions and answers provide guidance for implementing and complying with the AIS requirements:

Covered Iron and Steel Products

1) What is an iron or steel product?

An iron or steel product is one of the following made primarily of iron or steel that is permanently incorporated into the public water system or treatment works:

Lined or unlined pipes or fittings;
Manhole Covers;
Municipal Castings (defined in more detail below);
Hydrants;
Tanks;
Flanges;
Pipe clamps and restraints;
Valves;
Structural steel (defined in more detail below);
Reinforced precast concrete; and
Construction materials (defined in more detail below).

2) What does the term 'primarily iron or steel' mean?

'Primarily iron or steel' places constraints on the list of products above. For one of the listed products to be considered subject to the AIS requirements, it must be made of greater than 50% iron or steel, measured by cost. The cost should be based on the material costs.

3) Can you provide an example of how to perform a cost determination?

For example, the iron portion of a fire hydrant would likely be the bonnet, body and shoe, and the cost then would include the pouring and casting to create those components. The other material costs would include non-iron and steel internal workings of the fire hydrant (i.e., stem, coupling, valve, seals, etc). However, the assembly of the internal workings into the hydrant body would not be included in this cost calculation. If one of the listed products is not made primarily of iron or steel, United States (US) provenance is not required. An exception to this definition is reinforced precast concrete, which is addressed in a later question.

4) If a product is composed of more than 50% iron or steel, but is not listed in the above list of items, must the item be produced in the US? Alternatively, must the iron or steel in such a product be produced in the US?

The answer to both question is no. Only items on the above list must be produced in the US. Additionally, the iron or steel in a non-listed item can be sourced from outside the US.

American Iron and Steel

5) What is the definition of steel?

Steel means an alloy that includes at least 50 percent iron, between .02 and 2 percent carbon, and may include other elements. Metallic elements such as chromium, nickel, molybdenum, manganese, and silicon may be added during the melting of steel for the purpose of enhancing properties such as corrosion resistance, hardness, or strength. The definition of steel covers carbon steel, alloy steel, stainless steel, tool steel and other specialty steels.

6) What does 'produced in the United States' mean?

Production in the United States of the iron or steel products used in the project requires that all manufacturing processes, including application of coatings, must take place in the United States, with the exception of metallurgical processes involving refinement of steel additives. All manufacturing processes includes processes such as melting, refining, forming, rolling, drawing, finishing, fabricating and coating. Further, if a domestic iron and steel product is taken out of the US for any part of the manufacturing process, it becomes foreign source material. However, raw materials such as iron ore, limestone and iron and steel scrap are not covered by the AIS requirement, and the material(s), if any, being applied as a coating are similarly not covered. Non-iron or steel components of an iron and steel product may come from non-US sources. For example, for products such as valves and hydrants, the individual non-iron and steel components do not have to be of domestic origin.

7) Are the raw materials used in the production of iron or steel required to come from US sources?

No. Raw materials, such as iron ore, limestone, scrap iron, and scrap steel, can come from non-US sources.

8) If an above listed item is primarily made of iron or steel, but is only at the construction site temporarily, must such an item be produced in the US?

No. Only the above listed products made primarily of iron or steel, permanently incorporated into the project must be produced in the US. For example trench boxes, scaffolding or equipment, which are removed from the project site upon completion of the project, are not required to be made of U.S. Iron or Steel.

9) What is the definition of 'municipal castings'?

Municipal castings are cast iron or steel infrastructure products that are melted and cast. They typically provide access, protection, or housing for components incorporated into utility owned drinking water, storm water, wastewater, and surface infrastructure. They are typically made of grey or ductile iron, or steel. Examples of municipal castings are:

Access Hatches;
Ballast Screen;
Benches (Iron or Steel);
Bollards;
Cast Bases;
Cast Iron Hinged Hatches, Square and Rectangular;
Cast Iron Riser Rings;
Catch Basin Inlet;
Cleanout/Monument Boxes;
Construction Covers and Frames;
Curb and Corner Guards;
Curb Openings;
Detectable Warning Plates;
Downspout Shoes (Boot, Inlet);
Drainage Grates, Frames and Curb Inlets;
Inlets;
Junction Boxes;
Lampposts;
Manhole Covers, Rings and Frames, Risers;
Meter Boxes; Service Boxes;
Steel Hinged Hatches, Square and Rectangular;
Steel Riser Rings;
Trash receptacles;
Tree Grates;
Tree Guards;
Trench Grates; and
Valve Boxes, Covers and Risers.

10) What is 'structural steel'?

Structural steel is rolled flanged shapes, having at least one dimension of their cross-section three inches or greater, which are used in the construction of bridges, buildings, ships, railroad rolling stock, and for numerous other constructional purposes. Such shapes are designated as wide-flange shapes, standard I-beams, channels, angles, tees and zees. Other shapes include H-piles, sheet piling, tie plates, cross ties, and those for other special purposes.

11) What is a 'construction material' for purposes of the AIS requirement?

Construction materials are those articles, materials, or supplies made primarily of iron and steel, that are permanently incorporated into the project, not including mechanical and/or electrical components, equipment and systems. Some of these products may overlap with what is also considered "structural steel". This includes, but is not limited to, the following products: wire rod, bar, angles, concrete reinforcing bar, wire, wire cloth, wire rope and cables, tubing, framing, joists, trusses, fasteners (i.e., nuts and bolts), welding rods, decking, grating, railings, stairs, access ramps, fire escapes, ladders, wall panels, dome structures, roofing, ductwork, surface drains, cable hanging

systems, manhole steps, fencing and fence tubing, guardrails, doors, and stationary screens.

12) What is not considered a 'construction material' for purposes of the AIS requirement?

Mechanical and electrical components, equipment and systems are not considered construction materials. Mechanical equipment is typically that which has motorized parts and/or is powered by a motor. Electrical equipment is typically any machine powered by electricity and includes components that are part of the electrical distribution system.

The following examples (including their appurtenances necessary for their intended use and operation) are NOT considered construction materials: pumps, motors, gear reducers, drives (including variable frequency drives (VFDs)), electric/pneumatic/manual accessories used to operate valves (such as electric valve actuators), mixers, gates, motorized screens (such as traveling screens), blowers/aeration equipment, compressors, meters, sensors, controls and switches, supervisory control and data acquisition (SCADA), membrane bioreactor systems, membrane filtration systems, filters, clarifiers and clarifier mechanisms, rakes, grinders, disinfection systems, presses (including belt presses), conveyors, cranes, HVAC (excluding ductwork), water heaters, heat exchangers, generators, cabinetry and housings (such as electrical boxes/enclosures), lighting fixtures, electrical conduit, emergency life systems, metal office furniture, shelving, laboratory equipment, analytical instrumentation, and dewatering equipment.

13) If the iron or steel is produced in the US, may other steps in the manufacturing process take place outside of the US, such as assembly?

No. Production in the US of the iron or steel used in a listed product requires that all manufacturing processes must take place in the United States, except metallurgical processes involving refinement of steel additives.

14) What processes must occur in the US to be compliant with the AIS requirement for reinforced precast concrete?

While reinforced precast concrete may not be at least 50% iron or steel, in this particular case, the reinforcing bar and wire must be produced in the US and meet the same standards as for any other iron or steel product. Additionally, the casting of the concrete product must take place in the US. The cement and other raw materials used in concrete production are not required to be of domestic origin.

If the reinforced concrete is cast at the construction site, the reinforcing bar and wire are considered to be a construction material and must be produced in the US.

Compliance

15) How should an SRF loan recipient document compliance with the AIS

requirement?

In order to ensure compliance with the AIS requirement, specific AIS contract language must be included in each contract, starting with the SRF loan agreement, all the way down to the purchase agreements. **Required contract language that the Contractor must include in all subcontracts and purchase agreements under this Contract is included in AIS Appendix 4.**

The EPA guidance includes the language below on two AIS certification processes. **Both processes are acceptable**.

(a) **Step Certification** - EPA recommends the use of a step certification process, similar to one used by the Federal Highway Administration. The step certification process is a method to ensure that producers adhere to the AIS requirement and SRF loan recipients can verify that products comply with the AIS requirement. The process also establishes accountability and better enables States to take enforcement actions against violators.

Step certification creates a paper trail which documents the location of the manufacturing process involved with the production of steel and iron materials. A step certification is a process under which each handler (supplier, fabricator, manufacturer, processor, etc) of the iron and steel products certifies that their step in the process was domestically performed. Each time a step in the manufacturing process takes place, the manufacturer delivers its work along with a certification of its origin. A certification can be quite simple. Typically, it includes the name of the manufacturer, the location of the manufacturing facility where the product or process took place (not its headquarters), a description of the product or item being delivered, and a signature by a manufacturer's responsible party.

(b) **Certification by the final manufacturer** - Alternatively, the final manufacturer that delivers the iron or steel product to the worksite, vendor, or contractor, may provide a certification asserting that all manufacturing processes occurred in the US. While this type of certification may be acceptable, it may not provide the same degree of assurance. Additional documentation may be needed if the certification is lacking important information. Step certification is the best practice.

Attached, in **AIS Appendix 3**, is an example "American Iron and Steel Manufacturer Certification" which must be completed by manufacturers, collected by the Contractor and submitted to the Owner.

American Iron and Steel

Waiver Process

The statute permits EPA to issue waivers for a case or category of cases where EPA finds (1) that applying these requirements would be inconsistent with the public interest; (2) iron and steel products are not produced in the US in sufficient and reasonably available quantities and of a satisfactory quality; or (3) inclusion of iron and steel products produced in the US will increase the cost of the overall project by more than 25 percent.

In order to implement the AIS requirements, EPA has developed an approach to allow for effective and efficient implementation of the waiver process to allow projects to proceed in a timely manner. The framework described below will allow States, on behalf of the SRF loan recipients recipients, to apply for waivers of the AIS requirement directly to EPA Headquarters. Only waiver requests received from states will be considered. Pursuant to the Act, EPA has the responsibility to make findings as to the issuance of waivers to the AIS requirements.

Definitions

The following terms are critical to the interpretation and implementation of the AIS requirements and apply to the process described in this memorandum:

Reasonably Available Quantity: The quantity of iron or steel products is available or will be available at the time needed and place needed, and in the proper form or specification as specified in the project plans and design.

Satisfactory Quality: The quality of iron or steel products, as specified in the project plans and designs.

Assistance Recipient: A borrower or grantee that receives funding from a State CWSRF or DWSRF program.

Step-By-Step Waiver Process

Application by Assistance Recipient

Each local entity that receives SRF water infrastructure financial assistance is required by section 436 of the Act to use American made iron and steel products in the construction of its project. However, the recipient may request a waiver. Until a waiver is granted by EPA, the AIS requirement stands, except as noted above with respect to municipalities covered by international agreements.

The waiver process begins with the SRF assistance recipient. In order to fulfill the AIS requirement, the assistance recipient must in good faith design the project (where applicable) and solicit bids for construction with American made iron and steel products. It is essential that the assistance recipient include the AIS terms in any request for proposals or solicitations for bids, and in all contracts (see **AIS Appendix 4 for language that the Contractor must include in all subcontracts and purchase agreements under this**

Contract). The assistance recipient may receive a waiver at any point before, during, or after the bid process, if one or more of three conditions is met:

1. Applying the American Iron and Steel requirements of the Act would be inconsistent with the public interest;
2. Iron and steel products are not produced in the United States in sufficient and reasonably available quantities and of a satisfactory quality; or
3. Inclusion of iron and steel products produced in the United States will increase the cost of the overall project by more than 25 percent.

Proper and sufficient documentation must be provided by the assistance recipient. A checklist detailing the types of information required for a waiver to be processed is attached as **AIS Appendix 1**.

Additionally, it is strongly encouraged that assistance recipients hold pre-bid conferences with potential bidders. A pre-bid conference can help to identify iron and steel products needed to complete the project as described in the plans and specifications that may not be available from domestic sources. It may also identify the need to seek a waiver prior to bid, and can help inform the recipient on compliance options.

In order to apply for a project waiver, the assistance recipient should email the request in the form of a Word document (.doc) to the State SRF program. It is strongly recommended that the State designate a single person for all AIS communications. The State SRF designee will review the application for the waiver and determine whether the necessary information has been included. Once the waiver application is complete, the State designee will forward the application to either of two email addresses. For CWSRF waiver requests, please send the application to: cwsrfwaiver@epa.gov. For DWSRF waiver requests, please send the application to: dwsrfwaiver@epa.gov.

Evaluation by EPA

After receiving an application for waiver of the AIS requirements, EPA Headquarters will publish the request on its website for 15 days and receive informal comment. EPA Headquarters will then use the checklist in **AIS Appendix 2** to determine whether the application properly and adequately documents and justifies the statutory basis cited for the waiver – that it is quantitatively and qualitatively sufficient – and to determine whether or not to grant the waiver.

In the event that EPA finds that adequate documentation and justification has been submitted, the Administrator may grant a waiver to the assistance recipient. EPA will notify the State designee that a waiver request has been approved or denied as soon as such a decision has been made. Granting such a waiver is a three-step process:

1. Posting – After receiving an application for a waiver, EPA is required to publish the application and all material submitted with the application on EPA's website for 15 days. During that period, the public will have the opportunity to review the request and provide

informal comment to EPA. The website can be found at:
http://water.epa.gov/grants_funding/aisrequirement.cfm

2. Evaluation – After receiving an application for waiver of the AIS requirements, EPA Headquarters will use the checklist in **AIS Appendix 2** to determine whether the application properly and adequately documents and justifies the statutory basis cited for the waiver – that it is quantitatively and qualitatively sufficient – and to determine whether or not to grant the waiver.

3. Signature of waiver approval by the Administrator or another agency official with delegated authority – As soon as the waiver is signed and dated, EPA will notify the State SRF program, and post the signed waiver on our website. The assistance recipient should keep a copy of the signed waiver in its project files.

Public Interest Waivers

EPA has the authority to issue public interest waivers. Evaluation of a public interest waiver request may be more complicated than that of other waiver requests so they may take more time than other waiver requests for a decision to be made. An example of a public interest waiver that might be issued could be for a community that has standardized on a particular type or manufacturer of a valve because of its performance to meet their specifications. Switching to an alternative valve may require staff to be trained on the new equipment and additional spare parts would need to be purchased and stocked, existing valves may need to be unnecessarily replaced, and portions of the system may need to be redesigned. Therefore, requiring the community to install an alternative valve would be inconsistent with public interest.

EPA also has the authority to issue a public interest waiver that covers categories of products that might apply to all projects.

EPA reserves the right to issue national waivers that may apply to particular classes of assistance recipients, particular classes of projects, or particular categories of iron or steel products. EPA may develop national or (US geographic) regional categorical waivers through the identification of similar circumstances in the detailed justifications presented to EPA in a waiver request or requests. EPA may issue a national waiver based on policy decisions regarding the public's interest or a determination that a particular item is not produced domestically in reasonably available quantities or of a sufficient quality. In such cases, EPA may determine it is necessary to issue a national waiver.

Additional AIS Information

EPA's State Revolving Fund American Iron and Steel Requirement website includes additional information on American iron and steel requirements and waivers. The website address is as follows: http://water.epa.gov/grants_funding/aisrequirement.cfm

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AIS Appendix 1: Information Checklist for Waiver Request

The purpose of this checklist is to help ensure that all appropriate and necessary information is submitted to EPA. T his checklist is for informational purposes only and does not need to be included as part of a waiver application.

Ite	☐	Note
General • Waiver request includes the following information: — Description of the foreign and domestic construction materials — Unit of measure — Quantity — Price — Time of delivery or availability — Location of the construction project — Name and address of the proposed supplier — A detailed justification for the use of foreign construction materials • Waiver request was submitted according to the instructions in the memorandum • Assistance recipient made a good faith effort to solicit bids for domestic iron and steel products, as demonstrated by language in requests for proposals, contracts, and communications with the prime contractor		
Cost Waiver Requests • Waiver request includes the following information: — Comparison of overall cost of project with domestic iron and steel products to overall cost of project with foreign iron and steel products — Relevant excerpts from the bid documents used by the contractors to complete the comparison — Supporting documentation indicating that the contractor made a reasonable survey of the market, such as a description of the process for identifying suppliers and a list of contacted suppliers		

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Availability Waiver Requests • Waiver request includes the following supporting documentation necessary to demonstrate the availability, quantity, and/or quality of the materials for which the waiver is requested: — Supplier information or pricing information from a reasonable number of domestic suppliers indicating availability/delivery date for construction materials — Documentation of the assistance recipient's efforts to find available domestic sources, such as a description of the process for identifying suppliers and a list of contacted suppliers. — Project schedule — Relevant excerpts from project plans, specifications, and permits indicating the required quantity and quality of construction materials • Waiver request includes a statement from the prime contractor and/or supplier confirming the non-availability of the domestic construction materials for which the waiver is sought • Has the State received other waiver requests for the materials described in this waiver request, for comparable projects?		

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AIS Appendix 2: EPA Headquarters Review Checklist for Waiver Request

To be completed by EPA (Included here for information only)

Instructions: Review all waiver requests using the questions in the checklist, and mark the appropriate box as Yes, No or N/A. Marks that fall inside the shaded boxes may be grounds for denying the waiver. If none of your review markings fall into a shaded box, the waiver is eligible for approval if it indicates that one or more of the following conditions applies to the domestic product for which the waiver is sought:

1. The iron and/or steel products are not produced in the United States in sufficient and reasonably available quantities and of a satisfactory quality.
2. The inclusion of iron and/or steel products produced in the United States will increase the cost of the overall project by more than 25 percent.

Review Items	Yes	No	N/A	Comments
Cost Waiver Requests				
• Does the waiver request include the following information?				
— Comparison of overall cost of project with domestic iron and steel products to overall cost of project with foreign iron and steel products				
— Relevant excerpts from the bid documents used by the contractors to complete the comparison				
— A sufficient number of bid documents or pricing information from domestic sources to constitute a reasonable survey of the market				
• Does the Total Domestic Project exceed the Total Foreign Project Cost by more than 25%?				
Availability Waiver Requests				
• Does the waiver request include supporting documentation sufficient to show the availability, quantity, and/or quality of the iron and/or steel product for which the waiver is requested?				
— Supplier information or other documentation indicating availability/delivery date for materials				
— Project schedule				
— Relevant excerpts from project plans, specifications, and permits indicating the required quantity and quality of materials				
• Does supporting documentation provide sufficient evidence that the contractors made a reasonable effort to locate domestic suppliers of materials, such as a description of the process for identifying suppliers and a list of contacted suppliers?				
• Based on the materials delivery/availability date indicated in the supporting documentation, will the materials be unavailable when they are needed according to the project schedule? (By item, list schedule date and domestic delivery quote date or other relevant information)				
• Is EPA aware of any other evidence indicating the non-availability of the materials for which the waiver is requested? Examples include:				
— Multiple waiver requests for the materials described in this waiver request, for comparable projects in the same State				
— Multiple waiver requests for the materials described in this waiver request, for comparable projects in other States				
— Correspondence with construction trade associations indicating the non-availability of the materials				
• Are the available domestic materials indicated in the bid documents of inadequate quality compared those required by the project plans, specifications, and/or permits?				

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American Iron and Steel

AIS Appendix 3: American Iron and Steel Manufacturer Certification

Date _____

Manufacturer Name _____

Manufacturer Address _____

City, State Zip _____

Project Name _____

1. Complete (a) or (b) below as applicable

   (a) **Step Certification:** I, _____ (Authorized Manufacturer Representative) hereby certify that the _____(melting, bending, coating, galvanizing, cutting, etc.) process for _____(manufacturing or fabricating) the following products and/or materials shipped or provided for the subject project is in full compliance with the American Iron and Steel requirement as mandated in EPA's State Revolving Fund Programs.

   Item, Products and/or Material_____
   Item, Products and/or Material_____
   Item, Products and/or Material_____

   Such process took place at the following location: _____

   (b) **Certification by the Final Manufacturer**: I, _____ (Authorized Manufacturer Representative), certify that the following products and/or materials shipped/provided to the subject project are in full compliance with the American Iron and Steel requirement as mandated in EPA's State Revolving Fund Programs.

   Item, Products and/or Materials_____
   Item, Products and/or Materials_____
   Item, Products and/or Materials_____

   Such process took place at the following location(s): _____
   _____

Additionally, if any of the above compliance statements change while providing material to this project _____(Manufacturer) will immediately notify _____ (Contractor) and the _____(Owner).

_____ _____
(Signature of Authorized Manufacturer Representative) (Date)

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American Iron and Steel

AIS Appendix 4: Required Subcontract and Purchase Agreement Language

The Contractor shall include in all contracts and purchase agreements for this project the following American Iron and Steel contract language:

*"_____ (Subcontractor/Supplier) acknowledges to and for the benefit of the _____ (Owner) and the State of New Hampshire (State) that it understands the goods and service under this contract or purchase agreement (Agreement) are being funded with monies that are subject to statutory requirements commonly known as "American Iron and Steel;" (*P.L. 113-76, Consolidated Appropriation Act, 2014, section 436*) that requires all of the iron and steel products used in the project to be produced in the United States ("American Iron and Steel Requirement") including iron and steel products provided under this contract or Agreement. The Subcontractor/Supplier hereby represents and warrants to and for the benefit of the Owner and the State that (a) the Subcontractor/Supplier has reviewed and understands the American Iron and Steel Requirement, (b) all of the iron and steel products used in the project will be and/or have been produced in the United States in a manner that complies with the American Iron and Steel Requirement, unless a waiver of the requirement is approved, and (c) the Subcontractor/Supplier will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the American Iron and Steel Requirement, as may be requested by the Owner or the State."*

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BIDDER'S AMERICAN IRON AND STEEL ACKNOWLEDGEMENT

Instructions: This acknowledgement form must be completed and signed by the Bidder's authorized representative, and conveyed to Owner with bid submittal.

Project Name: _____

City/Town/Entity: _____

Bidder Name: _____

Bidder Address: _____

With submittal of this Bid, the Bidder acknowledges to and for the benefit of the Owner and the State of New Hampshire (State) that it understands that this project is subject to the "American Iron and Steel (AIS)" requirement of P.L. 113-76, Consolidated Appropriation Act, 2014 (Act), section 436 that requires all of the iron and steel used in the project be produced in the United States ("American Iron and Steel Requirement") including all iron and steel goods provided by the Bidder pursuant to this Bid.

The Bidder hereby presents and warrants to and for the benefit of the Owner and State that (a) the Bidder has reviewed and understands the American Iron and Steel Requirement, (b) all of the iron and steel products used in the project will be and/or have been produced in the United States in a manner that complies with the American Iron and Steel Requirement, unless a waiver of the requirement is approved, and (c) the Bidder will provide any further verified information, certification or assurance of compliance with this Acknowledgement, or information necessary to support a waiver of the American Iron and Steel Requirement, as may be requested by the Owner or the State

Notwithstanding any other provision of the Contract Documents, any failure to comply with this Acknowledgement by the Bidder shall permit the Owner or State to recover as damages against the Bidder any loss, expense, or cost (including without limitation attorney's fees) incurred by the Owner or State resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the State or any damages owed to the State by the Owner).

Additionally, The Bidder hereby acknowledges that Bidder must include in all contracts and purchase agreements for this project the following American Iron and Steel contract language:

*"_____ (Subcontractor/Supplier) acknowledges to and for the benefit of the _____ (Owner) and the State of New Hampshire (State) that it understands the goods and service under this contract or purchase agreement (Agreement) are being funded with monies that are subject to statutory requirements commonly known as "American Iron and Steel;" (*P.L. 113-76, Consolidated Appropriation Act, 2014, section 436*) that requires all of the iron and steel products used in the project to be produced in the United States ("American Iron and Steel Requirement") including iron and steel products provided under this contract or Agreement. The Subcontractor/Supplier hereby represents and warrants to and for the benefit of the Owner and the State that (a) the Subcontractor/Supplier has reviewed and understands the American Iron and Steel Requirement, (b) all of the iron and steel products used in the project will be and/or have been produced in the United States in a manner that complies with the American Iron and Steel Requirement, unless a waiver of the requirement is approved, and (c) the Subcontractor/Supplier will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the American Iron and Steel Requirement, as may be requested by the Owner or the State.*

_____ _____

(Signature of Certifying Bidder Representative) **(Date)**

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American Iron and Steel

DE MINIMIS WAIVER

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF WATER

DECISION MEMORANDUM

SUBJECT: De Minimis Waiver of Section 436 of P.L. 113-76, Consolidated Appropriations Act (CAA), 2014

FROM: Nancy K. Stoner
Acting Assistant Administrator

The EPA is hereby granting a nationwide waiver pursuant to the "American Iron and Steel (AIS)" requirements of P.L. 113-76, Consolidated Appropriations Act, 2014 (Act), section 436 under the authority of Section 436(b)(1) (public interest waiver) for de minimis incidental components of eligible water infrastructure projects. This action permits the use of products when they occur in de minimis incidental components of such projects funded by the Act that may otherwise be prohibited under section 436(a). Funds used for such de minimis incidental components cumulatively may comprise no more than a total of 5 percent of the total cost of the materials used in and incorporated into a project; the cost of an individual item may not exceed 1 percent of the total cost of the materials used in and incorporated into a project.

P.L. 113-76, Consolidated Appropriations Act, 2014 (Act), includes an "American Iron and Steel" (AIS) requirement in section 436 that requires Clean Water State Revolving Loan Fund (CWSRF) and Drinking Water State Revolving Loan Fund (DWSRF) assistance recipients to use specific domestic iron and steel products that are produced in the United States if the project is funded through an assistance agreement executed beginning January 17, 2014 (enactment of the Act), through the end of Fiscal Year 2014, unless the agency determines it necessary to waive this requirement based on findings set forth in Section 436(b). The Act states, "[the requirements] shall not apply in any case or category of cases in which the Administrator of the Environmental Protection Agency…finds that— (1) applying subsection (a) would be inconsistent with the public interest" 436(b)(1).

In implementing section 436 of the Act, the EPA must ensure that the section's requirements are applied consistent with congressional intent in adopting this section and in the broader context of the purposes, objectives, and other provisions applicable to projects funded under the SRF. Water infrastructure projects typically contain a relatively small number of high-cost components incorporated into the project. In bid solicitations for a project, these high-cost components are generally described in detail via project specific technical specifications. For these major components, utility owners and their contractors are generally familiar with the conditions of availability, the potential alternatives for each detailed specification, the approximate cost, and the country of manufacture of the available components.

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American Iron and Steel

Every water infrastructure project also involves the use of thousands of miscellaneous, generally low-cost components that are essential for, but incidental to, the construction and are incorporated into the physical structure of the project. For many of these incidental components, the country of manufacture and the availability of alternatives is not always readily or reasonably identifiable prior to procurement in the normal course of business; for other incidental components, the country of manufacture may be known but the miscellaneous character in conjunction with the low cost, individually and (in total) as typically procured in bulk, mark them as properly incidental. Examples of incidental components could include small washers, screws, fasteners (i.e., nuts and bolts), miscellaneous wire, corner bead, ancillary tube, etc. Examples of items that are clearly not incidental include significant process fittings (i.e., tees, elbows, flanges, and brackets), distribution system fittings and valves, force main valves, pipes for sewer collection and/or water distribution, treatment and storage tanks, large structural support structures, etc.

The EPA undertook multiple inquiries to identify the approximate scope of de minimis incidental components within water infrastructure projects during the implementation of the American Reinvestment and Recovery Act (ARRA) and its requirements (Buy American provisions, specifically). The inquiries and research conducted in 2009 applies suitably for the case today. In 2009, the EPA consulted informally with many major associations representing equipment manufacturers and suppliers, construction contractors, consulting engineers, and water and wastewater utilities, and performed targeted interviews with several well-established water infrastructure contractors and firms who work in a variety of project sizes, and regional and demographic settings to ask the following questions:

- What percentage of total project costs were consumables or incidental costs?

- What percentage of materials costs were consumables or incidental costs?

- Did these percentages vary by type of project (drinking water vs. wastewater treatment plant vs. pipe)?

The responses were consistent across the variety of settings and project types, and indicated that the percentage of total costs for drinking water or wastewater infrastructure projects represented by these incidental components is generally not in excess of 5 percent of the total cost of the materials used in and incorporated into a project. In drafting this waiver, the EPA has considered the de minimis proportion of project costs generally represented by each individual type of these incidental components within the many types of such components comprising those percentages, the fact that these types of incidental components are obtained by contractors in many different ways from many different sources, and the disproportionate cost and delay that would be imposed on projects if the EPA did not issue this waiver.

Assistance recipients who wish to use this waiver should in consultation with their contractors determine the items to be covered by this waiver and must retain relevant documentation (i.e., invoices) as to those items in their project files.

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American Iron and Steel

If you have any questions concerning the contents of this memorandum, please contact Timothy Connor, Chemical Engineer, Municipal Support Division, at connor.timothy@epa.gov or (202) 566-1059 or Kirsten Anderer, Environmental Engineer, Drinking Water Protection Division, at anderer.kirsten@epa.gov or (202) 564-3134.

Issued on: APR 15 2014

Approved by:

Nancy K. Stoner
Acting Assistant Administrator

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American Iron and Steel

NEW HAMPSHIRE DEPARTMENT OF ENVIRONMENTAL SERVICES
CLEAN WATER STATE REVOLVING FUND (CWSRF)
DRINKING WATER STATE REVOLVING FUND (DWSRF)
AMERICAN IRON AND STEEL - DE MINIMIS TRACKING FORM

Contractors who wish to use this waiver shall retain and provide to the Owner relevant documentation (i.e., invoices) as to those items in their project files, and shall summarize in reports to the Owner the types and/or categories of items to which this waiver is applied, the total cost of incidental components covered by the waiver for each type or category, and the calculations by which Contractor determined the total cost of materials used in and incorporated into the project. The form below must be completed and provided to the Owner with each payment application, and as requested by the Owner. Additionally, the Contractor shall submit a copy of the above documentation, calculations and forms to the Department of Environmental Services upon request.

Owner:	Project Name:
Contractor:	CWSRF/DWSRF Project #:
Total Cost of Materials to Date:	Is the project complete?

NOTES:

Under the deminimis waiver, funds used for such incidental components cumulatively may comprise no more than a total of 5 percent of the total cost of the material used in and incorporated into a project; and the cost of an individual item may not exceed 1 percent of the total cost of the material used in and incorporated into a project. Examples of incidental components could include small washers, screws, fasteners (i.e. nuts and bolts), miscellaneous wire, corner bead, ancillary tubes, etc.. Examples of items that are clearly not incidental include significant process fittings (i.e., tees, elbows, flanges, and brackets), distribution fittings and valves, force main valves, pipes for sewer collection and/or water distribution, treatment and storage tanks, large structural support structures, etc.

The De Minimis waiver is only applicable to the cost of materials used and incorporated into the project. Do not include other project costs (labor, installation costs, etc.) in the "Total Cost of Materials". Contractor must have sufficient documentation (i.e. invoices) to support all costs included in this calculation.

The de minimis waiver document is available at: http://water.epa.gov/grants_funding/upload/Deminimis-Waiver-04-15-14.pdf

De Minimis 5% Limit: _____

Component Description	Country of Origin (if available)	Quantity (if applicable)	Cost per Unit (if applicable)	Component's Total Cost	How is Cost Documented?*

Total De Minimis Cost of Components: _____

If approaching the 5% limit, contact DES immediately

* Documentation must demonstrate confirmation of the components' actual costs (invoice, etc.).

Completed by:

Name and Title: _____ Affiliation: _____

Signature: _____ Date: _____

Attachment A
NH Department of Environmental Service
Federal Labor Standards Provisions
29 CFR 5.5(a)

(1) Minimum Wage

(i) All laborers and mechanics employed or working upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (a)(1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in § 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided, that the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph (a)(1)(ii) of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

Wage determinations may be obtained from the U.S. Department of Labor’s web site, www.wdol.gov.

(ii)(A) The Loan recipient, shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The State award official shall approve a request for an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(1) The work to be performed by the classification requested is not performed by a classification in the wage determination; and
(2) The classification is utilized in the area by the construction industry; and

(3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(B) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the Loan recipient(s) agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), documentation of the action taken and the request, including the local wage determination shall be sent by the Loan recipient(s) to the State award official. The State award official will transmit the request, to the Administrator of the Wage and

Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210 and to the EPA DB Regional Coordinator concurrently. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification request within 30 days of receipt and so advise the State award official or will notify the State award official within the 30-day period that additional time is necessary.

(C) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the Loan Recipient (s) do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the award official shall refer the request and the local wage determination, including the views of all interested parties and the recommendation of the State award official, to the Administrator for determination. The request shall be sent to the EPA DB Regional Coordinator concurrently. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt of the request and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(D) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs (a)(1)(ii)(B) or (C) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, provided, that the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.
(2) Withholding.

The Loan recipient(s), shall upon written request of the Contracting Official or an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor under this contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the (Agency) may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

Attachment A
NH Department of Environmental Service
Federal Labor Standards Provisions
29 CFR 5.5(a)

(3) Payrolls and basic records.

(i) Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(ii)(A) The contractor shall submit weekly, for each week in which any contract work is performed, a copy of all payrolls to the Loan recipient, that is, the entity that receives the sub-grant or Loan from the State capitalization grant recipient. Such documentation shall be available on request of the State recipient or EPA. As to each payroll copy received, the Loan recipient shall provide written confirmation in a form satisfactory to the State indicating whether or not the project is in compliance with the requirements of 29 CFR 5.5(a)(1) based on the most recent payroll copies for the specified week. The payrolls shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that *full social security numbers and home addresses shall not be included on the weekly payrolls*. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division Web site at http://www.dol.gov/esa/whd/forms/wh347instr.htm or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the Loan recipient(s) for transmission to the State or EPA if requested by EPA, the State, the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. **It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the Loan recipient(s)**.

(B) Each payroll submitted shall be accompanied by a “Statement of Compliance,” signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

Attachment A
NH Department of Environmental Service
Federal Labor Standards Provisions
29 CFR 5.5(a)

(1) That the payroll for the payroll period contains the information required to be provided under § 5.5 (a)(3)(ii) of Regulations, 29 CFR part 5, the appropriate information is being maintained under § 5.5 (a)(3)(i) of Regulations, 29 CFR part 5, and that such information is correct and complete;

(2) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3;

(3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(C) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the “Statement of Compliance” required by paragraph (a)(3)(ii)(B) of this section.

(D) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

(iii) The contractor or subcontractor shall make the records required under paragraph (a)(3)(i) of this section available for inspection, copying, or transcription by authorized representatives of the State, EPA or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the Federal agency or State may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

(4) Apprentices and trainees-

(i) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work

actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(iii) Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

(5) Compliance with Copeland Act requirements. The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.

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(6) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 CFR 5.5(a)(1) through (10) and such other clauses as the EPA determines may by appropriate, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

(7) Contract termination; debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

(8) Compliance with Davis-Bacon and Related Act requirements. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.
(9) Disputes concerning labor standards. Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and Loan recipient(s), State, EPA, the U.S. Department of Labor, or the employees or their representatives.

10) Certification of eligibility.

(i) By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

4. Contract Provision for Contracts in Excess of $100,000

(a) Contract Work Hours and Safety Standards Act. The Loan recipient shall insert the following clauses set forth in paragraphs (a)(1), (2), (3), and (4) of this section in full in any contract in an amount in excess of $100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by Item 3, above or 29 CFR 4.6. As used in this paragraph, the terms laborers and mechanics include watchmen and guards.

(1) Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

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(2) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (a)(1) of this section the contractor and any subcontractor responsible therefore shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (a)(1) of this section, in the sum of $10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (a)(1) of this section.

(3) Withholding for unpaid wages and liquidated damages. The Loan recipient**,** upon written request of the Contracting Official or an authorized representative of the Department of Labor, shall withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (b)(2) of this section.

(4) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (a)(1) through (4) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (a)(1) through (4) of this section.

(b) In addition to the clauses contained in Item 3, above, in any contract subject only to the Contract Work Hours and Safety Standards Act and not to any of the other statutes cited in 29 CFR 5.1, the Prime Contractor shall insert a clause requiring that the subcontractor shall maintain payrolls and basic payroll records during the course of the work and shall preserve them for a period of three years from the completion of the contract for all laborers and mechanics, including guards and watchmen, working on the contract. Such records shall contain the name and address of each such employee, social security number, correct classifications, hourly rates of wages paid, daily and weekly number of hours worked, deductions made, and actual wages paid. Further, the Prime Contractor shall insert in any such contract a clause providing that the records to be maintained under this paragraph shall be made available by the subcontractor for inspection, copying, or transcription by authorized representatives of NH DES and the Department of Labor, and the subcontractor will permit such representatives to interview employees during working hours on the job.

SECTION 01010
SUMMARY OF WORK

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:

1. Main Electrical Systems Upgrade at the Franklin Wastewater Treatment Plant which is owned and operated by the New Hampshire Department of Environmental Services, Winnipesaukee River Basin Program. The major proposed work under this Contract includes:

   a. Construction of a new Annex over the existing lime silo foundation to house the new primary electrical equipment;
   b. Construction of a masonry fire wall between the Annex and the existing Operations Building;
   c. New concrete walkways to the Annex;
   d. Loam, seed and other site work to restore areas disturbed by the work;
   e. Compaction testing;
   f. Temporary power for the buildings and treatment processes;
   g. New electrical service;
   h. New Switchboard Main Distribution Panel;
   i. New Automatic transfer switch;
   j. New generator switchboard;
   k. Two hand holds for future generator installation;
   l. Existing distribution feeder splicing and connections to the new Switchboards;
   m. Concrete transformer pad and coordination of installation of transformer with PSNH;
   n. Complete branch circuit wiring systems including all raceways, conductors, cables, outlet and junction boxes, wiring devices and device connections;
   o. Complete TVSS and/or lightning arrestor and surge capacitor devices for distribution equipment;
   p. Underground electrical conduits and wiring;
   q. Integration of the new work into the plant’s existing SCADA system as specified in Division 13;
   r. New Fire alarm and security alarm system equipment at the Annex system with integration into existing Simplex systems;
   s. Lighting at the Annex;
   t. Relocate the existing multiple zone condensing unit;
   u. Furnish and implement a complete and approved coordination, short circuit and Arc Flash study for the complete electrical system including existing MCC’s and distribution panels at the facility.
   v. Maintain plant flow and treatment processes as detailed in Part 3 of this section.

2. Demolition of:

a. Removal of the existing transformer and concrete pad;
b. Remove the existing switchgear, service and feeder breaker components. The existing electrical switchgear frame located in the existing Electrical Room shall remain in order to provide support for the existing Pull Box. Provide proper covers to be installed over the openings.

3. Maintain plant flow and treatment processes as detailed in Part 3 of this section.
4. Remove and/or relocate equipment as indicated on the Drawings.
5. Manufacturer's representative certification of proper installation and start-up assistance.

B. Related Work Specified Elsewhere:
1. Coordination: Section 01050
2. Construction Schedules: Section 01310.

C. Removals, Relocations and Rearrangements
1. Examine the existing site for the work of all trades which will influence the cost of the work under the bid. This work shall include removals, relocations and rearrangements of subsurface installations (including electrical, water, storm water and process piping) and interior installations (including electrical, lights and piping) which may interfere with, disturb or complicate the performance of the work under the bid involving systems, equipment and related service lines, which shall continue to be utilized as part of the finished project. The Contractor is responsible for all coordination in this regard.
2. Provide in the bid a sufficient amount to include all removals, relocations, rearrangements and reconnections herein specified, necessary or required to provide approved operation and coordination of the combined new and existing systems and equipment.

D. Project record documents as specified in section 01720 and operations and maintenance manuals as specified in section 01340 and the related sections.

PART 2 - PRODUCTS

Not Applicable.

PART 3 - EXECUTION

3.1 MAINTAIN EXISTING WORKS

A. Maintain Treatment:
1. State and federal regulations require that at all times during construction work under this contract, the treatment facility remain operational.
2. The responsibility of the Contractor shall be to provide, maintain and operate temporary power to the buildings and each treatment process as necessary as the electrical power feed is disconnected from the existing electrical equipment until connection to the new equipment is operational and accepted.
3. The Contractor shall maintain on site at all times, a temporary generator sized to handle the loads required as each system is impacted. The minimum size of the temporary generator shall be 250 KW.

4. The Contractor's operations shall not hinder the delivery, storage and use of materials and supplies, nor hinder staff duties, nor disrupt utility service.
5. The Owner must have access to the existing plant and equipment at all times unless a specific exception is granted by the Owner.
6. In order to maintain the required degree of treatment, the Contractor must schedule his operations so that the following requirements can be complied with:
    a. Work on the power systems that impact each of the major plant operations including: Dewatering, Headworks, Primary Sludge, Return Sludge, the Administration Building, the Operations Building (Laboratory), Thickened Sludge, Anaerobic Digester, Blower and UV Disinfection shall be coordinated a minimum of one week in advance with the treatment plant staff.
    b. Work shall be conducted so that it impacts only a single MCC at any one time unless specifically approved by the Owner.
    c. The Headworks MCC shall not be taken off line during sampling periods at the facility without prior approval. Sampling is normally done starting on Tuesday 7:00 am until 7:00 am on Wednesday and Thursday 7:00 am until 7:00 am on Friday.
    d. Work that impacts the operations within the Administration Building shall take place on Saturday or temporary power shall be provided.
    e. Work that involves shutting down the entire plant at the existing main switch gear to disconnect each MCC shall be limited to a maximum of 45 minutes. During this work the Contractor shall provide power to maintain continuous operation of the UV system, using a portable generator and the main tie in arrangement at MCC-UV. The Contractor shall also provide continuous power to SCADA system and the Laboratory.
7. Refer to the Table 1 at the end of this section for additional information on construction sequencing and the requirements for maintaining operation of the facility.
8. A proposed sequence of construction is as follows:
    a. Install the transformer pad.
    b. Install the conduits to the new riser pole location.
    c. Install the secondary conduits and feeders from the transformer to the Annex.
    d. Construct the new Annex.
    e. Install the new electrical equipment.
    f. Install the interior conduits and wiring.
    g. Coordinate with PSNH for delivery and installation of the transformer.
    h. Coordinate with PSNH for installation of the new riser pole and the electrical feeders from the overhead power to the transformer.
    i. Coordinate with PSNH for the final electrical connections for the new electrical service and energizing the new electrical equipment.
    j. Connect each MCC at the facility to associated breaker in the new electrical equipment. The Contractor shall maintain a generator on site to provide temporary power in order to maintain operation of each system

until the new permanent connection is operational and accepted. Refer to Table 1.

k. Coordinate with PSNH for de-energizing the existing electrical service and removal of the primary feeders.
l. Demolish the existing transformer.
m. Demolish the existing electrical equipment to the extents indicated on the Drawings.
n. Complete the Arch Flash Study.
o. Complete the site work and restoration of all existing materials impacted by the work.

B. Minimize Interference

1. The Contractor shall at all times conduct his operations so as to interfere as little as possible with existing works. The Contractor shall develop a program, in cooperation with the Owner, Engineer, and interested officials, which shall provide for the construction and putting into service of the new works in the most orderly manner possible. This program shall be adhered to except as deviations therefrom are expressly permitted.
2. Work of connecting with, cutting into, and reconstructing existing electrical systems shall be planned to interfere with the operation of the existing facilities for the shortest possible time and when the demands on the facilities best permit such interference. Refer to Table 1. It may be necessary to work outside of normal working hours to minimize interference. Before starting work which will interfere with the operation of existing facilities, the Contractor shall do all possible preparatory work and shall see that all tools, materials, and equipment are made ready and at hand.
3. Any demolition of existing concrete or equipment in the Operations Building, Administration Building or Laboratory shall require the Contractor to keep dust from entering the rest of the building. Contractor shall provide temporary measures as required to control the exposure of dust to the treatment plant personnel and the remainder of the facility. Particular care shall be taken to limit the potential for dust and vibrations impacting the operations of the Laboratory. The Contractor shall provide for continuous safe passage around work for treatment facility personnel.
4. The Contractor shall not use the Owner’s bathrooms or kitchen facilities.
5. The Contractor shall limit his personnel to the proposed work areas and limits of work.
6. Existing equipment, utilities, structures, doors, windows, walls, etc. may need to be removed to allow installation of the new materials and equipment. Any items removed must be reinstalled or replaced as soon as possible and shall have no damage from removal and reinstallation.
7. The Contractor shall repair to preconstruction condition all damaged grass areas and pavement areas after demobilization.
8. The Contractor shall limit parking of workers’ personal vehicles to a designated area identified by the Owner. Parking of company vehicles owned by the Contractor and Subcontractors shall not interfere with access by the Owner on plant driveways or garage bays. On-site speed limit is 10 MPH.

3.2 CONSTRUCTION SEQUENCE

A. Construction of the proposed treatment facilities will disrupt the existing treatment facility structures and operations. To maintain treatment and to minimize disruption, the construction must be divided into phases or sequenced appropriately. The construction sequence phases and dates must allow the facility to maintain treatment. The Contractor may deviate from this construction sequencing as outlined in paragraph 3.2,C.

B. The Contractor shall submit to the Engineer for review and acceptance a complete schedule of his proposed sequence of construction operations prior to commencing any work. This schedule shall include the Contractor's plans for doing the work.

C. The Contractor must submit to the Engineer a written request to deviate from the above sequence, provided he can demonstrate to the Engineer that the continuity and degree of treatment will not be adversely affected.

D. The Contractor shall include the cost of all temporary facilities and temporary generator for power required to maintain treatment during the construction period in his lump-sum bid price. The cost shall include the cost for all labor, tools, fuel, electricity, equipment and materials necessary.

E. It shall be recognized that certain interruptions of, and disruptions to, the treatment processes and present plant operations will be required to complete the work of this Contract. Scheduled interruptions requiring interruption or bypassing of treatment process shall be kept to a minimum frequency and duration. Such interruptions shall be coordinated by the Contractor and the Owner using the Contractor’s proposed work schedule, but shall not affect the facilities ability to maintain treatment as described above.

F. The Contractor shall notify the Owner a minimum of seven days in advance of any work which may affect or disrupt the operation. Once the interruption occurs the Contractor must maintain a workforce on-site to complete the work in the agreed upon time.

G. Any work by the Contractor which requires the mechanical or electrical isolation of an existing piece of equipment, process or system shall be coordinated with the Engineer. Any and all isolation of electrical or mechanical equipment or process shall be accomplished in strict accordance with applicable codes and standards and the stricter of the Contractor's or Owner’s lock-out/tag-out procedures.

H. The Contractor shall have all materials and equipment on-site, and shall receive the Owner's approval, prior to initiating work which requires any part of the existing wastewater treatment plant to be off-line.

I. The Contractor shall allow in the Bid reasonable time to accommodate operations at the existing wastewater treatment plant, including the need for the Owner to respond to emergencies. The Contractor shall not be eligible for additional compensation due to interruptions of the Contractor's schedule, in order for the Owner to respond to routine conditions.

J. There are specific requirements for construction sequencing and phasing as noted in Paragraph 3.1.A.8 and Table 1. The Contractor shall submit a construction sequence that recognizes the requirement that the facility provide treatment and necessary support functions throughout the construction period and adheres to the specified minimum requirements as previously discussed. Pumping,

instrumentation, and control, Laboratory, alternate power and systems that support these efforts must be maintained as well.

K. The Contractor shall include the cost of all temporary facilities required to maintain treatment during the construction period in his lump-sum bid price. The cost shall include the cost for all labor, tools, equipment, materials and temporary systems, as necessary.

TABLE 1
SUMMARY OF MCC'S AND REQUIREMENTS FOR MAINTAINING TREATMENT OPERATIONS

MCC	Breaker, amp	Key Equipment	Requirements for Maintaining Treatment
FP – Dewatering	600	Screw conveyors Compressors Centrate Pumps	• Coordinate with treatment plant staff to determine possible periods when dewatering can be shut down, and • Complete the work so that the MCC is off line no more than 4 hours. **OR** • Place system on temporary power to maintain operation.
TPA – Admin Bldg	1200	Centrifuge 1 Centrifuge 2 Screw conveyor Admin Bldg Operations Building Training Center Laboratory	• Work to be done on the weekend, and • Coordinate with treatment plant staff to determine possible periods when dewatering can be shut down, and • Coordinate with training center class schedule; and • Work during mild weather conditions to maintain a minimum building temperature of 55 degrees Fahrenheit, and • Provide temporary power for the SCADA system, and • Provide 120VAC temporary power to PLC on second floor to keep SCADA network switch operational, and • Provide temporary power for the Laboratory, and

MCC	Breaker, amp	Key Equipment	Requirements for Maintaining Treatment
			• Complete the work so that the MCC is off line no more than 4 hours. **OR** • Place the entire system on temporary power to maintain operation.
HW – Headworks	600	Influent screens Grit pumps Screw conveyors	• Coordinate with treatment plant staff to determine possible dry weather periods when the Headworks can shut be down, and • Provide 120VAC temporary power to PLC to keep SCADA network switch operational, and • Complete the work so that the MCC is off line no more than 4 hours. **OR** • Place the system on temporary power to maintain operation.
PS – Primary Sludge	600	Primary clarifiers Primary sludge pumps	• Coordinate with treatment plant staff to determine possible dry weather periods when this system can shut be down, and • Provide 120VAC temporary power to PLC to keep SCADA network switch operational, and • Complete the work so that the MCC is off line no more than 4 hours. **OR** • Place the system on temporary power to maintain operation.
RS – Return Sludge	600	Secondary clarifiers	• Place the system on temporary power to

MCC	Breaker, amp	Key Equipment	Requirements for Maintaining Treatment
		RAS pumps WAS pumps	maintain operation.
TS – Thickened Sludge	600	Raw septage pumps Degritted septage pumps Gravity thickeners Thickened sludge pumps	• Place the system on temporary power to maintain operation.
SD – Sludge Digester	600	Digester mixing system Digester heating system Digester gas handling system	• Place the system on temporary power to maintain operation.
BL – Blowers	1200	Polymer feed system Aeration blowers	• Place the system on temporary power to maintain operation.
UV – UV Disinfection	1200	UV system Plant Water system	• Place the system on temporary power to maintain operation. . NOTE: UV/plant water system shall remain operational 100% of the time to maintain facility compliance.

END OF SECTION

SECTION 01045

CUTTING, CORING AND PATCHING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included - This section establishes general requirements pertaining to cutting, excavating, coring, fitting, and patching of the Work required to:
   1. Make alterations to existing structures.
   2. Make the parts fit properly.
   3. Remove and replace work not conforming to requirements of the Contract Documents.
   4. All cutting, coring, and rough patching shall be performed by the Contractor. Do not cut or alter work performed under separate contract without the Engineer's written permission. Finish patching shall be the responsibility of the Contractor and shall be performed by the trade associated with the application of the particular finish.

B. Related Work Specified Elsewhere:
   1. Pipe Sleeves and Seals are specified in Section 15092.

C. Quality Assurance:
   1. Perform all cutting, coring and patching in strict accordance with pertinent requirements of these Specifications, and in the event no such requirements are determined, in conformance with the Engineer's written direction.

D. Submittals:
   1. Request for the Engineer's consent:
      a. Prior to cutting which affects structural safety, submit written request to the Engineer for permission to proceed with cutting.
      b. Should conditions of the work, or schedule, indicate a required change of materials or methods for cutting and patching, so notify the Engineer and secure his written permission prior to proceeding.
   2. Notices to the Engineer
      a. Prior to cutting and patching pursuant to the Engineer's instructions, submit cost estimate to the Engineer. Secure the Engineer's approval of cost estimates and type of cost reimbursement before proceeding with cutting and patching.
      b. Submit written notice to the Engineer designating the time the work will be uncovered to provide for the Engineer's observation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials for replacement of work shall be equal to those of adjacent construction and shall comply with the pertinent sections of these Specifications.

B. Concrete and grout for rough patching shall be as specified in Division 3.

PART 3 - EXECUTION

3.1 CONDITIONS

A. Inspection:
   1. Inspect existing conditions, including elements subject to movement or damage during cutting, excavating, coring, backfilling, and patching.
   2. After uncovering the work, inspect conditions affecting installation of new work.

B. Discrepancies:
   1. If uncovered conditions are not as anticipated, immediately notify the Engineer and secure needed directions.
   2. Do not proceed in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 PREPARATION PRIOR TO CUTTING AND CORING

A. Provide all required protection including, but not necessarily limited to, shoring, bracing and support to maintain structural integrity of the work.

B. All cutting and coring shall be performed in such a manner as to limit the extent of patching.

C. All holes cut through concrete and masonry walls or slabs shall be core drilled unless otherwise approved. No structural members shall be cut without approval of the Engineer and all such cutting shall be done in a manner directed by him. No holes may be drilled in beams or other structural members without obtaining prior approval. All work shall be performed by mechanics skilled in this type of work.

D. If holes are cored through floor slabs they shall be drilled from below.

3.3 CORING

A. Coring shall be performed with an approved non-impact rotary tool with diamond core drills. Size of holes shall be suitable for pipe, conduit, sleeves, equipment or mechanical seals to be installed.

B. All equipment shall conform to OSHA standards and specifications pertaining to plugs, noise and fume pollution, wiring and maintenance.

C. Provide protection for existing equipment, utilities and critical areas against water or other damage caused by drilling operation.

D. Slurry or tailings resulting from coring operations shall be vacuumed or otherwise removed from the area following drilling.

3.4 CUTTING

A. Cutting shall be performed with a concrete wall saw and diamond saw blades of proper size.

B. Provide for control of slurry generated by sawing operation on both sides of wall.

C. When cutting a reinforced concrete wall, the cutting shall be done so as not to damage bond between the concrete and reinforcing steel left in structure. Cut shall be made so that steel neither protrudes nor is recessed from face of the cut.

D. Adequate bracing of area to be cut shall be installed prior to start of cutting. Check area during sawing operations for partial cracking and provide additional bracing as required to prevent a partial release of cut area during sawing operations.

E. Provide equipment of adequate size to remove cut panel.

3.5 PERFORMANCE

A. Perform all required excavating and backfilling as required under pertinent sections of these specifications. Perform cutting, coring and demolition by methods which will prevent damage to other portions of the work and will provide proper surfaces to receive installation of repair and/or new work. Perform fitting and adjustment of products to provide finished installation complying with the specified tolerances and finishes.

B. 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 approved.

END OF SECTION

SECTION 01050

COORDINATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Contractor is required to work in close proximity to Owner's existing facilities. The Contractor will be responsible for coordinating construction activities with Owner to ensure that services, facilities, and safe working conditions are maintained.

B. Others will be interfacing with this Contract and working within the work area and in the vicinity of this project. The Contractor, shall act as Construction Coordinator and coordinate construction activities with others working for Owner.

C. Any damage to existing structures, equipment and property, accepted equipment or structures, and property or work in progress by others; as a result of the Contractor's or his subcontractor's operations shall be made good by the Contractor at no additional cost to the Owner.

1.2 COORDINATION WITH OTHERS

A. New Hampshire Department of Environmental Services, Winnipesaukee River Basin Program (WRBP)

1. Contractor shall coordinate all work with the WRBP personnel. Contractor shall bear all costs for maintaining wastewater flows including, temporary facilities, and other requirements.

B. Public Service of New Hampshire (PSNH):

1. The Contractor shall be responsible for coordinating all work with PSNH for the installation of the new electrical service and transformer.

E. The Contractor shall provide the Owner, Engineer, and other parties identified above, a construction schedule indicating the times to perform the work required. The Contractor shall update the schedule when required and give all parties a minimum of one week notice before the start of any work. The Contractor shall daily communicate with the Engineer and Owner concerning updating the schedule, job progress, delay or early starts that has the potential to affect the force main operation, handling of wastewater flows, etc.

F. Each individual employed by the Contractor or his subcontractor or suppliers must sign in at the treatment facility office at each arrival on site. All individuals are required to sign out when leaving the site. The Contractor shall be responsible for informing all parties and verifying that this requirement is met.

G. Weekly (in-field) coordination meetings shall be held between the Contractor, Owner’s Representative, Engineer’s Representative, and other coordinating parties as needed. These meetings will be in addition to regular progress meetings, as described in section 01200. This meeting shall cover the following:

- Work to be completed the following week
- Project Schedule
- Shop Drawing and O&M issues
- Outstanding RFIs and Clarifications
- Change Orders and Field Orders

- Review of Record Drawing Information
- Discussion/Resolution of any old issues
- New issues discussion
- Contractor's Safety and Health Plan Updates

H. The Contractor shall provide their own preparation and storage areas.

I. The Contractor shall coordinate with Dig Safe for utility markout prior to construction, but the Contractor shall be responsible for verification of utility locations within the work area.

END OF SECTION

SECTION 01070

ABBREVIATIONS & SYMBOLS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Where any of the following abbreviations are used in these Specifications, they shall have the meaning set forth opposite each.

AASHTO	American Association of State Highway and Transportation Officials
AC	Alternating Current
ACI	American Concrete Institute
ACP	Asbestos Cement Pipe
AGA	American Gas Association
AIC	Ampere Interrupting Capacity
AGMA	American Gear Manufacturers Association
AIEE(IEEE)	American Institute of Electrical Engineers (Institute of Electrical and Electronics Engineers, Inc.)
AISC	American Institute of Steel Construction
amp	Ampere 125-16
Amer. Std.	American Standard for Cast Iron Pipe Flanges and Flanged Fittings, Class l25 (ASA Bl6 ll960)
ANSI	American National Standards Institute
API	American Petroleum Institute
ASA	American Standards Association
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWG	American or Brown and Sharpe Wire Gage
AWWA	American Water Works Association
BOD	Biochemical Oxygen Demand
c.f.	Cubic Foot
c.f.m.	Cubic Foot Per Minute
c.f.s.	Cubic Foot Per Second
CI	Cast Iron
CIPRA	Cast Iron Pipe Research Association
CSI	Construction Specifications Institute
c.y.	Cubic Yards
DC	Direct Current
DEP	Department of Environmental Protection
DI	Ductile Iron
DOT	Department of Transportation
EDR	Equivalent Directional Radiation
EPA	U.S. Environmental Protection Agency
fps	Feet Per Second
ft.	Feet

gal.	Gallons
gpd	Gallons Per Day
gpm	Gallons Per Minute
HP	Horsepower
IBR	Institute of Boiler and Radiator Manufacturers
in.	Inches
inter.	Interlock
ISA	Instrument Society of America
kva	Kilovolt-ampere
kw	Kilowatt
lb.	Pound
max.	Maximum
MCB	Master Car Builders
MGD	Million Gallons Per Day
Min.	Minimum
NBS	National Bureau of Standards
NEC	National Electrical Code, Latest Edition
NEMA	National Electrical Manufacturers Association
NEWWA	New England Water Works Association
NPT	National Pipe Thread
OS&Y	Outside Screw and Yoke
PCA	Portland Cement Association
ppm	Parts Per Million
%	Percent
psi	Pounds Per Square Inch
psig	Pounds Per Square Inch Gage
PVC	Polyvinyl Chloride
rpm	Revolutions Per Minute
RUS	Rural Utility Service
s.f.	Square Foot
STL. W.G.	U.S. Steel Wire, Washburn and Moen, American Steel and Wire Cos., or Roebling Gage
s.y.	Square yard
TDH	Total Dynamic Head
USAS	Standards of the United States of America Standards Institute (formerly American Standards Association)
USS GAGE	United States Standard Gage
VC	Vitrified Clay
WSP	Working Steam Pressure
Fed. Spec.	Federal Specifications issued by the Federal Supply Service of the General Service Administration, Washington, D.C.

END OF SECTION

SECTION 01150

MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. For lump sum items, payment shall be made to the Contractor in accordance with an accepted Progress Schedule and Schedule of Values on the basis of actual work completed.

B. For items that are a cash allowance, payment shall be based on the actual amount of cost incurred by the contractor for the item and shall not include any markup or overhead cost by the Contractor.

1.2 SCOPE OF PAYMENT

A. The Contractor shall accept compensation, as herein provided, in full payment for furnishing all materials, labor, tools, equipment, and incidentals necessary to the completed work and for performing all work contemplated and embraced by the Contract; also for all loss or damage arising from the nature of the Work, or from the action of the elements, or from any unforeseen difficulties which may be encountered during the prosecution of the Work and until its final acceptance by the Engineer, and for all risks of every description connected with the prosecution of the work, except as provided herein, also for all expenses incurred in consequence of the suspension of the work as herein authorized.

B. The payment of any partial estimate or of any retained percentage except by and under the approved final invoice, in no way shall affect the obligation of the Contractor to repair or renew any defective parts of the construction or to be responsible for all damage due to such defects.

1.3 PARTIAL PAYMENTS

A. Partial payments shall be made monthly as the work progresses. Partial payment shall be made subject to the provisions of the Supplemental and General Conditions.

1.4 PAYMENT FOR MATERIAL DELIVERED

A. When requested by the Contractor and at the discretion of the Owner, payment may be made for all or part of the value of acceptable, non-perishable materials and equipment which are to be incorporated into bid items, have not been used, and have been delivered to the construction site or placed in storage places acceptable to the Owner. Payment shall be subject to the provisions of the General and Supplementary Conditions.

B. The Contractor shall be responsible for the appropriate storage and security of all stored materials. The Contractor shall be responsible for damage or loss of stored materials at no additional cost to the owner.

C. No payment shall be made upon fuels, supplies, lumber, false work, or other materials, or on temporary structures or other work of any kind which are not a permanent part of the Contract.

1.5 FINAL PAYMENT

A. The Engineer will make, as soon as practicable after the entire completion of the project, a final quantity invoice of the amount of the Work performed and the value of such Work. Owner shall make final payments of the sum found due less retainages subject to the provisions of the General and Supplementary Conditions.

1.6 INCIDENTAL WORK

A. Incidental work items for which separate payment is not made include (but are not limited to) the following items:
   1. Clearing, grubbing and stripping
   2. Dust control
   3. Dewatering
   4. Clean-up
   5. Erosion control
   6. Loam, seeding, grading, liming, fertilization, mulching and watering
   7. Bedding and backfill
   8. Compaction testing of backfill
   9. Restoration of property, and replacement of fences, curbs, structures, sign posts, guard rails, and other minor items disturbed by the construction activities
   10. Coordination with the Owner, Utilities and others, including related inspection cost (refer to Section 01050)
   11. Utility crossings and relocations of existing utilities required to complete the work.
   12. Project Signs
   13. Trench boxes, steel and/or wood sheeting as required, including that left in place
   14. Project record documents
   15. Materials testing
   16. Construction schedules, bonds, insurance, shop drawings, warranties, guarantees, certifications, and other submittals required by the Contract Documents
   17. Temporary power and utilities for construction.
   18. Temporary power and utilities to maintain operation of the existing wastewater treatment systems during construction
   19. Temporary utility services to buildings as required to maintain service during construction
   20. Quality assurance testing
   21. Temporary construction and other facilities not to be permanently incorporated into the Work necessary for construction sequencing and maintenance of operations
   22. Weather protection

23. Permits not otherwise paid for or provided by the Owner including the State Building Permit from the State Fire Marshal's office and all local building permits.
24. Visits to the Project site or elsewhere by personnel or agents of the Contractor, including manufacturer's representatives, as may be required
25. On-site and other facilities acceptable to Engineer for the storage of materials, supplies and equipment to be incorporated into the Work
26. Training and facilities start-up services required by the Contract Documents
27. Mobilization/demobilization
28. Test pits to determine existing utility locations and elevations, soils conditions, groundwater conditions, dewatering requirements and as required to complete the project
29. Utility markings
30. Pavement markings
31. Removal and replacement of existing pavement
32. Earthwork (except ledge)
33. Preconstruction photos and videos
34. Construction administration and insurance

1.7 DESCRIPTION OF PAY ITEMS

A. The following sections describe the measurement of and payment for the work to be done under the respective items listed in the Bid Form.

B. Each unit or lump sum price stated in the Bid Form shall constitute full compensation, as herein specified, for each item of the work completed.

Bid Item 1– Main Electrical Systems Upgrade

Payment of the lump sum price for the Base Bid shall be full compensation for furnishing all labor, materials, tools and equipment required to construct the Annex and for upgrading of the main electrical systems at the Franklin Wastewater Treatment Plant, complete as indicated on the Drawings and as specified and all its' appurtenances in its entirety, unless included in another bid item.

Bid Item 2 - Allowance for work by PSNH

Method of Measurement: Cash Allowance $20,000.

The Contractor shall include this cash allowance for fees charged by PSNH for the purchase of the new transformer, the installation of the new electrical service entrance, final connections and all services by the utility required to complete the electrical service entrance. The total paid to the Contractor by the Owner shall be the actual total ffe charged by PSNH without additional markup by the Contractor.

END OF SECTION

SECTION 01200

PROJECT MEETINGS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: To enable orderly review during progress of the work, and to provide for systematic discussion of problems, the Engineer will conduct project meetings throughout the construction period.

B. Related work described elsewhere: The Contractor's relations with his subcontractors and materials suppliers and discussions relative thereto, are the Contractor's responsibility and are not part of project meetings content.

1.2 QUALITY ASSURANCE

A. Persons designated by the Contractor to attend and participate in the project meetings shall have all required authority to commit the Contractor to solutions agreed upon in the project meetings.

1.3 SUBMITTALS

A. Agenda items: To the maximum extent practicable, advise the Engineer at least 24 hours in advance of project meetings regarding all items to be added to the agenda.

B. Minutes: The Engineer will compile minutes of each project meeting and will furnish copies to the Contractor and the Owner. The Contractor may make and distribute such other copies as he wishes.

PART 2 - PRODUCTS

(No products are required in this Section.)

PART 3 - EXECUTION

3.1 MEETING SCHEDULE

A. Except as noted below for Preconstruction Meeting, project meetings will be held monthly. Coordinate as necessary to establish mutually acceptable schedule for meetings.

3.2 MEETING LOCATION

A. To the maximum extent practicable, meetings will be held at the job site in the Engineer's field office.

3.3 PRECONSTRUCTION MEETING

A. Preconstruction meeting will be scheduled within twenty days after the Effective Date of the Agreement, but before the Contractor starts work at the site. Provide attendance by authorized representatives of the Contractor and all major subcontractors. The Engineer will advise other interested parties and request their attendance.

B. Minimum agenda: Distribute data on, and discuss:
   1. Identification of key project personnel for Owner, Engineer, Contractor, funding/regulatory Agencies.
   2. Responsibilities of Owner, Engineer, Resident Project Representative, Contractor.
   3. Channels and procedures for communications.
   4. Construction schedule, including sequence of critical work.
   5. Easements, permits.
   6. Contract Documents, including distribution of required copies of original documents and revisions.
   7. Processing of Shop Drawings and other data submitted to the Engineer for review.
   8. Processing of field decisions and Change Orders.
   9. Rules and regulations governing performance of the Work, including funding/regulatory Agency requirements.
   10. Procedures for safety and first aid, security, quality control, housekeeping, and other related matters.
   11. Davis Bacon payroll submission requirements.

3.4 PROJECT MEETINGS

A. Attendance: To the maximum extent practicable, assign the same person or persons to represent the Contractor at project meetings throughout progress of the Work. The Superintendent shall attend. Subcontractors, materials suppliers, and others may be invited to attend those project meetings in which their aspects of the Work are involved.

B. Minimum agenda:
   1. Review, revise as necessary, and approved minutes of previous meeting.
   2. Review progress of the Work since last meeting, including status of submittals for approval.
   3. Review schedule of work to be accomplished prior to next meeting.
   4. Discuss monthly partial payment request.
   5. Review status of change order requests and Work Directive Changes.
   6. Identify problems which impede planned progress.
   7. Davis Bacon payrolls.
   8. Safety.
   9. Develop corrective measures and procedures to regain planned schedule.
   10. Complete other current business.

END OF SECTION

SECTION 01310

CONSTRUCTION SCHEDULES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: Within ten (10) days after the effective date of the Agreement between Owner and Contractor submit to the Engineer an estimated progress schedule as specified herein.

B. Form of Schedules:
   1. Narrative: Completely describe the construction methods to be employed.
   2. Network Analysis System:
      a. Provide a separate horizontal schedule line for each trade or operation and show concurrent and preceding activities.
      b. Present in chronological order the beginning of each trade or operation showing duration and float time.
      c. Scale: Identify key dates and allow space for updating and revision.
   3. Mathematical Analysis:
      a. A mathematical analysis shall accompany the network diagram. A computer printout will be acceptable.
      b. Information shall be included on activity numbers, duration, early start, late start, etc. and float times.

C. Content of Schedules:
   1. Provide complete sequence of construction by activity:
      a. Shop Drawings, Project Data and Samples:
         1) Submittal dates.
         2) Dates reviewed copies will be required.
      b. Decision dates for:
         1) Products specified by allowances.
         2) Selection of finishes.
      c. Estimated product procurement and delivery dates.
      d. Dates for beginning and completion of each element of construction.
   2. Identify work of separate phases and logically grouped activities.
   3. Show the projected percentage of completion for each item of work as of the first day of each month.
   4. Provide separate sub-schedules, if requested by the Engineer, showing submittals, review times, procurement schedules, and delivery dates.

D. Updating:
   1. Show all changes occurring since previous submission.
   2. Indicate progress of each activity, show completion dates.
   3. Include:
      a. Major changes in scope.
      b. Activities modified since previous updating.
      c. Revised projections due to changes.
      d. Other identifiable changes.
   4. Provide narrative report, including:
      a. Discussion of problem areas, including current and anticipated delay

factors.

b. Corrective action taken, or proposed.

c. Description of revisions that may affect schedules.

1.2 SUBMITTALS

A. Submit updated schedules with each progress payment request.

B. Submit 4 copies of initial and updated schedules to the Engineer.

END OF SECTION

SECTION 01320

SAFETY AND HEALTH PLAN

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:

1. The Contractor shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the work, as outlined herein and in the General and Special Conditions of the Contract Documents. Within (10) days after the effective date of the Agreement between Owner and Contractor, submit to the Engineer a Safety and Health Plan as specified herein.
2. Contractor shall comply with all applicable Laws and Regulations related to the safety of persons or property, or for the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection.
3. Contractor shall designate a qualified and experienced safety representative (OSHA defined "Competent Person") at the site whose duties and responsibilities shall be the prevention of accidents and maintaining and supervising of safety precautions and programs, including a "Job Hazards Analysis".
4. The Contractor shall be solely responsible to provide all labor, equipment, and utilities sufficient to ensure no construction noise, particulates, or odors, are allowed to accumulate to levels which adversely affect health or work in, or near the construction area.

B. Content of Safety and Health Plan:

1. Prepare complete safety and health plan in accordance with the requirements of CFR Title 29 Part 1926 - Safety and Health Regulations for Construction.
   a. Provide documentation that Contractor's hazardous communication program is up to date.
   b. Provide documentation that Contractor's safety training is up to date.
   c. Prepare a project specific Safety and Health Plan addressing construction safety issues, including but not limited to excavations, fall protection and egress, as well as provisions for construction in hazardous environmental conditions at the wastewater treatment facility. The hazardous environmental conditions at the wastewater treatment facility include, but are not limited to, confined space entry, electrically-classified spaces, and chemical storage and handling areas, to name a few.
2. Safety provisions for confined space entry shall follow General Industry Standard CFR Title 29 Part 1910.146 and will be incorporated into the Safety and Health Plan.
   a. The work area defined on the drawings does not include any confined spaces at the facility. The Contractor shall coordinate with the Owner if they encounter any spaces that are potentially a confined space. Spaces classified as Permit Required Confined Space may only be entered with

a permit, alternate procedures (1910.146 (c) (5)), or reclassification to non-permit required confined space (1910.146 (c) (7)). The Contractor is required to perform a site evaluation to identify all hazards and potential hazards in work areas, prior to control of site.

b. The Contractor shall be responsible for all aspects of construction site safety including development of appropriate confined space entry procedures. The plan shall include, but not necessarily be limited to, the following:
   - Definitions
   - Confined Space Evaluations
   - Equipment Selection
   - Confined Space Entry Training Documentation
   - Permit Required Confined Space Entry Requirements
   - Testing (Monitoring) and Ventilation
   - Confined Space Entry Permit Form
   - Rescue and Emergency Procedures
   - Emergency Contact Information

c. The Contractor shall inform the Owner and Engineer's representative whenever work will be performed in a confined space and the permit space program that the Contractor will follow.

d. The Contractor shall inform the Owner and Engineer's representative of any hazards confronted or created during entry operations, either through a briefing or during the entry operation.

e. The Contractor will coordinate entry operations with the Owner when both Owner personnel and Contractor personnel will be working in or near permit spaces.

f. The Owner, Engineer, their representatives, independent testing laboratories and government agencies, when inspecting the site, shall be supplied by the Contractor proper safety equipment when entry into a confined space is required.

3. The work area defined on the drawings does not include any spaces which are classified as an electrical hazard. The Contractor shall coordinate with the Owner if they encounter any spaces that are potentially classified. The Contractor is required to perform a site evaluation to identify all hazards and potential hazards in work areas, prior to control of site. Contractor shall implement appropriate safety precautions and/or construction practices to comply with classification requirements. Contractor shall ensure that all employees and subcontractors working in these areas have received appropriate training and are properly equipped in accordance with Contractor's Safety and Health Plan.

C. Updating:

1. Contractor shall be responsible for updating the Safety and Health Plan as appropriate throughout the course of the construction period.

1.2 SUBMITTALS

A. **Contractor shall be responsible for all aspects of construction site safety.**

Provide 3 copies of the Contractor's site specific Safety and Health Plan to the Engineer. The Safety and Health Plan is provided for information only to inform the Owner, Engineer (and Resident Project Representative) of the project specific safety program requirements. The Contractor will overview the plan with the Owner (and staff), Engineer (and Resident Project Representative) at the beginning of the project, and subsequently when the safety plan is updated.

B. Provide updated Safety and Health Plans as necessary during the course of the project.

C. Contractor's most current Safety and Health Plan shall be available at the construction site throughout the construction project.

1.3 ON-SITE COORDINATION MEETINGS

A. Contractor shall review key aspects of Safety and Health Plan at the Pre-Construction Meeting, and subsequent on-site safety informational meeting.

B. Contractor shall report to Engineer and Owner at each progress meeting concerning compliance with the Safety and Health Plan for the most recent construction period and new considerations and requirements for the upcoming period.

C. Contractor shall hold weekly on-site coordination meetings with Resident Project Representative and Owner to ensure that Owner's staff is aware of key Safety and Health Plan requirements of the current phase of construction.

END OF SECTION

SECTION 01340

SUBMITTALS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:
   1. Submit to the Engineer, Shop Drawings, Operation and Maintenance Manuals, Manufacturers' Certificates, Project Data, and Samples required by the Specification Sections.

B. Related Work Specified Elsewhere:
   1. Construction Schedules: Section 01310
   2. Project Record Documents: Section 01720
   3. General Conditions: Section C.

1.2 SHOP DRAWINGS

A. Shop Drawings are required for each and every element of the work. Each shop drawing shall be assigned a number consisting of the Specification Section number followed by a dash and then a sequential number beginning with 01 (e.g., 16000-01) for purposes of easy identification. Resubmittals shall include an alphabetic suffix after the corresponding sequential number (e.g., 16000-01A).

B. Shop Drawings are generally defined as all fabrication and erection drawings, diagrams, brochures, schedules, bills of material, manufacturers data, spare parts lists, and other data prepared by the Contractor, his subcontractors, suppliers, or manufacturers which illustrate the manufacturer, fabrication, construction, and installation of the work, or a portion thereof.

C. The Contractor shall submit to the Engineer a four of hardcopies of Shop Drawings and approved data (for Owner's, Engineer's and Field Representative's files), and one electronic Portable Document Format (PDF) transmitted using e-mail, File Transfer Protocol (FTP), or approved submittal sharing software. The Engineer shall return one hardcopy and electronic PDF to the Contractor for duplication and distribution to subcontractors, suppliers and manufacturers. All shop drawing comments will be summarized on the Submittal Review Form and must be retained with each submittal hardcopy and electronic PDF.

D. The Contractor shall provide a completed Submittal Certification Form (copy provided for Contractor's use at the end of this Specification Section) which shall be attached to every hardcopy and electronic PDF of each shop drawing. Shop Drawings shall show the principal dimensions, weight, structural and operating features, space required, clearances, type and/or brand of finish or shop coat, grease fittings, etc., depending on the subject of the drawing. When it is customary to do so, when the dimensions are of particular importance, or when so specified, the drawings shall be certified by the manufacturer or fabricator as correct for the work.

E. Shop Drawings shall be submitted as a complete package by specification section, unless otherwise reviewed and approved by the Engineer. It is the intent that all information, materials and samples associated with each specification section be included as a single submittal for the Engineer's review. Any deviation from this

requirement, such as submitting miscellaneous metals grouped by structure, shall be requested in writing with an anticipated shop drawing breakdown/schedule prior to any associated submittal.

F. The Contractor shall be responsible for the prompt and timely submittal of all shop and working drawings so that there shall be no delay to the work due to the absence of such drawings.

G. No material or equipment shall be purchased or fabricated especially for the Contract until the required shop and working drawings have been submitted as hereinabove provided and reviewed for conformance to the Contract requirements. All such materials and equipment and the work involved in their installation or incorporation into the Work shall then be as shown in and represented by said drawings.

H. Until the necessary review has been made, the Contractor shall not proceed with any portion of the work (such as the construction of foundations), the design or details of which are dependent upon the design or details of work, materials, equipment or other features for which review is required.

I. All shop and working drawings shall be submitted to the Engineer by and/or through the Contractor, who shall be responsible for obtaining shop and working drawings from his subcontractors and returning reviewed drawings to them. Hard copies of shop drawings shall be of standardized sizes to enable the Owner to maintain a permanent record of the submissions. Approved standard sizes shall be: (a) 24 inches by 36 inches; (b) 11 inches by 17 inches, and (c) 11 inches by 8-1/2 inches. Provision shall be made in preparing the shop drawings to provide a binding margin on the left hand side of the sheet. Shop drawings submitted other than as specified herein may be returned for resubmittal without being reviewed.

J. Only drawings which have been checked and corrected by the fabricator should be submitted to the Contractor by his subcontractors and vendors. Prior to submitting drawings to the Engineer, the Contractor shall check thoroughly all such drawings to satisfy himself that the subject matter thereof conforms to the Drawings and Specifications in all respects. All drawings which are correct shall be marked with the date, checker's name, and indication of the Contractor's approval, and then shall be submitted to the Engineer.

K. If a shop drawing shows any deviation from the Contract requirements, the Contractor shall make specific mention of the deviations in his letter of transmittal. Shop Drawings that contain significant deviations that are not brought to the attention of the Engineer may be subject to rejection.

L. Should the Contractor submit equipment that requires modifications to the structures, piping, electrical conduit, wires and appurtenances, layout, etc., detailed on the Drawings, he shall also submit details of the proposed modifications. If such equipment and modifications are accepted, the Contractor, at no additional cost to the Owner, shall do all work necessary to make such modifications.

M. A maximum of two submissions of each Shop Drawing will be reviewed, checked, and commented upon without charge to the Contractor. Any additional submissions which are ordered by the Engineer to fulfill the stipulations of the Drawings and Specifications, and which are required by virtue of the Contractor's neglect or failure to comply with the requirements of the Drawings and Specifications, or to

make those modifications and/or corrections ordered by the Engineer in the review of the first two submissions of each Shop Drawing, will be reviewed and checked as deemed necessary by the Engineer, and the cost of such review and checking, as determined by the Owner, and based upon Engineer's documentation of time and rates established for additional services in the Owner-Engineer Agreement for this Project, may be deducted from the Contractor to make all modifications and/or corrections as may be required by the Engineer in an accurate, complete, and timely fashion. Resubmittals for the sole purpose of providing written responses to review comments will not be considered a resubmittal counting towards the two submission limit.

1.3 SAMPLES

A. The Contractor shall submit samples when requested by the Engineer to establish conformance with the specifications, and as necessary to define color selections available.

1.4 OPERATION AND MAINTENANCE MANUALS

A. The Contractor shall furnish the Engineer a minimum of two hardcopies and 1 electronic PDF of a complete instruction manual for installation, operation and maintenance of each item specified (unless otherwise specified) transmitted using e-mail, File Transfer Protocol (FTP), Compact Disc (CD) or approved submittal sharing software. At least 45 days prior to the expected substantial completion date, the Contractor shall submit to the Engineer all manuals in accordance with the requirements specified herein.

B. Each manual shall be provided in a stand-alone binder or shall be inserted into a 3-ring binder. Include the General Contractor's and Manufacturer's representative's contact information on the front cover. O&M manuals must be appropriate for the project and customized for the project. If a Manufacturer's standard O&M manual is included in the submittal, all non-applicable content must be removed or crossed out.

C. Manuals shall include operating and maintenance information on all systems and pieces of equipment. The manual shall contain sufficient data to install, operate, maintain, repair and rebuild all components of the equipment, design data specific to the project. Descriptions of operation should include procedures for both normal and emergency operation. All information required by the Operations and Maintenance Manual Certification Form described herein and any additional information deemed necessary by the Owner and Engineer for proper installation, operation and maintenance. Also include model numbers and serial numbers, as well as rated capacities and motor data, where applicable.

D. Attached to every hardcopy and electronic PDF of each Operations and Maintenance Manual submitted, the Contractor shall provide a copy of the complete Operations and Maintenance Manual Certification Form (copy provided for the Contractor's use at the end of this Specification Section) signed by both the Contractor and the Manufacturer.

1.5 MANUFACTURER'S CERTIFICATES

A. Prior to accepting the installation, the Contractor shall submit manufacturer's certificates for each item specified.

B. Such manufacturer's certificates shall state that the equipment has been installed under either the continuous or periodic supervision of the manufacturer's authorized representative, that it has been adjusted and initially operated in the presence of the manufacturer's authorized representative, and that it is operating in accordance with the specified requirements, to the manufacturer's satisfaction. All costs for meeting this requirement shall be included in the Contractor's bid price.

1.6 SUBMISSION REQUIREMENTS

A. Accompany submittals with transmittal letter, containing:
   1. Date.
   2. Project title and number.
   3. Contractor's name and address.
   4. The sequential shop drawing number for each shop drawing, project data and sample submitted shall be:
      i. Specification Section number followed by a dash and then a sequential number beginning with 01 (e.g., 16000-01).
      ii. Under limited situations when additional different pieces of equipment are submitted under the same specification section, those submittals shall be numbered sequentially (e.g. 05500-01, 05500-02, 05500-03, etc.).
      iii. Resubmittals shall include decimal point and an alphabetic suffix after the corresponding sequential number (e.g., 16000-01A).
      iv. O&M submittals shall be numbered with the Specification Section number followed by a dash, the letters “OM”, another dash, and then a sequential number beginning with 01 (e.g. 16000-OM-01). Resubmittals of O&Ms shall include an alphabetic suffix after the corresponding sequential number (e.g., 16000-OM-01A).
   5. Notification of deviations from Contract Documents.
   6. Other pertinent data.

B. A completed Submittal Certification Form shall be attached to each hardcopy and electronic PDF of each shop drawing and must include:
   1. Project name
   2. Specification Section and sequential number with alphabet suffix for resubmittal
   3. Description
   4. Identification of deviations from Contract Documents.
   5. Contractor's stamp, initialed or signed, certifying review of the submittal, verification of field measurements and compliance with Contract Documents.
   6. Where specified or when requested by the Engineer, manufacturer's certification that equipment, accessories and shop painting meet or exceed the Specification requirements.
   7. Where specified, manufacturer's guarantee.

C. Requirements for Electronic Submittals:
   1. Each individual shop drawing or O&M submittal shall be contained in one

PDF.

2. The first page of the PDF shall be the Submittal Certification Form as described above.
3. Subject lines for e-mails transmitting PDF submissions and subsequent correspondence referring to specific submittals shall identify the submittal's Specification Section, sequential number, appropriate alphabet suffix for resubmittals, and a brief description (e.g. 16010-01-Electrical General).
3. The electronic PDF shall be **exactly** as submitted in the hardcopy and shall be transmitted using e-mail, File Transfer Protocol (FTP), or approved submittal sharing software.
4. PDF versions of 24x36 drawings shall be converted to 24 x 36 PDFs so as not to lose the clarity of the original drawing.
5. Electronic submittals shall be in a "searchable" format wherever possible.
6. Electronic PDF submittals that are not submitted in accordance with the requirements stated above will not be reviewed by the Engineer.

1.7 RESUBMISSION REQUIREMENTS

A. Revise initial drawings as required and resubmit as specified for initial submittal.

B. Indicate on drawings any changes which have been made other than those required by Engineer. All renumbering of shop drawings, relabeling of individual pieces or assemblies or relocating of pieces or assemblies to other Drawings within the submittal shall be clearly brought to the attention of the Engineer.

1.8 ENGINEER'S REVIEW

A. The review of shop and working drawings hereunder will be general only, and nothing contained in this specification shall relieve, diminish or alter in any respect the responsibilities of the Contractor under the Contract Documents and in particular, the specific responsibility of the Contractor for details of design and dimensions necessary for proper fitting and construction of the work as required by the Contract and for achieving the result and performance specified thereunder.

B. The Engineer's review comments will be summarized on a Submittal Review Form, which includes an action code. A description of each action code is provided below.

1. **No Exceptions Taken (Status 0 on shop drawing log)**. The shop drawing complies with the Contract Document requirements. No changes or further information are required. Where appropriate, the submittal review form will be used to alert the Contractor, Owner and Field personnel of remaining items within that specification section that still needs to be submitted.
2. **Make Corrections Indicated (Status 1 on shop drawing log)**. The shop drawing complies with the Contract Document requirements except for minor changes, as indicated. Resubmittal is not required unless it is specifically called for; however, Engineer requires that all comments will be addressed by the Contractor, unless otherwise notified in writing prior to execution of the relevant work.
3. **Conditional to Remarks (Status 2 on shop drawing log)**. The shop drawing potentially complies with the Contract Document requirements, contingent

upon satisfactory resolution of review comments. Remarks will explicitly list what information needs to be resubmitted. Resubmittal from the Contractor should include a cover letter or summary which indicates how each review comment has been addressed.

4. **Revise and Resubmit (Status 3 on shop drawing log)**. The shop drawing does not comply with the Contract Document requirement as submitted, but may with changes indicated and/or submission of additional information. The entire package must be resubmitted with the necessary information and a cover letter which indicates how each review comment has been addressed and where to find the information in the resubmittal.
5. **Rejected (Status 4 on shop drawing log)**. The shop drawing does not comply with the Contract Document requirements, for the reasons indicated in the remarks, and is unacceptable.
6. **In Review (Status 5 on shop drawing log)**. The shop drawing is currently under review.
7. **For Information Only (Status 6 on shop drawing log)**. The shop drawing review was informational only. No comments are provided.

SUBMITTAL CERTIFICATION FORM

PROJECT: _____ CONTRACTOR'S PROJ. NO: _____

CONTRACTOR: _____ ENGINEER'S PROJ. NO: _____

ENGINEER: _____

SHOP DRAWING NUMBER:	_____	-	_____
	SPECIFICATION SECTION OR DRAWING NO:		SEQUENTIAL NUMBER (& ALPHA SUFFIX FOR RESUBMITTAL)

DESCRIPTION: _____

MANUFACTURER:_____

The above referenced submittal has been reviewed by the undersigned and I/we certify that the material and/or equipment meets or exceeds the project specification requirements with

☐ NO DEVIATIONS

or

☐ A COMPLETE LIST OF DEVIATIONS AS FOLLOWS[a]:

_____

_____

_____

_____

_____

By:_____ By:_____

Contractor[b] Manufacturer[c]

Date: _____Date: _____

[a] Any deviations not brought to the attention of the Engineer for review and concurrence shall be the responsibility of the Contractor to correct, if so directed.

[b] Required on all submittals

[c] When required by specifications

General Contractor's Stamp

OPERATIONS AND MAINTENANCE MANUAL CERTIFICATION FORM

PROJECT: _____ CONTRACTOR'S PROJ. NO: _____

CONTRACTOR: _____ ENGINEER'S PROJ. NO: _____

ENGINEER: _____

O&M NUMBER: _____ - OM- _____

SPECIFICATION SECTION OR DRAWING NO: — SEQUENTIAL NUMBER (& ALPHA SUFFIX FOR RESUBMITTAL)

DESCRIPTION: _____

MANUFACTURER:_____

The above referenced operations and maintenance manual has been reviewed by the undersigned and I/we certify that the manual is customized as needed for this project, inserted in a 3-ring binder, and contains the following items:

- ☐ Table of Contents
- ☐ Maintenance Schedule and Summary
- ☐ Lubrication Schedule
- ☐ Troubleshooting Information
- ☐ Alarm Sequence with Description
- ☐ Warranty Information
- ☐ Rebuild Information for All Components/ Systems
- ☐ Startup, Operation, Shutdown Procedures
- ☐ Safety Procedures
- ☐ Shop Drawings corrected to As-Built Conditions
- ☐ Project-Related Design Data
- ☐ Wiring Diagrams
- ☐ Equipment Layout Drawings & Schematics
- ☐ Equipment Performance Curves
- ☐ Parts and Service Contact Information
- ☐ Manufacturer's Contact Information
- ☐ Emergency Operations Plan
- ☐ List of Part Numbers and manufacturers for all Components
- ☐ List of Spare Parts Supplied and Cost
- ☐ Electronic Submittal

By:_____ Contractor[a]

Date: _____

By:_____ Manufacturer[b]

Date: _____

[a] Contact information shall include name, address and telephone number.
[b] Required on all Operation and Maintenance Manuals.
[c] When required by Specifications.

Page ___ of ___

General Contractor's Stamp

END OF SECTION

SECTION 01370

SCHEDULE OF VALUES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Extent of Work:
   1. Provide a detailed breakdown of the agreed Contract Sum showing values allocated to each of the various parts of the Work, as specified herein and in other provisions of the Contract Documents.

B. Related Work Specified Elsewhere:
   1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, and Sections of these Specifications.
   2. Schedule of values is required under the General Conditions.
   3. Schedule of values is required to be compatible with applications for progress payment.

1.2 QUALITY ASSURANCE

A. Use required means to assure arithmetical accuracy of the sums described.

B. When so required by the Engineer, provide copies of the subcontracts or other data acceptable to the Engineer substantiating the sums described.

1.3 SUBMITTALS

A. Prior to first application for payment, submit a proposed schedule of values to the Engineer.
   1. Secure the Engineer's approval of the schedule of values prior to submitting first application for payment.

END OF SECTION

SECTION 01380

CONSTRUCTION PHOTOGRAPHS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:

1. Pre-Construction Record: Contractor shall utilize digital photographs and/or video to obtain a visual record of the project area; copies of same shall be given to the Engineer and Owner.
2. Notify Engineer at least three (3) working days prior to photographing or videoing the project area so Engineer may, at his option, observe.

1.2 QUALITY

A. Pre-Construction Record: Quality shall be such that the condition of existing pavement, curbing, driveway entrances, sidewalks, building walls, finishes, furnishings, casework, exposed piping, conduits and all other exposed items that can be readily determined.

1.3 SUBMITTAL OF PRINTS

A. Pre-Construction Record: Submit hard copy prints and electronic files on CD ROM, and video electronic files on DVD to the Engineer and Owner prior to any construction work.

B. The quality of the photos and video are subject to approval by the Engineer prior to the start of construction work in the areas shown by the photos.

END OF SECTION

SECTION 01400

QUALITY CONTROL

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

A. General Quality Control.
B. Workmanship.
C. Manufacturer's Instructions.
D. Manufacturer's Certificates.
E. Manufacturer's Field Services.
F. Testing Laboratory Services.

1.2 RELATED REQUIREMENTS

A. Section C - General Conditions: Inspection and testing required by governing authorities.
B. Section 01340 - Submittals: Submittal of Manufacturer's Instructions and Certifications.
C. Section 02200 - Earthwork.

1.3 QUALITY CONTROL

A. Maintain quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.

1.4 WORKMANSHIP

A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.
B. Perform work by persons qualified to produce workmanship of specified quality.
C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking.

1.5 MANUFACTURERS' INSTRUCTIONS

A. Comply with instructions in full detail, including each step in sequence. Should instructions conflict with Contract Documents, request clarification from Engineer before proceeding.

1.6 MANUFACTURERS' CERTIFICATES

A. When required by individual Specifications Section, submit manufacturer's certificate that products meet or exceed specified requirements.

1.7 MANUFACTURERS' FIELD SERVICES

A. When specified in respective Specification Sections, require supplier and/or manufacturer to provide qualified personnel to observe field conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment as applicable, and to make appropriate

recommendations.

B. Representative shall submit written report to Engineer listing observations and recommendations.

1.8 TESTING LABORATORY SERVICES

A. Contractor will employ and pay for services of an Independent Testing Laboratory to perform inspections, tests, and other services wherever an Independent Testing Laboratory is required by individual specification sections listed in paragraph 1.2 above, unless otherwise indicated.

B. Services will be performed in accordance with requirements of governing authorities and with specified standards.

C. Reports will present observations and test results and indicate compliance or non-compliance with specified standards and with Contract Documents. Independent Testing Laboratory will submit one copy of each report directly to each of the following: Engineer, Resident Project Representative and Contractor. Reports will be mailed within 5 days of obtaining test results. If test results indicate deficiencies, Independent Testing Laboratory shall telephone or FAX results to Engineer, Resident Project Representative and Contractor within 24 hours.

D. Contractor shall cooperate with Independent Testing Laboratory personnel; furnish tools, samples of materials, design mix, equipment, storage and assistance as requested.

E. Contractor shall coordinate all testing work and shall notify Engineer and Independent Testing Laboratory at least 24 hours prior to performing work requiring testing services. The Contractor shall suspend work on that portion of the Project until testing can be performed. Such suspension will not be grounds for a claim against the Owner for delay, nor will it be an acceptable basis for an extension of time.

F. Payment for Independent Testing Laboratory services shall be the Contractor's responsibility.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 01500

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:

1. This section includes temporary facilities for the Contractor's work and facilities for the Contractor's workforce on site. Temporary facilities to maintain plant operations is specified in Section 01010 – Summary of Work and Section 16010 – Electrical – General.
2. Provide and pay for all temporary applicable utilities required to properly perform the Work at no additional cost to the Owner including the placement and removal of the temporary utilities.
2. Completely remove all temporary equipment and materials upon completion of the Work and repair all damage caused by the installation of temporary utilities.
3. Make all necessary applications and arrangements for electric power, light, water and other utilities with the local utility companies. Notify the local electric power company if unusually heavy loads, such as welders, will be connected.
4. Contractor shall provide temporary ventilation during construction as required to ensure a safe working environment. The temporary ventilation systems shall address the following conditions, including but is not limited to removal of paint flumes and other potentially toxic conditions associated with the contractor's activities, and ventilation of confined spaces, in compliance with all OSHA and State safety requirements.

1.2 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies:

1. Obtain permits as required by local governmental authorities.
2. Obtain easements, when required, across private property other than that of the Owner for temporary power service.
3. Comply with the latest National Electrical Code.
4. Comply with all local, State and Federal codes, laws, and regulations.

B. All temporary utilities are subject to the approval of the Engineer.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Electrical:

1. The General Contractor shall make necessary arrangements and coordinate with the Owner for connection to the existing power supply for all temporary light and power requirements. In general, the temporary electrical power shall include all necessary switches, poles, wiring, cables, conduit, raceways,

panelboards, fixtures, lamps and receptacles to supply construction power of adequate capacity for the project. General Contractor shall be responsible for making all arrangements for using any existing power for temporary purposes. Use new or used materials adequate in capacity for the purposes intended.

2. Materials must not create unsafe conditions or violate the requirements of applicable codes.
3. Conductors:
   a. Wire, cable or busses of appropriate type, sized in accordance with the latest National Electrical Code for the applied loads.
   b. Use only UL approved wire.
4. Conduit:
   a. Rigid steel, galvanized: ANSI C80.1.
   b. Electrical metallic tubing: ANSI C80.3.
   c. Other material approved by NEC.
5. Equipment: Provide appropriate enclosures for the environment in which used in compliance with NEMA Standards.
6. Temporary power shall be based upon the following minimum requirements:
   a. Lighting - 300 watt per 1,000 square feet of floor area.
   b. Receptacles - One 15 ampere duplex for 1,000 square feet of floor space.
   c. Special Construction Equipment - Provide one 30-amp, 2-pole fused switch for equipment connection. The cost for cables and connection from switch to the special equipment will be borne by the Sub-Contractor requiring same.
7. The General Contractor will pay for the cost of energy consumed by all trades, including cost of lamp replacement. The General Contractor and Subcontractors of all trades shall furnish their own extension cords and such additional lamps as may be required for their work, shall pay for the cost of temporary wiring of a special nature for light and power required, other than that above mentioned.
8. All temporary work shall be furnished and installed in conformity with the National Electrical Code and in accordance with local ordinances and requirements of the municipal power authority. All temporary wiring and accessories shall be removed after it has served its purpose.

B. Heating and Ventilation at New Construction:
   1. The General Contractor shall furnish, install, and maintain a complete temporary heating and ventilation systems, including fuel therefore, which will provide heat and ventilation as required by the trades and for the protection of personnel in the work spaces, and stored and installed materials from injury as can be caused by dampness and cold. The General Contractor shall bear all costs incurred from the temporary heating and ventilation from the time the systems are first required until the date of Substantial Completion of the General Contract, as defined in the General Conditions and Supplementary Conditions.
   2. Under no circumstance shall the permanent heating system be used for temporary heating purposes, until the building/buildings have been considered

as satisfactorily enclosed by the Engineer, specified hereunder.

3. Temporary heating equipment must be smokeless and fumeless type, Underwriters Laboratories, Factory Mutual, Fire Marshal and Engineer approved, and will fulfill the heating requirements specified hereunder.
4. As soon as practicable, after the building/buildings have been considered satisfactorily enclosed by the Engineer, the General Contractor shall have the permanent heating and ventilation systems and apparatus put in operation. Electrical service, wiring, controls, and other essential parts of the permanent system must be installed prior to utilizing the heating system.
5. After enclosure of the building/buildings and before installation of wet work such as interior masonry maintain temperatures of 50 degrees minimum, except for a period commencing 10 days prior to the installation of interior painting, whichever occurs first, after which time the temperature shall be maintained at a minimum of 65 degrees F., until the project is either partially or permanently occupied by the Owner.

C. Water and Sanitary:

1. The General Contractor shall make necessary arrangements for connection to the municipal water supply and shall provide, at his own expense, any extensions as required for the operation of this project. The General Contractor shall bear all costs incurred for the temporary water services, including the costs of the water itself.
2. All lines, temporary or permanent, shall be protected and maintained by the General Contractor. Temporary lines shall be removed by the General Contractor when the temporary service is no longer required.
3. The General Contractor shall provide an adequate drinking water supply, satisfactorily cooled, for his employees.
4. The General Contractor shall furnish, install, maintain and pay for adequate temporary chemical type toilet accommodations, for all persons employed on the work and located where approved by the Engineer. The accommodations shall be in proper enclosures and in accordance with Municipal Ordinances and shall be maintained in proper, safe and sanitary conditions and suitably heated when requested.
5. Relocate temporary toilet facilities as required to facilitate the construction.
6. Remove all temporary facilities at completion of work when directed by the Engineer.

PART 3 - EXECUTION

3.1 PERFORMANCE

A. Electrical:

1. Provide electrical energy to:
   a. All necessary points on the construction site so that power can be obtained at any desired point with extension cords no longer than 100 feet.

b. Construction site offices.
c. Lighting as required for safe working conditions at any location on the construction site.
d. Night security light.
e. When applicable, Owner's present facilities during the changeover of electrical equipment.

2. Maintain electrical energy throughout the entire construction period.
3. Capacity:
   a. Provide and maintain adequate electrical service for construction use by all trades during the construction period at the locations necessary, as specified herein.
   4. Installation:
   a. Install all work with a neat and orderly appearance.
   c. Have all installations performed by a qualified electrician.
   d. Modify service as job progress requires.
   e. Locate all installations to avoid interference with cranes and materials handling equipment, storage areas, traffic areas and other work.

B. Heating and Ventilation:
1. Maintain a heated and ventilated environment for the work at the temperature and for the length of time specified or as directed by the Engineer, and as needed to protect all individuals on the construction site.
2. Precaution:
   a. Operate temporary heating apparatus in such a manner that finished work will not be damaged.
   b. Repair all damage, caused by temporary heating operations, to the complete satisfaction of the Engineer.

C. Water:
1. Provide and maintain water for drinking and construction purposes as required for the proper execution of the Work.

D. Sanitary Accommodations:
1. Provide and maintain sanitary accommodations for the use of the employees of the General Contractor, subcontractors, and Engineer.
2. Sanitary accommodations shall meet the requirements of all local, State and Federal health codes, laws and regulations.

END OF SECTION

SECTION 01562

DUST CONTROL

PART 1 - GENERAL

1.1 DESCRIPTIONS

A. Work Included:

1. Furnish and apply water or calcium chloride on the road surfaces within the construction site, when required to control dust and when directed by the Engineer.
2. When dust control is not included as a separate item in the Contract, the work shall be considered incidental to the appropriate items of the Contract.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Water for Sprinkling:

B. Clean, free of salt, oil, and other injurious matter.

C. Calcium Chloride:

1. Meet the requirements of AASHTO M144.

PART 3 - EXECUTION

3.1 APPLICATION

A. Water:

1. Apply water by methods approved by the Engineer.
2. Use approved equipment including a tank with gauge equipped pump and spray bar.

B. Calcium Chloride:

1. Apply at a rate sufficient to maintain a damp surface but low enough to assure non-contamination of water courses.
2. Apply water prior to calcium chloride addition.

END OF SECTION

SECTION 01580

PROJECT IDENTIFICATION AND SIGNS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:

1. Provide and erect sign(s) at the project site to identify the project and to indicate the applicable Federal and State Government Agencies that are participating in the development of the project.

B. Do not place, or allow the placement of, other advertising sign boards at the project site or along rights-of-way furnished for the project work.

PART 2 - PRODUCTS

2.1 MATERIAL AND DESIGN

A. Construct a sign of 3/4-inch exterior grade, high density overlaid plywood or other material, approved by the Engineer, suitable for signs.

PART 3 - EXECUTION

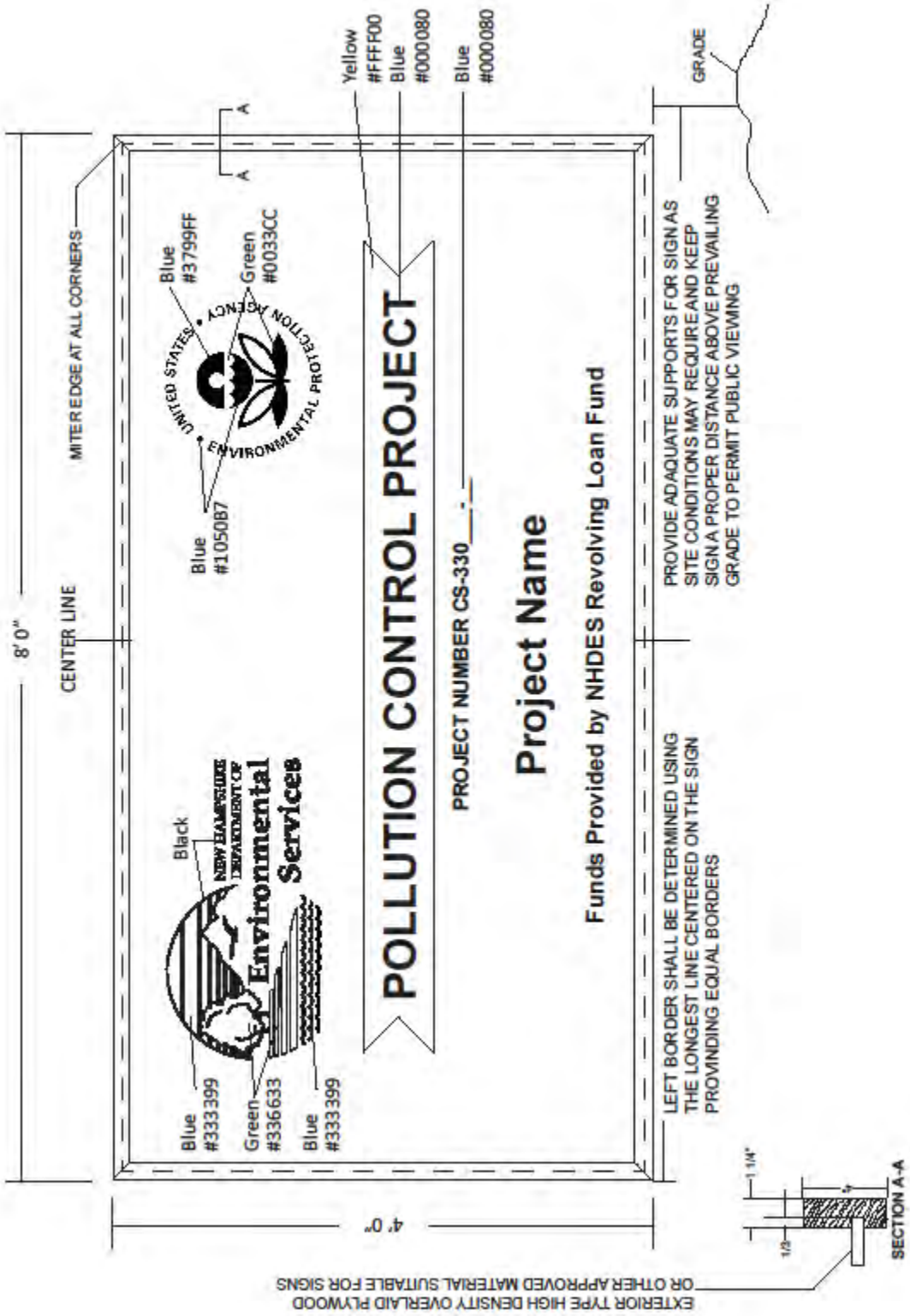
3.1 INSTALLATION

A. Erect the sign in a prominent location as approved by the Engineer.

B. Construct the sign in accordance with the following sample Drawing.

C. Remove the sign when the Work has been completed at no additional cost to the Owner.

END OF SECTION


8' 0"
4' 0"
CENTER LINE
MITER EDGE AT ALL CORNERS
A
A
Blue #3799FF
Green #0033CC
Blue #1050B7
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Black
NEW HAMPSHIRE DEPARTMENT OF
Environmental Services
Blue #333399
Green #336633
Blue #333399
Yellow #FFFF00
Blue #000080
Blue #000080
POLLUTION CONTROL PROJECT
PROJECT NUMBER CS-330___-__
Project Name
Funds Provided by NHDES Revolving Loan Fund
LEFT BORDER SHALL BE DETERMINED USING THE LONGEST LINE CENTERED ON THE SIGN PROVINDING EQUAL BORDERS
PROVIDE ADAQUATE SUPPORTS FOR SIGN AS SITE CONDITIONS MAY REQUIRE AND KEEP SIGN A PROPER DISTANCE ABOVE PREVAILING GRADE TO PERMIT PUBLIC VIEWING
GRADE
1 1/4"
1/3
SECTION A-A
EXTERIOR TYPE HIGH DENSITY OVERLAID PLYWOOD OR OTHER APPROVED MATERIAL SUITABLE FOR SIGNS

SECTION 01630

SUBSTITUTIONS AND PRODUCT OPTIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. The below listed requirements are in addition to the requirements contained in the General Conditions of the Construction Contract.

1.2 SUBMITTALS

A. Submit a written application for approval completely describing the proposed substitution.

B. Submit, when requested by the Engineer:

1. Manufacturer's catalog data.
2. Illustrations.
3. Specifications.
4. Samples.
5. Other material that may be required to determine acceptability.

1.3 CRITERIA

A. The following criteria will be used by the Engineer in determining the acceptability of proposed substitutions:

1. Adaptability to the design.
2. Functional performance.
3. Quality of materials.
4. Strength of materials.
6. Complexity, frequency and cost of maintenance.

1.4 RESULTING CHANGES

A. If proposed substitutions are judged as being acceptable, make all changes to structures, buildings, piping, electrical, and other items necessary to accommodate the substitutions, at no additional cost to the Owner.

B. Whenever 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.

C. Engineer’s Cost Reimbursement: Engineer will record Engineer’s costs in evaluating a substitute proposed or submitted by Contractor. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.

END OF SECTION

SECTION 01710

PROJECT CLEANING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:

1. Maintain premises and public properties free from accumulations of waste, debris, and rubbish, caused by operations.
2. At completion of work, remove waste materials, tools, equipment, machinery and surplus materials, and clean all sight-exposed surfaces. Leave project clean and ready for use.

1.2 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies: Conduct cleaning and disposal operations in accordance with all applicable local and state laws, ordinances, and code requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Use only cleaning materials recommended by manufacturer of surfaces to be cleaned.

B. Use cleaning materials only on surfaces recommended by cleaning material manufacturers.

PART 3 - EXECUTION

3.1 PERFORMANCE

A. Cleaning During Construction:

1. Execute cleaning operations to ensure that buildings, grounds, and public properties are maintained free from accumulations of waste materials and rubbish.
2. Entirely remove and dispose of material or debris during the progress of the work that has washed into or has been placed in watercourses, ditches, gutters, drains, catch basins, or elsewhere as a result of the Contractor's operations.
3. Wet down dry materials and rubbish to lay dust and prevent blowing dust.
4. At reasonable intervals during the progress of work, clean the site and dispose of waste materials, debris, and rubbish.
5. Clean interiors of buildings, when applicable, prior to finish painting, and continue to clean on an as-needed basis until buildings are ready for occupancy.
6. Handle materials in a controlled manner with as few handlings as possible. Do not drop or throw material from heights.
7. When applicable, schedule cleaning operations so that dust and other contaminants resulting from the cleaning process will not fall on wet, newly painted surfaces.

B. Control of Hazards:
   1. Store volatile wastes in covered metal containers, and remove from premises daily.
   2. Prevent accumulation of wastes which may create hazardous conditions.
   3. Provide adequate ventilation during use of volatile or noxious substances.

C. Disposal:
   1. Do not burn or bury rubbish and waste materials on project site.
   2. Do not dispose of volatile wastes, such as mineral spirits, oil, or paint thinner, in storm or sanitary drains.
   3. Do not dispose of wastes into streams or waterways.

D. Final Cleaning:
   1. Employ experienced workmen, or professional cleaners, for final cleaning.
   2. Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials, from all sight-exposed interior and exterior finished surfaces.
   3. Repair, patch and touch up marred surfaces to specified finishes.
   4. Broom clean paved surfaces.
   5. Rake clean non-paved surfaces of the project site.
   6. Restore to their original condition those portions of the site not designated for alterations by the Contract Documents.

END OF SECTION

SECTION 01720

PROJECT RECORD DOCUMENTS

PART l - GENERAL

1.1 DESCRIPTION

A. Work Included:
   1. Keep accurate record documents for all additions, demolition, substitutions of material, variations in work, and any other additions or revisions to the Contract.

B. Related Work Specified Elsewhere:
   1. Shop Drawings, Project Data, Samples and Operations and Maintenance Manuals are specified in "General Conditions" and Section 01340, Submittals.

1.2 MAINTENANCE OF DOCUMENTS

A. Maintain at job site, one copy of:
   l. Contract Drawings
   2. Specifications
   3. Addenda
   4. Reviewed Shop Drawings
   5. Change Orders
   6. Any other modifications to the Contract
   7. Field Test Reports

B. Store documents in files and racks specifically identified for this use that are apart from documents used for construction.

C. File documents in a logical manner indexed for easy reference.

D. Maintain documents in clean, dry, legible condition.

E. Do not use record documents for construction purposes.

F. Make documents available at all times for inspection by the Engineer and Owner, and by the end of the project, transmit these documents to the Engineer.

1.3 RECORDING

A. Label each document "PROJECT RECORD" in large high printed letters.

B. Keep record documents current and do not permanently conceal any work until required information has been recorded.

C. General Field Recording Issues:
   1. All ties should be taken from existing, permanent features such as utility poles, corners of houses and hydrants. Porches, sheds or other house additions should be avoided for they could be torn down. A minimum of two ties should be taken.
   2. Stations should be recorded to the nearest foot.
   3. Inverts should be recorded to the nearest hundredth of a foot.
   4. Elevations should be recorded to the nearest hundredth of a foot.
   5. Building dimensions should be recorded to the nearest 1/4".

D. Project Record Drawings - Legibly mark Contract Drawings to record existing utilities and actual construction of all work, including but not limited to the following (where applicable):

1. Existing Utilities
   Water mains and services, water main gate valves, sewer mains and services, storm drains, culverts, steam lines, gas lines, tanks, plant water lines , process lines and other existing utilities encountered during construction must be accurately located and shown on the Drawings. In congested areas supplemental drawings or enlargements may be required.
   a. Show any existing utilities encountered in plan and profile and properly labeled showing size, material and type of utility. Ties should be shown on plan. Utility should be drawn to scale in section (horizontally and vertically) and an elevation should be called out to the nearest hundredth of a foot.
   b. When existing utility lines are broken and repaired, ties should be taken to these locations.
2. Buried Electrical Conduit
   a. Show routing for electrical conduits and pull boxes, especially in close proximity to buildings and when the conduits change direction or cross underground piping.
3. Buildings
   a. In general, small changes to structures should not be redrawn. If any dimensional changes were made in the field, the numerical change should be made on the Drawing and be properly labeled. Update dimensions and elevations on Drawings.
   b. Show finished concrete elevations (top of slab, top of wall, top of footing, etc.). Redraw any foundation, frost wall, etc. that was modified, deepened, or altered during construction.
   c. Adjust finished concrete horizontal dimensions that are shown on the Drawings.
   d. Adjust structural steel elevations and horizontal dimensions that are shown on the Drawings.
   e. Show location of anchors, construction and control joints, and waterstops, when they are different from those shown on Drawings.
   f. Any additions or major changes should be shown in both plan and elevation (i.e. relocated doors, opposite door swings, change in wall location, relocation of floor drains).
   g. Show approximate location and routing of electrical conduits in walls, slabs and ceilings. Most conduits are run in groups, therefore, use range of measurements to define location for entire section of conduits.
   h. Special circuits for computers, alarms and instrumentation should be shown.
   i. Show any changes in location and elevation of ductwork and devices, fuel piping and equipment, and heat piping and equipment.
   j. If wall mounted electrical switches, control boxes, thermostats, etc. have been relocated significantly, (other side of door, or to a wall other than

indicated diagrammatically on electrical plans) make the revision accordingly.

E. Specifications and Addenda - Legibly mark up each section to record:
   1. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.
   2. Changes made by Change Order, Field Order, or other method.

1.4 SUBMITTALS

A. At the completion of the project, deliver record documents to the Engineer.
B. Accompany submittal with transmittal letter, in duplicate, containing:
   1. Date, project title and number.
   2. Contractor's name and address.
   3. Title and number of each record document with certification that each document is completed and accurate.
   4. Signature of Contractor, or his authorized representative.
C. Failure to supply all information on the Project Record Drawings as specified in Part 1.3 may result in additional retainage from monthly partial payment requests, and in non-approval of final payments of the Contract and/or if contract time (as specified in accordance with the Standard General Conditions of the Construction Contract) has elapsed, this shall be grounds for the enactment of the liquidated damages as specified.

END OF SECTION

SECTION 02050

DEMOLITION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:

1. The Contractor shall furnish all labor, materials, tools, equipment and apparatus necessary and shall do all work required to complete the demolition, removal, and alterations of existing facilities as indicated on the Drawings, as herein specified, and/or as directed by the Engineer.
2. Demolition and alteration work within occupied areas shall be accomplished with minimum interference to the occupants and to the plant which shall be in continuous operation during construction.
3. All equipment, piping, and other materials that are not to be relocated or to be returned to the Owner shall become the property of the Contractor and shall be disposed of by him, away from the site of the work and at his own expense.
4. All demolition or removal of existing structures, utilities, equipment, and appurtenances shall be accomplished without damaging the integrity of existing structures, equipment, and appurtenances to remain, to be salvaged for relocation or stored for future use.
5. Such items that are damaged shall be either repaired or replaced at the Contractor's expense to a condition at least equal to that which existed prior to the start of his work.

B. Related Work Specified Elsewhere: (When Applicable)

1. Summary of Work, Section 01010.
2. Construction Schedules, Section 01310.
3. Earthwork, Section 02200.

1.2 JOB CONDITIONS

A. Condition of Structures:

1. The Owner assumes no responsibility for the actual condition of structures to be demolished.
2. Conditions existing at the time of inspection for bidding purposes will be maintained by the Owner as far as practicable. However, variations within the structures may occur due to Owner's removal and salvage operations prior to the start of demolition work (where applicable).

1.3 UTILITIES

A. Utility Locations: Utility locations shown on the plans are approximate only, based on information supplied by the utility companies.

B. Coordination with Utilities: The Contractor shall make all necessary arrangements and perform any necessary work to the satisfaction of affected utility companies

and governmental divisions involved with the discontinuance or interruption of affected public utilities and services.

1.4 SUBMITTALS

A. Schedule - Demolition:
   1. Submit two (2) copies of proposed methods and operations of demolition to the Engineer for review prior to the start of work. Include in the schedule the coordination for shut-off, capping and continuation of utility services as required.
   2. Provide a detailed sequence of demolition and removal work to ensure the uninterrupted progress of the Owner's operations.

1.5 PROTECTIONS

A. Ensure the safe passage of persons around the area of demolition. Conduct operations to prevent injury to adjacent buildings, structures, other facilities and persons. Erect temporary, covered passageways as required by authorities having jurisdiction.
B. Provide interior and exterior shoring, bracing, or support to prevent movement, settlement or collapse of structures to be demolished and adjacent facilities to remain.

1.6 DAMAGES

A. The Contractor shall promptly repair damages caused by demolition operations to adjacent facilities at no cost to the Owner.

PART 2 - PRODUCTS

Not Applicable.

PART 3 - EXECUTION

3.1 PERFORMANCE

A. Remove and dispose of non-salvageable material in accordance with all applicable local and state laws, ordinances and code requirements.
B. Dispose of material as it accumulates, typically on a daily basis. Coordinate the demolition and disposal schedule with the Owner on a daily basis.
C. Carefully remove, store and protect from damage all materials to be salvaged.
D. Buildings and Adjacent Property:
   1. Protect all buildings and property adjacent to equipment to be removed from damage by erecting suitable barriers or by other suitable means.
   2. Leave such buildings in a permanently safe and satisfactory condition.
E. Maintaining Traffic:
   1. Ensure minimum interference with roads, streets, driveways, sidewalks and adjacent facilities.
   2. Do not close or obstruct streets, sidewalks, alleys or passageways without permission from authorities having jurisdiction.

H. Maintain Treatment: During demolition, maintain wastewater treatment as outlined in Section 01010, Summary of Work.

I. Demolition Sequence: The demolition sequence shall conform to the reviewed and approved project schedule, and restrictions outlined in Section 01310, Construction Schedules.

J. Pest Control:
   1. Provide pest control when needed or when directed by the Engineer.
   2. Exterminate and prevent migration of rodents to adjoining buildings in accordance with the requirements of the state or local health department.

END OF SECTION

SECTION 02115

STRIPPING AND STOCKPILING TOPSOIL

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: Segregate topsoil approved by the Engineer prior to excavation, trenching and grading operations and stockpile it for use in the work.

B. Related Work Specified Elsewhere: (When Applicable)

1. Demolition, Section 02050.
2. Earthwork, Section 02200.
3. Loaming and Seeding, Section 02485.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Topsoil shall consist of friable loam of at least two percent decayed organic matter (humus), free of subsoil, and reasonably free of clay lumps, brush, roots, weeds, and other objectionable vegetation, stones and similar objects larger than one (1) inch in any dimension, litter and other materials unsuitable or harmful to plant growth. It shall contain no toxic materials.

B. The quality of the topsoil material to be used shall be subject to approval by the Engineer.

PART 3 - EXECUTION

3.1 PERFORMANCE

A. Remove topsoil from the areas that are likely to be disturbed as a result of construction operations to a depth based on the soil profile, as approved by the Engineer.

B. Remove topsoil from all designated areas prior to the performance of normal excavation.

3.2 STORAGE

A. Transport topsoil and deposit in storage piles convenient to the areas which are subsequently to receive the application of topsoil.

B. Stockpile topsoil separate from other excavated materials in areas approved by the Engineer.

C. Take all necessary precautions to prevent other excavated material and objectionable material from becoming intermixed with the topsoil before, during and after stripping and stockpiling operations.

D. Neatly trim and grade stockpiles to provide drainage from surfaces and to prevent depressions where water may become impounded.

E. Construct temporary erosion control devices for all stockpiled material, subject to the Engineer's approval.
F. All loam stripped and stockpiled shall be immediately seeded with 70% Domestic/30% Perennial Rye Grass.

END OF SECTION

SECTION 02200

EARTHWORK

PART 1 - GENERAL

1.1 DESCRIPTION

A. The Work described by this Section consists of all earthwork encountered and necessary for construction of the project as indicated in the Contract Documents, and includes but is not limited to the following:
   1. Excavation
   2. Backfilling and Filling
   3. Compaction
   4. Grading
   5. Providing soil material as necessary
   6. Disposal of excess suitable material and unsuitable materials

B. Related Work Specified Elsewhere:
   1. Quality Control, Section 01400.
   2. Clearing and Grubbing, Section 02110.
   3. Stripping and Stockpiling Topsoil, Section 02115.
   4. Temporary Erosion Control, Section 02270.
   5. Loaming and Seeding, Section 02485.
   6. Bituminous Concrete Paving, Section 02513C

1.2 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies:
   1. All work shall be performed and completed in accordance with all local, state and federal regulations.
   2. The General Contractor shall secure all other necessary permits unless otherwise indicated from, and furnish proof of acceptance by, the municipal and state departments having jurisdiction and shall pay for all such permits, except as specifically stated elsewhere in the Contract Documents.

B. Line and Grade: The Contractor shall establish the lines and grades in conformity with the Drawings and maintain same to properly perform the work.

C. Testing Methods:
   1. Gradation Analysis: Where a gradation is specified the testing shall be in accordance with ASTM C117 and ASTM C136 (latest revision).
   2. Compaction Control:
      a) Unless otherwise indicated, wherever a percentage of compaction for backfill is indicated or specified, it shall be the in-place density divided by the maximum density and multiplied by 100. The maximum density

shall be the density at optimum moisture as determined by ASTM Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort, Designation D1557 (Modified Proctor), latest revision, unless otherwise indicated.

b) The in-place density shall be determined in accordance with ASTM Standard Test Method for Density and Unit Weight of Soil in Place by the Sand Cone Method, Designation D1556, latest revision, or Nuclear Method Designation D2922.

c) Wherever specifically indicated, maximum density at optimum moisture may be determined by ASTM Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort, ASTM D698 (Standard Proctor), latest revision.

d) An Independent Testing Laboratory will be retained by the Contractor to conduct all laboratory and field soil sampling and testing, and to observe earthwork and foundation construction activities. Laboratory testing will consist of sieve analyses, natural water content determinations, and compaction tests. Field testing will consist of in-place field density tests and determination of water contents.

1.3 SUBMITTALS

A. Collection of samples and testing of all materials for submittals shall be performed by the Independent Testing Laboratory and paid for by the Contractor.

B. Submit test results in accordance with the procedure specified in the General and Supplementary Conditions.

C. Submit test results (including gradation analysis) and source location for all borrow material to be used at least 10 working days prior to its use on the site. Contractor shall identify and provide access to borrow sites.

D. Submit moisture density curve for each type of soil (on site or borrow material) to be used for embankment construction or fill beneath structures or pavement.

1.4 TESTS

The Independent Testing Laboratory shall conform to the following procedures and standards:

A. Submit test results in accordance with the procedure specified in the General and Supplementary Conditions.

B. All testing shall be performed by a qualified Independent Testing Laboratory acceptable to the Engineer and Owner at the Contractor's expense.

C. Trenches: Field density test in trenches within the paved areas shall be taken at 50 linear foot intervals on every second lift.

D. In addition to the above tests the Independent Testing Laboratory will perform additional density tests at locations and times requested by the Engineer.

E. Additional density testing will be required by the Engineer if the Engineer is not satisfied with the apparent results of the Contractor's compaction operation shall be at the Contractor’s expense. The Contractor shall take the necessary steps to bring the work into compliance with the project requirements at no additional cost to the

Owner. No allowance will be considered for delays in the performance of the work.

1.5 JOB CONDITIONS

A. Site Information:

1. Data on indicated subsurface conditions are not intended as representations or warranties of accuracy or continuity between soil borings. It is expressly understood that Owner and Engineer will not be responsible for interpretations or conclusions drawn therefrom by the Contractor. Data are made available for the convenience of Contractor.
2. Additional test borings and other exploratory operations may be made by Contractor at no additional cost to Owner.

B. Existing Utilities and Structures:

1. The locations of utilities and structures shown on the Drawings are approximate as determined from physical evidence on or above the surface of the ground and from information supplied by the utilities. The Engineer in no way warranties that these locations are correct. It shall be the responsibility of the Contractor to determine the actual locations of any utilities or structures within the project area.

PART 2 - PRODUCTS

2.1 SOIL MATERIAL

A. Gravel Base: Shall be crushed gravel (NHDOT Item #304.3, Crushed Gravel) of hard durable particles free from vegetable matter, lumps or balls of clay and other deleterious substances. At least 50% of the material retained on the 1-inch sieve shall have a fractured face. The material shall meet the following gradation requirements:

Sieve Designation	Percent by Weight Passing Square Mesh Sieves
3 inch	100
2 inch	95-100
1 inch	55-85
No. 4	27-52
No. 200	0-12 (fraction passing No. 4 sieve)

B. Gravel Subbase: Shall be crushed gravel (NHDOT Item #304.2, Gravel) consisting of hard durable particles which are free from vegetable matter, lumps or balls of clay and other deleterious substances. The maximum size of stone particles shall not exceed three-fourths of the compacted thickness of the layer being placed but in no case larger than 6 inches. The gradation of the material shall meet the grading requirements of the following table:

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves

6 inch	100
No. 4	25-70
No. 200	0-12 (fraction passing No. 4 sieve)

C. Common Borrow: Shall consist of approved material required for the construction of the work where designated. Common borrow shall be free from frozen material, perishable rubbish, peat, organic, and other unsuitable material. Where used as pipe bedding and initial pipe backfill, maximum rock size shall be 1 inch.

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves
6 inch	100
¼ inch	25-90
No. 4	0-50
No. 200*	0-10

* Only allowable where used as trench fill along HDPE pipe.

Common borrow may be used for embankments unless otherwise indicated and provided that the material is at a moisture content suitable for compaction to the specified density. No rocks shall exceed ¾ of the depth of the specified lift thickness.

D. Crushed Stone (Fine): Shall be a uniform material consisting of clean, hard, and durable particles or fragments, free from vegetable or other objectionable matter, containing angular pieces, as are those which come from a mechanical crusher. Material shall meet the requirements for NHDOT Item No. 304.4, Crushed Stone (fine). Acceptable sand may be blended as necessary to obtain the proper gradation for the fine aggregate portion. The material shall meet the following gradation requirements:

Sieve Designation	Percent by Weight Passing Square Mesh Sieve
2 inch	100
1-1/2 inch	85-100
¾ inch	45-75
No. 4	10-45
No. 200	0-5

E. Screened Stone: Shall be a well graded stone consisting of clean, hard, and durable particles or fragments, free from vegetable or other objectionable matter, meeting the following gradation requirements:

Sieve Designation	Percent by Weight Passing Square Mesh Sieve

1 inch	100
3/4 inch	90-100
3/8 inch	20-55
No. 4	0-10
No. 20	5-15
No. 40	0-5

F. Select Fill (Structural Fill): Shall be graded stone consisting of clean, hard, and durable particles or fragments, free from vegetable or other objectionable matter. The maximum size of stone particles shall not exceed 4 inches, except where it is used for pipe bedding in which case maximum size shall be 2 inches. The material shall meet the following gradation requirements:

Sieve Designation	Percent by Weight Passing Square Mesh Sieve
4 inch	100
3 inch	90-100
¼ inch	25-90
No. 40	0-30
No. 200	0-5

G. Sand (base material): Shall be well graded durable material free of organic matter and conform to the following gradation requirements (NHDOT Item No. 304.1, Sand):

Sieve Designation	Percent by Weight Passing Square Mesh Sieve
6 inch	100
No. 4	70-100
No.200	0-12

H. Sand (concrete aggregate): Sand for use as concrete aggregate shall conform to the requirement for fine aggregate in ASTM Standard Specifications for Concrete Aggregate, Designation C33, and will meet the following requirements:

Sieve Designation	Percent by Weight Passing Square Mesh Sieve
6 inch	100
No. 4	95-100
No. 16	50-85
No. 50	10-30
No.100	2-10
No.200	0-5

2.2 CONCRETE

A. If concrete is required for excess excavation, provide 3,000 psi concrete complying with the requirements of Section 03300.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions under which excavating, backfilling, filling, compaction and grading are to be performed and notify the Engineer in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.2 EXCAVATION

A. General:

1. Excavation consists of removal and disposal of all material encountered when establishing line and grade elevations required for execution of the work.
2. The Contractor shall make excavations in such manner and to such widths as will give suitable room for lying and jointing the conduit; shall furnish and place all sheeting, bracing, and supports; shall do all cofferdamming, pumping, and draining; and shall render the bottom of the excavations firm, dry and acceptable in all respects.
3. All excavation shall be classified as either earth or ledge.
   a) Earth Excavation shall consist of the removal, hauling and disposal of all earth materials encountered during excavation including but not limited to native soil or fill, pavement (bituminous or concrete), existing sewers and manholes, ashes, loam, clay, swamp muck, debris, soft or disintegrated rock or hard pan which can be removed with a backhoe, or a combination of such materials, and boulders measuring less than 2.5 cubic yards.
   b) Ledge Excavation: Shall consist of the removal, hauling, and disposal of all ledge or rock encountered during excavation. "Ledge" and "rock" shall be defined as any natural compound, natural mixture that in the opinion of the Engineer can be removed from its existing position and state only by drilling and blasting, wedging, sledging, boring or breaking up with power operated tools. No boulder, ledge, slab, or other single piece of excavated material less than two cubic yards in total volume shall be considered to be rock unless, in the opinion of the Engineer it must be removed from its existing position by one of the methods mentioned above.
4. The Contractor shall not have any right of property in any materials (items or suitable soil) taken from any excavation. Do not remove any such materials from the construction site without the approval of the Engineer. This provision shall in no way relieve the Contractor of his obligations to remove and dispose of any material determined by the Engineer to be unsuitable for backfilling. The Contractor shall dispose of unsuitable and unwanted excess

material in accordance with the applicable sections of the Contract Documents.

B. Additional Excavation: When excavation has reached required subgrade elevations, notify the Engineer and Resident Project Representative who will observe the conditions.
   1. If material unsuitable for the structure, gravel road or pipeline (in the opinion of the Engineer) is found at or below the grade to which excavation would normally be carried in accordance with the Drawings and/or Specifications, the Contractor shall remove such material to the required width and depth and replace it with thoroughly compacted select fill, screened stone, crushed stone, or concrete as directed by the Engineer.
   2. All excavated materials designated by the Engineer as unsuitable shall become the property of the Contractor and disposed of at locations in accordance with all State and local laws and the provisions of the Contract Documents.

C. Unauthorized Excavation: Shall consist of removal of materials beyond indicated subgrade elevations or dimensions without specific authorization of Engineer. Unauthorized excavation, as well as remedial work required by the Engineer shall be at the Contractor's expense. Remedial work required is as follows:
   1. Under footings, foundation bases, or retaining walls, fill unauthorized excavation with select fill or screened stone compacted to 95%. Provide 12" minimum select fill or screened stone directly under footings. Concrete fill may be used to bring elevations to proper position, when acceptable to Engineer.
   2. If the bottom of a trench is excavated beyond the limits indicated, backfill the resulting void with thoroughly compacted screened stone, unless otherwise indicated.
   3. Elsewhere, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by Engineer.

D. Structural Excavation:
   1. Shall consist of the removal, hauling, disposal, of all material encountered in the excavation to permit proper installation of structures.
   2. Excavations for structures shall be carried to the lines and subgrades shown on the Drawings.
   3. Excavate areas large enough to provide suitable room for building the structures.
   4. The extent of open excavation shall be controlled by prevailing conditions subject to any limits designated by the Engineer.
   5. Provide, install, and maintain sheeting and bracing as necessary to support the sides of the excavation and to prevent any movement of earth which could diminish the width of the excavation or otherwise injure the work, adjacent structures, or persons and property in accordance with all state and OSHA safety standards.

6. Erect suitable fences around structure excavation and other dangerous locations created by the work, at no additional cost to the Owner.
7. Exposed subgrade surfaces shall remain undisturbed, protected, and maintained as uniform, plane areas and shape to receive the foundation components of the structure.
   a. Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10', and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection.
   b. In excavating for structures, take care not to disturb bottom of excavation. Excavate by hand to final grade and trim bottoms to required lines and grades to leave solid base to receive the structure.

E. Trench Excavation: Shall consist of removal, hauling and disposal of all material encountered in the excavation to the widths and depths shown on the Drawings to permit proper installation of underground utilities.
   1. Excavate trenches to the uniform width shown on the Drawings sufficiently wide to provide sufficient space for installation, backfilling, and compaction. Every effort should be made to keep the sides of the trenches firm and undisturbed until backfilling has been completed and consolidated.
   2. Trenches shall be excavated with approximately vertical sides between the elevation of the center of the pipe and an elevation one foot above the top of the pipe.
   7. The extent of open excavation shall be controlled by prevailing conditions subject to any limits prescribed by the Engineer.
   8. As the excavation progresses, install such shoring and bracing necessary to prevent caving and sliding and to meet the requirements of the state and OSHA safety standards, as outlined in the appropriate section of this Specification.

F. Protection of Persons, Property and Utilities:
   1. Barricade open excavations occurring as part of this work and post with warning lights in compliance with local and State regulations.
   2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations. Exercise extreme caution and utilize sheeting, bracing, and whatever other precautionary measures that may be required.
   3. Rules and regulations governing the respective utilities shall be observed in execution of all work. Active utilities and structures shall be adequately protected from damage, and removed or relocated only as indicated or specified. Inactive and abandoned utilities encountered in excavation and grading operations shall be removed, plugged or capped only with written authorization of the utility owner. Report in writing to the Engineer, the locations of such abandoned utilities. <u>Extreme care shall be taken when performing work in the vicinity of existing utility lines, utilizing hand excavation in such areas, as far as practicable.</u>

4. Repair, or have repaired, all damage to existing utilities, structures, lawns, other public and private property which results from construction operations, at no additional expense to the Owner, to the complete satisfaction of the Engineer, the utility, the property owner, and the Owner.

G. Stability of Excavations:
1. Slope sides of excavations to comply with all codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.
2. Maintain sides and slopes of excavations in a safe condition until completion of backfilling.

H. Shoring and Bracing:
1. Provide materials for shoring and bracing, such as sheet piling, uprights, stringers and cross-braces, in good serviceable condition.
2. Provide trench shoring and bracing to comply with local codes and authorities having jurisdiction.
3. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Install shoring and bracing as excavation progresses.

I. Material Storage:
1. Stockpile excavated materials which are satisfactory for use on the work until required for backfill or fill. Place, grade and shape stockpiles for proper drainage and protect with temporary seeding or other acceptable methods to control erosion.
2. Locate and retain soil materials away from edge of excavations.
3. Dispose of excess soil material and waste materials as herein specified.

J. Dewatering:
1. To ensure proper conditions at all times during construction, the Contractor shall provide and maintain ample means and devices (including spare units kept ready for immediate use in case of breakdowns) with which to intercept and/or remove promptly and dispose properly of all water entering trenches and other excavations (including surface and subsurface waters).
2. Excavations shall be kept dry until the structures, pipes, and appurtenances to be built therein have been completed to such extent that they will not be floated or otherwise damaged.

K. Cold Weather Protection:
1. Protect excavation bottoms against freezing when atmospheric temperature is less than 35°F.
2. No frozen material shall be used as backfill or fill and no backfill shall be placed on frozen material.

L. Separation of Surface Material:
1. The Contractor shall remove only as much of any existing pavement as is necessary for the prosecution of the work.
2. Prior to excavation, existing pavement shall be cut where in the opinion of the Engineer it is necessary to prevent damage to the remaining road surface.

3. Where pavement is removed in large pieces, it shall be disposed of before proceeding with the excavation.
4. From areas within which excavations are to be made, loam and topsoil shall be carefully removed and separately stored to be used again as directed; or, if the Contractor prefers not to separate surface materials, he shall furnish, as directed, loam and topsoil at least equal in quantity and quality to that excavated.

M. Dust Control:
1. Dust Control shall comply with the requirements of Section 01562.
2. During the progress of the work, the Contractor shall conduct his operations and maintain the area of his activities, including sweeping and sprinkling of streets as necessary, so as to minimize the creation and dispersion of dust.
3. If the Engineer decides that it is necessary to use calcium chloride for more effective dust control, the contractor shall furnish and spread the material, as directed.

3.3 BACKFILL AND FILL

A. General:
1. Backfilling shall consist of replacing material removed to permit installation of structures or utilities, as indicated in the Contract Documents.
2. Filling shall consist of placing material in areas to bring them up to grades indicated on the Drawings.
3. The Contractor shall provide and place all necessary backfill and fill material, in layers to the required grade elevations.
4. Backfill excavations as promptly as work permits, but not until completion of the following:
   a. Inspection, approval, and recording locations of underground utilities.
   c. Removal of concrete formwork.
   d. Removal of shoring and bracing, and backfilling of voids with satisfactory materials. Temporary sheet piling driven below bottom of structures shall be removed in manner to prevent settlement of the structure or utilities, or cut off and left in place if required.
   e. Removal of trash and debris.
   f. Permanent or temporary horizontal bracing is in place on horizontally supported walls.
   g. Density testing having results meeting requirements specified herein.
5. In general, and unless otherwise indicated, material used for backfill of trenches and excavations around structures shall be suitable excavated material which was removed in the course of making the construction excavation. Unless otherwise specified or allowed by the Engineer the backfill and fill shall be placed in layers not to exceed 8 inches in thickness.
6. All fill and backfill under structures and pavement, and adjacent to structures, shall be compacted crushed stone or select fill as specified or as indicated on the Drawings. The fill and backfill materials shall be placed in layers not exceeding 8 inches in thickness.

7. Suitable excavated material shall meet the following requirements:
   a. Free from large clods, silt lumps or balls of clay.
   b. Free from stones and rock fragments with larger than 12 inch maximum dimension.
   c. Free from organics, peat, etc.
   d. Free from frozen material.
8. If sufficient suitable excavated material is not available from the excavations, and where indicated on the Drawings, the backfill material shall be select fill or common borrow, unless otherwise indicated, as required and as directed by the Engineer.
9. Do not backfill with, or on, frozen materials.
10. Remove or otherwise treat as necessary, previously placed material that has frozen prior to placing backfill.
11. Do not mechanically or hand compact material that is, in the opinion of the Engineer, too wet.
12. Do not continue backfilling until the previously placed and new materials have dried sufficiently to permit proper compaction.
13. The nature of the backfill materials will govern the methods best suited for their placement and compaction. Compaction methods and required percent compaction is covered in Compaction section.
14. Before compaction, moisten or aerate each layer as necessary to provide a water content necessary to meet the required percentage of maximum dry density for each area classification specified.
15. Do not allow large masses of backfill material to be dropped into the excavation in such a manner that may damage pipes and structures.
16. Place material in a manner that will prevent stones and lumps from becoming nested.
17. Completely fill all voids between stones with fine material.
18. Do not place backfill on or against new concrete until it has attained sufficient strength to support loads without distortion, cracking, and other damage.
19. Deposit backfill and fill material evenly on all sides of structures to avoid unequal soil pressures.
20. Keep stones or rock fragments with a dimension greater than two inches at least one foot away from the pipe or structure during backfilling.
21. Leave sheeting in place when damage is likely to result from its withdrawal.
22. Completely fill voids left by the removal of sheeting with screened stone which is compacted thoroughly.

B. Bedding, Initial Backfill and Trench Backfill
   1. Place bedding and backfill in layers of uniform thickness specified herein, and as shown on the Drawings.
   2. Thoroughly compact each layer by means of a suitable vibrator or mechanical tamper.
   3. Install bedding and initial backfill in layers of uniform thickness not greater than 8 inches.

4. Deposit the remainder of the backfill in uniform layers not greater than 8 inches.
5. Provide underground sewer marking tape for the full length of sewer trenches as shown on the Drawings. Marking tape shall be as specified in the appropriate section of this Division.
6. Where soft silt and clay soils are encountered the trench shall be excavated 6 inches below the normal bedding and backfilled with 6 inches of compacted sand.
7. Backfill trenches with concrete where trench excavations pass within 18 inches of column or wall footings and which are carried below the bottom of such footings, or which pass under wall footings. Place concrete to the level of the bottom of adjacent footings.
8. The following schedule gives the bedding requirements for various types of pipe. Distances refer to vertical thickness below the pipe.

BEDDING REQUIREMENTS

Conduits	6 inches min. sand.

9. The following schedule gives the initial backfill requirements for various types of pipes.

INITIAL BACKFILL REQUIREMENTS

Conduits	6 inches min. sand.

10. Special bedding and backfill requirements shown on the Drawings supersede requirements of this section.

C. Improper Backfill:
1. When 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, and compacting work performed to correct improper backfilling shall be performed at no additional cost to the Owner.

D. Ground Surface Preparation:
1. Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow, strip, scarify or break-up sloped surface steeper than 1 vertical to 4 horizontal.
2. When existing ground surface has a density less than that specified under "compaction" for the particular area classification, break up the ground surface, pulverize, moisture-condition to the optimum moisture content, and compact to required depth and percentage of maximum density.

3.4 COMPACTION:

A. General: Control soil compaction during construction to provide not less than the minimum percentage of density specified for each area classification.

B. Percentage of Maximum Density Requirements:

1. Compact soil to not less than the following percentages of maximum dry density determined in accordance with ASTM D1557 as indicated.

a. Structures: Compact each layer of backfill or fill material below or adjacent to structures to at least 95% of maximum dry density (ASTM D1557).

b. Off Traveled Way Areas: Compact each layer of backfill or fill material to at least 90% of maximum dry density (ASTM D1557).

c. Walkways: Compact each layer of backfill or fill material to at least 93% of maximum dry density (ASTM D1557).

d. Roadways, Drives and Paved Areas: Compact each layer of fill, subbase material, and base material to at least 95% of maximum dry density (ASTM D1557).

C. Moisture Control:

1. Where subgrade or a layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade, or layer of soil material, in quantities controlled to prevent free water appearing on surface during or subsequent to compaction operations.

2. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.

3. Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing or pulverizing until moisture content is reduced to a satisfactory level.

D. Compaction Methods: The Contractor may select any method of compaction that is suitable to compact the material to the required density.

1. General: Whatever method of compacting backfill is used, care shall be taken that stones and lumps shall not become nested and that all voids between stones shall be completely filled with fine material. All voids left by the removal of sheeting shall be completely backfilled with suitable materials and thoroughly compacted.

2. Tamping or Rolling: If the material is to be compacted by tamping or rolling, the material shall be deposited and spread in uniform, parallel layers not exceeding the uncompacted thicknesses specified. Before the next layer is placed, each layer shall be tamped as required so as to obtain a thoroughly compacted mass. Care shall be taken that the material close to the excavation side slopes, as well as in all other portions of the fill area, is thoroughly compacted. When the excavation width and the depth to which backfill has been placed are sufficient to make it feasible, and it can be done effectively and without damage to the pipe or structure, backfill may, on approval, be compacted by the use of suitable rollers, tractors, or similar powered equipment instead of by tamping. For compaction by tamping or rolling, the

rate at which backfilling material is deposited shall not exceed that permitted by the facilities for its spreading, leveling, and compacting as furnished by the Contractor.

E. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, re-shape, and compact to required density prior to further construction.

3.5 GRADING:

A. General:
   1. Grading shall consist of that work necessary to bring all areas to the final grades.
   2. Uniformly grade areas within limits of work requiring grading, including adjacent transition areas.
   3. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades.

B. Grading Outside Building Lines:
   1. Grade areas adjacent to building to drain away from structures and to prevent ponding.
   2. Grade surfaces to be free from irregular surface changes, and as follows:
      a. Lawn or Unpaved Areas: Finish grade areas to receive loam to within not more than 1" above or below the required subgrade elevations.
      b. Gravel roads: Shape surface of areas under roads to line, grade and cross-section, with finish surface not more than 3/8" above or below the required subgrade elevation.

C. Compaction: After grading, compact subgrade surfaces to the depth and percentage of maximum density for each area classification.

D. Protection of Graded Areas:
   1. Protect newly graded areas from traffic and erosion. Keep free of trash and debris.
   2. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.

3.6 BASE COURSE AND LEVELING COURSE

A. General: Base course consists of placing the specified materials in layers to support a leveling course, as indicated in the Drawings.

B. Grade Control: During construction, maintain lines and grades including crown and cross-slope of base course and leveling course.

C. Placing:
   1. Place base course on prepared subbase conforming to indicated cross-section and thickness. Maintain optimum moisture content for compacting base materials.
   2. Place leveling course on prepared base course, conforming to indicated cross-section and thickness. Maintain optimum moisture content for compaction.

D. Shaping and Compacting:

1. All layers of aggregate base course and leveling course shall be compacted to the required density immediately after placing. As soon as the compaction of any layer has been completed, the next layer shall be placed.
2. The Contractor shall bear full responsibility for and make all necessary repairs to the base leveling courses and the subgrade until the full depth of the base leveling courses is placed and compacted. Repairs shall be made at no additional cost to the Owner.
3. If the top of any layer of the aggregate base or leveling course becomes contaminated by degradation of the aggregate or addition of foreign materials, the contaminated material shall be removed and replaced with the specified material at the Contractor's expense.

END OF SECTION

SECTION 02270

TEMPORARY EROSION CONTROL

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:
   1. The work under this section shall include provision of all labor, equipment, materials and maintenance of temporary erosion control devices as specified herein, and as directed by the Engineer.
   2. Erosion control measures shall be provided as necessary to correct conditions that develop prior to the completion of permanent erosion control devices or as required to control erosion that occurs during normal construction operations.
   3. Construction operations shall comply with all federal, state and local regulations pertaining to erosion control.
   4. After awarded the Contract, prior to commencement of construction activities, meet with the Engineer to discuss erosion control requirements and develop a mutual understanding relative to details of erosion control.

B. Related Work Specified Elsewhere:
   1. Stripping and Stockpiling Topsoil, Section 02115.
   2. Earthwork, Section 02200.
   3. Loaming and Seeding, Section 02785.

C. Design Criteria:
   1. Conduct all construction in a manner and sequence that causes the least practical disturbance of the physical environment.
   2. Stabilize disturbed earth surfaces in the shortest time and employ such temporary erosion control devices as may be necessary until such time as adequate soil stabilization has been achieved.

1.2 SUBMITTALS

A. The Contractor shall furnish the Engineer, in writing, his work plan giving proposed locations for storage of topsoil and excavated material before beginning construction. A schedule of work shall accompany the work plan. Acceptance of this plan will not relieve the Contractor of the responsibility of completion of the work as specified.

1.3 QUALITY ASSURANCE

A. All materials and methods of erosion control shall meet the guidelines established by the "New Hampshire Stormwater Manual, Volume 3: Erosion and Sediment Controls During Construction" prepared by Comprehensive Environmental, Inc. and the New Hampshire Department of Environmental Services, dated December 2008 or latest revision, herein after referred to as the NHSMM, Volume3.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Baled Hay: At least 14" by 18" by 30" securely tied to form a firm bale, staked as necessary to hold the bale in place.

B. Sand Bags: Heavy cloth bags of approximately one cubic foot capacity filled with sand or gravel.

C. Mulches: Type and use shall be as specified in the NHSMM, Volume 3. Loose hay, straw, peat moss, wood chips, bark mulch, crushed stone, wood excelsior, or wood fiber cellulose.

D. Mats and Nettings: Type and use shall be as specified in the NHSMM, Volume 3. Twisted Craft paper, yarn, jute, excelsior wood fiber mats, glass fiber and plastic film.

E. Permanent Seed: Conservation mix appropriate to the predominant soil conditions as specified in the NHSMM, Volume 3 and subject to approval by the Engineer.

F. Temporary Seeding: Use species appropriate for soil conditions and season as specified in the NHSMM, Volume 3 and subject to approval by the Engineer.

H. Water: The Contractor shall provide water and equipment to mitigate fugitive dust, as directed by the Engineer.

I. Filter Fabrics: Filter fabric shall be of one of the commercially available brands such as Mirafi, Typar or equivalent. Fabric types for particular applications shall be in accordance with Section 02260 and shall be approved by the Engineer prior to installation.

2.2 CONSTRUCTION REQUIREMENTS

A. Temporary Erosion Checks:

1. Temporary erosion checks shall be constructed in ditches and other locations as necessary.
2. Baled hay, sand bags or siltation fence may be used in an arrangement to fit local conditions.

B. Temporary Berms: Temporary barriers shall be constructed along the toe of embankments when necessary to prevent erosion and sedimentation.

C. Temporary Seeding: Temporary vegetative cover should be applied where exposed soil surfaces will not be final graded within 45 days from the initial disturbance. Such areas shall receive temporary seeding in accordance with Table 4-1, 4-2 and 4-3 of the NHSMM, Volume 3 (see below).

Seeding Recommendations for Temporary Vegetation (Table 4-1):

Season	Seed	Rate
Early Spring (before 5/15)	Oats	80 lbs/acre
	Annual Ryegrass	40 lbs/acre
Spring (4/1 - 6/1)	Perennial Ryegrass	30 lbs/acre
Late Summer/Early Fall	Winter Rye	80 lbs/acre
(8/15 - 9/15)	Annual Ryegrass	40 lbs/acre
	Perennial Ryegrass	30 lbs/acre

Vegetative growth covering at least 85% of the disturbed area should be achieved prior to October 15th. If this condition is not achieved, implement other temporary stabilization measures for overwinter protection.

D. Temporary Mulch: Areas that have been temporarily or permanently seeded should be mulched immediately following seeding. Mulch materials and application shall be as specified in the NHSMM, Volume 3.

E. Silt Fence: Silt fences shall consist of porous filter fabric with a wire mesh backing and shall be supported by posts as per manufacturer's recommendations. Fabric shall meet the requirements outlined in Specification Section 02260 and be approved by the Engineer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Temporary Erosion Checks:
   1. Temporary erosion checks shall be constructed in ditches and at other locations designated by the Engineer. The Engineer may modify the Contractor's arrangement of silt fences, bales and bags to fit local conditions.
   2. Baled hay, silt fences, or sandbags, or some combination, may be used in other areas as necessary to inhibit soil erosion.
   3. Siltation fence shall be located and installed as shown on plans or as required to comply with all Federal, State and Local Regulations.

B. Maintenance: Erosion control features shall be installed prior to excavation wherever appropriate. Temporary erosion control features shall remain in place and shall be maintained until at least 85% stabilization has been achieved. The Contractor shall be responsible for maintaining erosion control features throughout the life of the construction contract. Maintenance will include periodic inspections by the Owner or Engineer for effectiveness of location, installation and condition with corrective action taken by the Contractor as appropriate.

C. Removing and Disposing of Materials:
   1. When no longer needed, material and devices for temporary erosion control shall be removed and disposed of as approved by the Engineer.
   2. When removed, such devices may be reused in other locations provided they are in good condition and suitable to perform the erosion control for which they are intended.
   3. When dispersed over adjacent areas, the material shall be scattered to the extent that it causes no unsightly conditions nor creates future maintenance problems.

END OF SECTION

SECTION 02485

LOAMING & SEEDING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: Furnish, place, and test loam, seed, lime, and fertilizer where shown on the drawings and protect and maintain seeded areas disturbed by construction work, as directed by the Engineer.

B. Related Work Specified Elsewhere: (When Applicable)
   1. Stripping and Stockpiling Topsoil, Section 02115.
   2. Earthwork, Section 02200.
   3. Temporary Erosion Control, Section 02270.

1.2 SUBMITTALS AND TESTING

A. Seed:
   1. Furnish the Engineer with duplicate signed copies of a statement from the vendor, certifying that each container of seed delivered to the project site is fully labeled in accordance with the Federal Seed Act and is at least equal to the specification requirements.
   2. This certification shall appear in, or with, all copies of invoices for the seed.
   3. The certification shall include the guaranteed percentages of purity, weed content and germination of the seed, and also the net weight and date of shipment. No seed may be sown until the Contractor has submitted the certificates and certificates have been approved.
   4. Each lot of seed shall be subject to sampling and testing, at the discretion of the Engineer, in accordance with the latest rules and regulations under the Federal Seed Act.

B. Loam:
   1. Inform the Engineer, within 30 days after the award of the Contract, of the sources from which the loam is to be furnished.
   2. Obtain representative soil samples, taken from several locations in the area under consideration for topsoil removal, to the full stripping depth.
   3. Have soil samples tested by an independent soils testing laboratory, approved by the Engineer, at the Contractor's expense.
   4. Have soil samples tested for physical properties and pH (or lime requirement), for organic matter, available phosphoric acid, and available potash, in accordance with standard practices of soil testing.
   5. Approval, by the Engineer, to use soil for the work will be dependent upon the results of the soils tests.

C. Lime & Fertilizer:
   1. Furnish the Engineer with duplicate copies of invoices for all lime and fertilizer used on the project showing the total minimum carbonates and minimum percentages of the material furnished that pass the 90 and 20 mesh sieves and the grade furnished.

2. Each lot of lime and fertilizer shall be subject to sampling and testing at the discretion of the Engineer.
3. Sampling and testing shall be in accordance with the official methods of the Association of Official Agricultural Chemists.
4. Upon completion of the project, a final check may be made comparing the total quantities of fertilizer and lime used to the total area seeded. If the minimum rates of application have not been met, the Engineer may require the Contractor to distribute additional quantities of these materials to meet the minimum rates.

1.3 DELIVERY, STORAGE & HANDLING

A. Seed:
1. Furnish all seed in sealed standard containers, unless exception is granted in writing by the Engineer.
2. Containers shall be labeled in accordance with the United States Department of Agriculture's rules and regulations under the Federal Seed Act in effect at the time of purchase.
3. Percent germination and purity of each seed type in the mixture and weed seed content of the mixture shall be clearly stated on the label.
4. Seed shall be subject to the testing provisions of the Association of Official Seed Analysts. The month and year of test shall be clearly stated on the label.

B. Fertilizer:
1. Furnish all fertilizer in unopened original containers.
2. Containers shall be labeled with the manufacturer's statement of analysis.

1.4 JOB CONDITIONS

A. Loam: Do not place or spread loam when the subgrade is frozen, excessively wet or dry, or in any condition otherwise detrimental, in the opinion of the Engineer, to the proposed planting or to proper grading.

B. Seeding:
1. Planting Seasons: Seeding and initial fertilizing shall be done between May 1 and June 1, between August 15 and September 15, or as permitted. If seeding is done during July or August, additional mulch material may be required by the Engineer. The Contractor may seed at other times as permitted by the Engineer. Regardless of the time of seeding, the Contractor shall be responsible for each seeded area until it is accepted.
2. Weather Conditions:
a. Do not perform seeding work when weather conditions are such that beneficial results are not likely to be obtained, such as drought, excessive moisture, or high winds.
b. Stop the seeding work when, in the opinion of the Engineer, weather conditions are not favorable.
c. Resume the work only when, in the opinion of the Engineer, conditions become favorable, or when approved alternate or corrective measures and procedures are placed into effect.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Seed:

1. Select a seed mixture that is current and consistent with the following Tables 4-1 through 4-3 of the "New Hampshire Stormwater Management Manual, Volume 3: Erosion and Sediment Controls During Construction" prepared by Comprehensive Environmental, Inc. and the New Hampshire Department of Environmental Services, herein after referred to as the NHSMM, Volume 3. Note: Reed Canary Grass is a problematic species near wetland applications according to the New Hampshire Wetlands Bureau and therefore shall not be used.

Seeding Recommendations for Temporary Vegetation (Table 4-1)

Seed	Dates	Rate
Oats	Prior to May 15	80 lbs/acre
Annual Ryegrass	Aug. 15 - Sept. 15 and/or Early Spring	40 lbs/acre
Perennial Ryegrass	Apr. 1 - June 1 and/or Aug. 15 - Sept. 15	30 lbs/acre
Winter Rye	Aug. 15 - Sept. 15	112 lbs/acre

Seed Mixture Selection Based on Soil Type (Table 4-2)

Use	Mixture Tables	Soil Drainage			
		I.	II.	III.	IV.
Steep cuts	A	Fair	Good	Good	Fair
and fills,	B	Poor	Good	Fair	Fair
borrow and	C	Poor	Good	Exc.	Good
disposal areas	E	Fair	Exc.	Exc.	Poor
Waterways, emergency	A	Good	Good	Good	Fair
spillways and other	C	Good	Exc.	Exc.	Fair
channels with flowing water					
Lightly used	A	Good	Good	Good	Fair
parking lots,	B	Good	Good	Fair	Poor
odd areas,	C	Good	Exc.	Exc.	Fair
unused lands, and low intensity use recreation sites					
Play areas and athletic	F	Fair	Exc.	Exc.	
fields. (Topsoil is	G	Fair	Exc.	Exc.	
essential for good turf)					

Notes:

1. I. Droughty
   II. Well Drained
   III. Moderately Well Drained
   IV. Poorly Drained
2. Exc.= Excellent
3. Refer to Table 4-3 for seed mixture and application rates

Seed Mixtures for Permanent Vegetation (Table 4-3):

Mixture	Species	Application Rate-Pounds per Acre	1,000 sq. ft.
A	Tall Fescue	20	0.45
	Creeping Red Fescue	20	0.45
	Redtop	2	0.05
	Total	*42*	*0.95*
B	Tall Fescue	15	0.35
	Creeping Red Fescue	10	0.25
	Crown vetch/OR	15	0.35
	Flatpea	30	0.75
	Total	*40 or 55*	*0.95 or 1.35*
C	Tall Fescue	20	0.45
	Creeping Red Fescue	20	0.45
	Birdsfoot Trefoil	8	0.20
	Total	*48*	*1.10*
E	Tall Fescue	20	0.45
	Flatpea	30	0.75
	Total	*50*	*1.20*
F	Creeping Red Fescue	50	1.15
	Kentucky Bluegrass	50	1.15
	Total	*100*	*2.30*
G	Tall Fescue	150	3.60

2. Do not use seed which has become wet, moldy, or otherwise damaged in transit or during storage.

B. Loam:

1. Fertile, friable, natural loam typical of the locality, without admixture of subsoil, refuse or other foreign materials and obtained from a well-drained site. Mixture of sand, silt, and clay particles in equal proportions.
2. Free of stumps, roots, heavy of stiff clay, stones larger than 1-inch in diameter, lumps, coarse sand, weeds, sticks, brush or other deleterious matter.
3. Not less than 4% nor more than 20% organic matter.
4. Loam depth shall be 4 inches, unless otherwise indicated.

C. Lime:

1. Provide lime which is ground limestone (equivalent to 50% calcium plus magnesium oxide) that 90% will pass a No. 20 sieve and 50% will pass a No. l00 sieve.

2. Coarser materials will be acceptable provided the specified rates of application are increased proportionately on the basis of quantities passing a No. l00 sieve. No additional payment will be made to the Contractor for the increased quantity.

D. Fertilizer:
1. Provide a commercial fertilizer approved by the Engineer.
2. Provide fertilizer containing approved ratio low phosphate (N-P205-K20).
3. Fertilizer should be restricted to a low phosphate, slow release nitrogen fertilizer when applied to areas between 25 feet and 250 feet from a surface water body. No fertilizer except limestone should be applied within 25 feet of the surface water.

PART 3 - EXECUTION

3.1 PREPARATION

A. Equipment:
1. Provide all equipment necessary for the proper preparation of the ground surface and for the handling and placing of all required materials.
2. Demonstrate to the Engineer that the equipment will apply materials at the specified rates.

B. Soil: Perform the following work prior to the application of lime, fertilizer or seed.
1. Scarify the subgrade to a depth of 2 inches to allow the bonding of the loam with the subsoil (critical when soil has been compacted by construction operations).
2. Apply loam to a depth of 4 inches or as directed on areas to be seeded.
3. Trim and rake the loam to true grades free from unsightly variations, humps, ridges or depressions.
4. Remove all objectionable material and form a finely pulverized seed bed.

3.2 PERFORMANCE

A. Grading:
1. Grade the areas to be seeded as shown on the Drawings or as directed by the Engineer.
2. Leave all surfaces in even and properly compacted condition.
3. Maintain grades on the areas to be seeded in true and even conditions, including any necessary repairs to previously graded areas.

B. Placing Topsoil:
1. Uniformly distribute and evenly spread loam on the designated areas.
2. Spread the loam in such a manner that planting work can be performed with little additional soil preparation or tillage.
3. Correct any irregularities in the surface resulting from topsoiling or other operations to prevent the formation of depressions where water may stand.
4. Thoroughly till the topsoil to a depth of at least 4 inches by plowing, harrowing, or other approved method until the condition of the soil is acceptable to the Engineer. The surface shall be cleared of all debris and or stones one inch or more in diameter.

C. Placing Fertilizer:
   1. Distribute fertilizer uniformly at a rate determined by the soils test over the areas to be seeded. If soil testing is not feasible on small or variable sites, or where timing is critical, fertilizer may be applied at the rate of 600lbs/acre.
   2. Incorporate fertilizer into the soil to a depth of at least 4 inches by discing, harrowing, or other methods acceptable to the Engineer.
   3. The incorporation of fertilizer may be a part of the tillage operation specified above.
   4. Distribution by means of an approved seed drill equipped to sow seed and distribute fertilizer at the same time will be acceptable.

D. Placing Lime:
   1. Uniformly distribute lime immediately following or simultaneously with the incorporation of fertilizer.
   2. Distribute lime at a rate determined from the pH test, to a depth of at least 4 inches by discing, harrowing, or other methods acceptable to the Engineer. If soil testing is not feasible on small or variable sites, or where timing is critical, lime may be applied at the rate of 3 ton/acre.

E. Seeding:
   1. Fine rake and level out any undulations or irregularities in the surface resulting from tillage, fertilizing, liming or other operations before starting seeding operations.
   2. Hydroseeding:
      a. Hydroseeding may be performed where approved and with equipment approved by the Engineer.
      b. When hydroseeding, seeding rates shall be increased 10%.
      c. Seed and fertilizing materials shall be kept thoroughly agitated in order to maintain a uniform suspension within the tank of the hydroseeder.
      d. The spraying equipment must be designed and operated to distribute seed and fertilizing materials evenly and uniformly on the designated areas at the required rates.
   3. Drill Seeding:
      a. Drill seeding may be performed with approved equipment having drills not more than 2 inches apart.
      b. Sow the seed uniformly over the designated areas to a depth of ¼ to ½ inch and at a rate outlined in Table 4-3 of the New Hampshire Stormwater Management Manual, Volume 3: Erosion and Sediment Controls During Construction.

   4. Broadcast Seeding:
      a. Broadcast seeding may be performed by equipment approved by the Engineer.
      b. Sow the seed uniformly over the designated areas to a depth of ¼ to ½ inch and at a rate outlined in Table 4-3 of the New Hampshire Stormwater Management Manual, Volume 3: Erosion and Sediment Controls During Construction.

c. Sow half the seed with the equipment moving in one direction and the remainder of the seed with the equipment moving at right angles to the first sowing.
d. Cover the seed to an average depth of ¼ to ½ inch by means of a brush harrow, spike-tooth harrow, chain harrow, cultipacker, or other approved devices.
e. Do not perform broadcast seeding work during windy weather.

F. Compacting:
1. Seeded areas must be raked lightly after sowing unless seeding is to be directly followed by application of approved mulch.
2. Compact the entire area immediately after the seeding operations are complete.
3. Compact by means of a cultipacker, roller, or other equipment approved by the Engineer weighing 100 pounds per linear foot of roller.
4. If the soil is of such type that a smooth or corrugated roller cannot be operated satisfactorily, use a pneumatic roller (not wobbly wheel) that has tires of sufficient size to obtain complete coverage of the soil.
5. When using a cultipacker or similar equipment, perform the final rolling at right angles to the prevailing slopes to prevent erosion or at right angles to the prevailing wind to prevent dust.

3.3 PROTECTION & MAINTENANCE

A. Protection:
1. Protect the seeded area against traffic or other use.
2. Erect barricades and place warning signs as needed.

B. Maintenance:
1. At the time of the first cutting, set mower blades 2 inches high. All lawns shall require at least two mowing cycles before acceptance. Coordinate schedule for mowing with Engineer.
2. Maintenance shall also include all temporary protection fences, barriers and signs and all other work incidental to proper maintenance.
3. Maintain grass areas until a full stand of grass is indicated, which will be a minimum of 45 days after all seeding work is completed, and shall not necessarily related to Substantial Completion of the General Contract.
4. Protection and maintenance of grass areas shall consist of watering, weeding, cutting, repair of any erosion and reseeding as necessary to establish a uniform stand for the specified grasses, and shall continue until Acceptance by the Engineer of the work of this section. It shall also include the furnishing and applying of such pesticides as are necessary to keep grass areas free of insects and disease. All pesticides shall be approved by Engineer prior to use.

3.4 ACCEPTANCE

A. At final acceptance of the project all areas shall have a close stand of grass with no weeds present and no bare spots greater than 3 inches in diameter over greater than 5% of the overall seeded area.

END OF SECTION

SECTION 02510

CEMENT CONCRETE SIDEWALKS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: This work shall consist of the construction of new cement concrete sidewalks and walkways in accordance with these specifications and in reasonably close conformity with the lines and grades shown on the Drawings or established by the Engineer.

B. Related Work Specified Elsewhere:

1. Earthwork, Section 02200

1.2 RELATED DOCUMENTS

A. State of New Hampshire Department of Transportation Standard Specifications for Road and Bridge Construction, 2010 or latest edition, herein after referred to as NHDOT Specifications.

1.3 QUALITY ASSURANCE

A. Materials: Use only materials furnished by a bulk cement concrete producer regularly engaged in the production of portland cement concrete.

B. Submittals: A certificate of compliance shall be furnished to the Contracting Officer that the materials supplied comply with the specification requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

A. The Portland cement concrete shall be Class "A" concrete and conform to the requirements of NHDOT.

B. The reinforcements, joint material and protective coating shall conform to the requirements of NHDOT.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Excavation shall be to the depth and width that will permit the installation and bracing of the forms. The foundation shall be shaped and compacted to a firm, even surface conforming to the section shown on the plans. All soft and yielding material shall be removed and replaced with acceptable material.

B. Base course materials shall conform to the requirements of NHDOT Base Material 304.3, as Specified in Section 02200.

3.2 FORMS

A. Forms shall be of wood or metal and shall extend for the full depth of the concrete. All forms shall be true, free from warp and of sufficient strength to resist the pressure of the concrete without springing. Bracing and staking of forms shall be such that the forms remain in both horizontal and vertical alignment until their removal.

3.3 PLACING CONCRETE

A. The foundation shall be thoroughly moistened immediately prior to placing the concrete. The proportioning, mixing and placing of the concrete shall be in accordance with good construction practices, as stated in the requirements of the NHDOT specifications Section 520.3.

3.4 FINISHING

A. Concrete shall be finished by use of wood, or magnesium floats, by skilled concrete finishers. A fine-grained broom finish shall be applied.
B. All outside edges and expansion or construction joints shall be edged with an edging tool having a radius of ¼-inch. All crack control joints in sidewalks subject to foot traffic shall be edged with a jointing tool.

3.5 JOINTS

A. Construct transverse and longitudinal crack control joints by sawing, jointing tool or other approved method to a minimum depth of one third the slab thickness. If the jointing tool is not capable of constructing a joint to the correct depth, saw the joint to the correct depth.
B. Saw crack control joints as soon as concrete has hardened sufficiently to permit sawing without excessive raveling and before uncontrolled shrinkage cracking occurs, usually between four and twenty-four hours.
C. Crack control joints shall match existing joints and/or be spaced in accordance with NHDOT Specification Section 608.
D. Expansion joints shall match existing joints. Slabs shall be placed alternately and the joints coated with an approved bituminous material before placing the adjacent slab.
E. When a concrete sidewalk is constructed adjacent to a curb, building or other fixed structure, a 1/4 inch thick premolded joint filler shall be used between the slab and the structure. Joint filler shall be installed for the full depth of the slab.

3.6 CURING

A. Concrete shall be cured for a minimum of 7 days. Curing compounds will not be allowed. Curing shall be by moist burlap or plastic sheets, or by other approved materials placed in close contact with the finished concrete as soon as the concrete has set sufficiently to avoid damage from the placement of the coverings. During the curing period, all traffic, both pedestrian and vehicular, shall be excluded. Vehicular traffic shall be excluded for such additional time as may be directed.

3.7 COATINGS

A. Protective coatings shall be applied in accordance with NHDOT Specification Section 534.3.

END OF SECTION

SECTION 02513C

BITUMINOUS CONCRETE PAVING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:
   1. Furnish all plant, labor, equipment and materials required to install bituminous concrete pavement courses, including driveways, temporary and permanent trench paving and restoration of pavement markings as shown on the Drawings and as specified herein.
   2. Remove bituminous asphaltic and/or portland cement pavement, and replace bituminous asphaltic pavement, base, binder courses and surface courses, including temporary pavement, within the area(s) shown on the Drawings and as directed by the Engineer.
   3. Keep pavement removal to a minimum width suitable for the required construction.
   4. Apply pavement markings to the permanent paving as specified.

B. Work Not Included: Removal and replacement of paving for the convenience of the Contractor will not be considered for payment.

C. Related Work Specified Elsewhere: (When Applicable)
   1. Earthwork, Section 02200.

1.2 QUALITY ASSURANCE

A. Materials: Use only materials furnished by a bulk bituminous concrete producer regularly engaged in the production of hot mixed, hot laid bituminous concrete.

B. Equipment: Provide, maintain and operate pavers, dump trucks, tandem, 3-wheel and pneumatic tired rollers well suited to the mixtures being placed. Provide, maintain and operate hand equipment as required. When applicable, provide, maintain and operate trimming equipment and materials.

C. Mix Requirements, Method of Placement and Compaction: Standard Specifications for Road & Bridge Construction, State of New Hampshire, Department of Transportation, latest edition, hereinafter called NH DOT Standards for mixing, placing and compacting bituminous concrete surfaces are applicable to this work.

1.3 SUBMITTALS

A. A certificate of compliance shall be furnished to the Engineer that the materials supplied comply with the specification requirements.

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.

5. Identification of material.
6. Gross, tare and net weights.
7. Signed by the bituminous concrete producer.
8. Stamped by a licensed public weigh master.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Hot Bituminous Paving Mix:
   1. General: These mixtures shall be composed of mineral aggregate, mineral filler, if required, and bituminous material.
   2. Composition of the Mixtures: The mineral aggregates, filler, if required, and bituminous material shall be proportioned and mixed as hereinafter specified to conform to the composition by weight tabulation in the NHDOT Standards. Sufficient approved mineral filler shall be used to correct any deficiencies in grading of fine aggregate.
   3. Should a change of sources of materials be made, a new job mix formula shall be established by the Contractor before the new material is used. When unsatisfactory results or other conditions make it necessary, the Engineer may establish a new job mix formula.
   4. The aggregate will be accepted in stockpiles at the plant site. The bituminous material will be accepted on certification.
   5. If the Contractor elects to furnish bituminous concrete from more than one plant, the job mix formula must be adhered to by all plants.
B. Mineral Filler: Limestone dust, portland cement, or other inert material complying with AASHTO M17, Section 2.
C. Tack Coat: Emulsified type, Grade RS-1, CRS-1, HFMS-1, CSS-1, 1h
D. Pavement markings shall conform to AASHTO Designation M248 for ready-mixed white and yellow traffic paints, Type I.

PART 3 - EXECUTION

3.1 GENERAL

A. Grade Control: The Contractor shall establish and maintain the required lines and grades, including crown and cross-slope, for each course during construction operations.
B. Trench areas shall receive initial paving as the work progresses where trenches are in paved streets. Not more than 300 linear feet of backfill trench shall be left unpaved.
C. Reset all existing manholes and catch basins to finished grade as required at no additional cost to the Owner.

3.2 PAVEMENT REMOVAL

A. General:
   1. Exercise extreme care in the removal of pavement so that pavement will not be unnecessarily disturbed or destroyed.

2. Mechanically cut pavement to be removed to a straight line, unless otherwise directed by the Engineer.
3. All pavement removed shall become the property of the Contractor and disposed of at acceptable locations designated by the Owner and at no additional cost to the Owner.

3.3 SURFACE PREPARATION

A. Prime and tack coats shall conform to the NH DOT Standard Specifications.
B. Prime Coat: Apply at the rate of 0.50 gallons per square yard over compacted base. Apply material to penetrate and seal, but not flood, surface. Cure and dry as long as necessary to attain penetration and evaporation of the dilution agent.
C. Tack Coat: Apply to contact surfaces of previously constructed asphalt or portland cement concrete and surfaces abutting or projecting into asphalt concrete pavement. Distribute at rate of 0.05 to 0.15 gallons per square yard of surface.

3.4 PLACING THE MIX

A. General: Place asphalt concrete mixture on prepared surface. Minimum allowable temperature for placing is 225°F. Maximum shall be 325°F. Place in areas inaccessible to paving machine and small areas by hand. Place each course to required grade, cross-slope and compacted thickness.
B. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened to the extent that the pavement will not be damaged.

3.5 PAVEMENT MARKINGS

A. Material, approved by the Engineer, is to be furnished and applied after the installation of permanent paving.
B. Apply pavement markings in accordance with existing markings. Match paint color, marking dimensions, layout and other details with existing markings in the vicinity of the project.

END OF SECTION

SECTION 02650

BURIED UTILITY MARKINGS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: This work shall consist of providing and installing utility line markings above all buried lines installed as part of this contract and replacing existing markings disturbed as part of this contract. Buried utilities are indicated on the Civil and Electrical Drawings.

B. Related Work Specified Elsewhere:

1. Earthwork, Section 02200.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials and color shall be in accordance with latest AASHTO specifications for pipe and utility marking.

B. Marking tape color shall be in accordance with latest American Public Works Association (APWA) Uniform Color Code and American National Standards Institute ANSI Standard Z535.1, Safety Color Code specifications for buried utility marking as noted in the Schedule below.

1. Schedule

Marker Color	**Buried Utility**
Orange	Telecommunication, signal, alarm
Red	Electric Power lines cables conduits and lighting cables

2. Warning Information shall be in Black Letters with typical wording of:

a. "CAUTION: BURIED (NAME OF UTILITY LINE) BELOW"

C. For ferrous pipe material use 0.004" minimum polyethylene film; 6" wide clearly marking the type of buried utility.

D. For non-ferrous pipe material (e.g. Concrete, PVC, PE, etc.) use detection tape composite of polyethylene and metallic core 6" wide clearly marking type of buried utility.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Marking tape shall be installed over utility lines centerline and buried 24" below grade.

B. Markings damaged during opening of trench shall be reinstalled with 2' overlap at broken sections.

END OF SECTION

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Cast-In-Place Concrete
B. Formwork
C. Concrete reinforcement and accessories
D. Modifications and/or Repairs to concrete
E. Concrete curing
F. Concrete finishing
G. Concrete repairs
H. Non-Shrink Grout

1.2 RELATED SECTIONS

A. Section 01340 - Submittals
B. Section 01400 - Quality Control
C. Section 04200 - Unit Masonry
D. Section 07900 - Joint Sealers
E. Section 16050 - Basic Materials and Methods

1.3 REFERENCES

A. ACI 211.1-91 (2009) - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
B. ACI 301-10 - Standard Specifications for Structural Concrete
C. ACI 302.1R-04 - Guide for Concrete Floor and Slab Construction
D. ACI 304.2R-96 (2008) - Placing Concrete by Pumping Methods
E. ACI 305R-10 - Hot Weather Concreting
F. ACI 306.1-90 (2002) - Standard Specification for Cold Weather Concreting
G. ACI 308R-01 (2008) - Guide to Curing Concrete
H. ACI 308.1-98 - Standard Specification for Curing Concrete
I. ACI 309R-05 - Guide for Consolidation of Concrete
J. ACI 318-08 - Building Code Requirements for Structural Concrete and Commentary
K. ACI 347R-04 - Guide to Formwork for Concrete
L. ACI 350-06 - Code Requirements for Environmental Engineering Concrete Structures and Commentary
M. ASTM A82-M-07 - Specification for Steel Wire, Plain, for Concrete Reinforcement
N. ASTM A185-M-07 - Specification for Steel Welded Wire Fabric, Plain for Concrete Reinforcement
O. ASTM A615/ A615M-09b for Concrete Reinforcement - Specification for Deformed and Plain Billet - Steel Bars
P. ASTM C31/C31M-10 - Standard Practice for Making and Curing Concrete Test Specimens in the Field
Q. ASTM C33-11 - Specification for Concrete Aggregates

R. ASTM C39/C39M-10 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
S. ASTM C42/C42M-10a Standard Test Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
T. ASTM C94/C94M-11 - Specification for Ready Mixed Concrete
U. ASTM C150-09 - Specification for Portland Cement
V. ASTM C172-10 - Practice for Sampling Freshly Mixed Concrete
W. ASTM C231-10 - Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
X. ASTM C260-10a - Specification for Air Entraining Admixtures for Concrete
Y. ASTM C309R-07 - Guide for Consolidation of Concrete
Z. ASTM C494/C494M-10a - Specification for Chemical Admixtures for Concrete
AA. ASTM C595-10 - Specification for Blended Hydraulic Cements
BB. ASTM C618-08a - Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
CC. ASTM C881/C881M-10 - Specification for Epoxy-Resin-Base Bonding Systems for Concrete
DD. ASTM C989-10 - Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars
EE. ASTM C1107/C1107M-11 - Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
FF. ASTM C1240-10a - Specification for Silica Fume Used in Cementitious Mixtures
GG. ASTM C1602-06 - Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete
HH. ASTM E 329-11 - Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction
II. Concrete Reinforcing Steel Institute - Manual of Standard Practice
JJ. Concrete Reinforcing Steel Institute - Placing Reinforcing Bars

1.4 QUALITY ASSURANCE

A. Perform work in accordance with ACI 301, ACI 318 and ACI 350 as modified here-in.
B. Maintain copies of ACI 301, ACI 318, and ACI 350 on site.

1.5 SUBMITTALS

A. Submit shop drawings for concrete reinforcement prior to fabrication, showing bar bends, details and placement. Submit reinforcement for cast in place concrete and concrete masonry.
B. Submit Concrete Mix designs including past field performance test results which meet the criteria specified in Chapter 5 of ACI 318.
C. Submit sieve analysis and soundness tests for fine and coarse aggregates taken within the last three (3) months.
E. Submit Cement Manufacturer's Certificates of conformance with ASTM C150 taken during the last 3 months.
F. For all pozzolans proposed, submit certificates of conformance with respective ASTM standards indicated in Part 2.3.A of this specification.
G. Submit sample concrete mix delivery slip.

H. Submit product data for concrete curing, sealing and hardening compounds. Indicate the intended use and location for all products.
I. Independent Testing Laboratory will submit one copy each of all test reports to each of the following: Engineer, Resident Project Representative, Contractor and Concrete Supplier.
J. Independent Testing Laboratory will submit reports within 5 days of testing or inspection.
K. Independent Testing Laboratory will telephone the Engineer within 24 hours if tests indicate deficiencies.
L. Submit a written outline of cold weather protection measures, hot weather protection measures, and curing methods.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

A. Plywood: APA, B-B Plyform Class I exterior.
B. Lumber: Southern pine, No. 2 grade or equal.
C. Steel: Minimum 16 ga. sheet, well matched, tight fitting, stiffened to resist loads without excess deflection.
D. Form Ties: snap-off type, galvanized metal, adjustable lengths designed to break back at least 1 inch from finished surface or ties as indicated above.
E. Form release agent: non-staining colorless, compatible with finishes. Super-X Emulsive by A.H. Harris & Sons, Inc., StarSeal EF Bio-Release by Vexcon, Q-2 Form Release by Unitex or equivalent.
F. Conform to ACI 301 and ACI 347

2.2 REINFORCING STEEL

A. Bars: ASTM A615 Grade 60; deformed new materials.
B. Welded wire fabric: ASTM A185
C. Tie wire: ASTM A82, annealed.
D. Bolsters, chairs and supports: plastic coated, stainless steel, or epoxy coated.
E. Conform to CRSI Code of Standard Practice-Fabrication.

2.3 CAST-IN-PLACE CONCRETE

A. Concrete Materials
   1. Portland cement: ASTM C150; Type II. Tricalcium Aluminate (C_3A) content in cement less than 8%. Cement shall be furnished from one source during the project.
   2. Pozzolans:
      a. Ground Granulated Blast Furnace Slag: ASTM C989 - Grade 120.
      b. Fly Ash: ASTM C618 - Type F
   3. Aggregates:
      a. Fine aggregate shall consist of washed inert natural sand conforming to the requirements of ASTM Specification C-33.
      b. Coarse aggregate shall consist of a well graded crushed stone or a washed gravel conforming to the requirements of ASTM Specification

C-33.

4. Water: Potable from municipal water supply or shall meet the requirements of ASTM C1602.
5. Admixtures: All from one common manufacturer.

B. Admixtures
1. Low Range Water Reducer: Pozzolith 210 by Master Builders; WRDA with HYCOL by Grace Construction Products Division; or equivalent meeting ASTM C494 Type A.
2. High Range Water Reducer (superplasticiser): Rheobuild 1000 or Glenium 3000 NS by Master Builders; Daracem 100 or ADVA 140M by W.R. Grace; or equivalent meeting ASTM C494 Type F.
3. Air entraining agent: Micro-Air by Master Builders, DAREX II AEA by Grace Construction Products; or equivalent meeting ASTM C260.
4. Non-corrosive non-chloride accelerator: Pozzutec 20+ by Master Builders; Polarset by W. R. Grace or equivalent meeting ASTM C494 type C or E.
5. Not permitted: Calcium chloride, thiocyanates or admixtures containing more than 0.05% chloride ions.

C. Concrete
1. Concrete Class
   a. Reinforced concrete sections: Class A
2. Concrete proportioning shall conform to ACI 318, Chapter 5 except as modified below:

Class	Strength (f'_c)	Coarse Aggregate	% Air ± (1.5%)	Cem.Fac (LB/CY)	Max W/C Ratio	Min.-Max. Slump w/o HRWR	Min.-Max. Slump w/ HRWR
A	4000 PSI	No. 67 (3/4")	6	564-620	0.42	1-3	4-8

3. An alternate concrete mix design using blended hydraulic cements and pozzolans may be proposed. Any alternate mix design proposed shall include a minimum of 30 compressive strength test results from the past 12 months exhibiting a consistent strength and standard deviation. The proposed mix shall contain cementitious materials in the following proportions
   a. Portland Cement - No less than 75% of the total by weight.
   b. Ground Granulated Blast Furnace Slag - No greater than 25% of the total by weight.
   c. Fly Ash - No greater than 15% of the total by weight.
4. The maximum slump as indicated in the above table will be as measured at the batch plant.
5. Concrete pumping shall conform to ACI 304 unless otherwise indicated herein
6. High range water reducer shall be added either at the concrete batch plant or on site for Class A mixes to obtain the slumps as indicated above.
7. No additional mix water shall be added to the concrete on site which will increase the water-cement ratio of the mix. If additional water is to be added on site, it shall be held back from the specified quantity in the mix design

during batching and shall be added on-site for the sole purpose of providing the initial sump as specified prior to adding the high range water reducer. The amount of water held back from the mix shall be clearly indicated on the concrete mix delivery slip. The Resident Project Representative shall be notified prior to adding the water on site. The addition of a greater quantity of water than that indicated shall be cause for non-compliance and potential rejection of the concrete truck.

8. Concrete shall be furnished from one source during the project.
9. Selection of Concrete Proportions - The Concrete producer shall select the concrete mix proportions on the basis of past field performance or the use of trial mixes in accordance with ACI 318 Chapter 5.

2.4 ACCESSORIES

A. Expansion Joint Fillers:
   1. For joints less than ½" thick: J-Joint polyethylene foam with tear off strip for sealant or approved equal; joint filler to be slab thickness in depth less 0.5 inch for sealant.
   2. For joints ½" thick or greater: Self expanding cork by W.R. Meadows or W.R. Grace or equal, size as indicated on the Drawings.
B. Bond Breaker: Thompson's Water Seal or equivalent, or form oil.
C. Epoxy bonding adhesive: Epoxy resin/portland cement moisture resistant bonding agent: Armatec 110 EpoCem by Sika Corporation, Corr-Bond by Euclid Chemical Company, Epobond by L&M Construction Chemicals, Inc. or equivalent.
D. Epoxy dowel anchors: High strength epoxy based, two component, 100% solids resin meeting the requirements of ASTM C881, Type IV or V, Grade 2 or 3 and Class A, B or C (as recommended by the manufacturer). HIT RE 500 SD Epoxy Adhesive by Hilti, Epoxy-Tie Set by Simpson Strong-Tie, Euco #620 Epoxy System by Euclid Chemical Company or equivalent.

2.5 NON-SHRINK GROUT

A. Conform to ASTM C1107.
B. Install in accordance with manufacturer's recommendations, using appropriate grout for intended use.

2.6 CURING MATERIALS

A. Curing and Sealing Compound; ASTM C309 Type 1 Class B. Emulsion Kurseal 309 by A.H. Harris & Sons, Inc., Aqua-Cure VOX by Euclid, Starseal EF Cure 500 by Vexcon, or equivalent.
C. Curing/Hardening Compound: Sodium Silicate Type. Eucosil by Euclid Chemical Company, Super KurHard by A.H. Harris & Sons, Inc., or equivalent.
D. Curing, Sealing and Hardening Compound: Ashford Formula by Curecrete, 12-34 by Unitex, Starseal EF Medium Gloss by Vexcon, Kurseal 800 by A.H. Harris, or equal.
E. Curing Water: Water shall be potable from a municipal water supply or shall meet the requirements of ASTM C1602, and shall be free of materials that have the potential to stain concrete. The temperature of the curing water shall not be lower than 20°F cooler than the surface temperature of the concrete at the time the water

and concrete come in contact.

2.7 FINISHING MATERIALS

A. Slab Sealer: Silane or Siloxane based 96% chloride ion screen, Baracade Silane 100 by Euclid Chemical, SikaGard 701W by Sika Corporation, Starseal EF Weatherseal Plus by Vexcon, or equal.

B. Bonding Admixture: Latex, non-rewetable type SBR Latex or Flex-con by Euclid Chemical, Daraweld C by W.R. Grace or equivalent.

C. Patching Mortar: 1 part of a mixture of white and grey portland cement to 2.5 parts of damp loose sand. Cement type to match substrate.

2.8 REPAIR MATERIALS

A. Epoxy Adhesive: Armatec 110 Epocem by Sika Corporation, Corr-Bond by Euclid Chemical Company, Epobond by L&M Chemical, or equivalent.

B. Repair Materials: Repair materials shall be as indicated in the table below:

REPAIR MATERIALS				
Company	Random Cracks (dry)	Random Cracks (wet)	Excessive Cracking	Spalls, Honeycomb Areas and Holes
Sika	Sidadur 35 Hi-Mod LV	SikaFix HH	SikaTop 122 or 123 Plus	SikaTop 122 or 123 Plus
L&M	-	-	Durathin Patch	Duracrete
Euclid	Eucopoxy Injection Resin	-	Euco Qwickstitch	Eucocrete
Simpson Strong-tie	Crack-Pac	Crack-Pac Flex H2O		

NOTES:

1. All repair materials shall be installed in accordance with the manufacturer's recommendations.
2. All cracks that are wet (either damp or leaking) at the time of repair shall be repaired with a material that is specifically intended for wet repair as recommended by the manufacturer.
3. All spall repair material shall be bonded to the concrete with an epoxy adhesive material.

PART 3 - EXECUTION

3.1 FORMWORK

A. Conform to ACI 301 and ACI 347.

B. Erect plumb and straight. Maintain rigid. Brace sufficiently.
C. Allow no concrete leakage. Provide continuous, straight, smooth exposed surfaces.
D. Treat forms with form release agent. Protect reinforcing from contact with form release agent.
E. Earth forms shall not be permitted.
F. Chamfer all exposed outside corners and edges 0.75 inch unless otherwise noted.
G. Clean out inside of forms of all foreign materials prior to concrete placement.
H. Maintain forms and shores supporting the cast concrete for a minimum of 36 hours. These periods represent cumulative number of days or hours during which the temperature of the air surrounding the concrete is above 50°F and the concrete has been damp and no loss of moisture has occurred.
I. Form pressures increase with the use of concrete with High Range Water Reducers. Design forms accordingly.
J. All concrete formwork, including reinforcing steel and embedment items, shall have a temperature greater than or equal to 35°F at the time of concrete placement.

3.2 REINFORCEMENT

A. Conform to the CRSI Code of Standard Practice - Field Erection for surface condition, bending, spacing and placement tolerance.
B. Splicing reinforcement: conform to ACI 318; welded wire fabric to be lapped 1½ courses or 12 inches; tie fabric at 24 inches on center maximum spacing.
C. Provide bar supports: on grade use concrete brick; elsewhere use manufactured wire supports.
D. Do not bend reinforcing partially embedded in the concrete.

3.3 EMBEDDED ITEMS

A. Coordinate installation of embedded items. Contractor shall coordinate the installation and securing of all embedded items.
B. Contractor shall coordinate number and layout of masonry dowels with the Mason prior to installation.
C. Pipes or Conduits for embedment within a slab, wall or beam, other than those merely passing through, shall satisfy the following:
   1. Shall not be larger in outside diameter than one-third (1/3) the thickness of the slab, wall or beam.
   2. Shall not be spaced closer than 3 diameters on center.
   3. Shall not impair significantly the strength of the concrete.

3.4 PLACING CONCRETE

A. Notify Engineer and Independent Testing Laboratory 24 hour's minimum prior to each placement.
B. All concrete delivery trucks at each placement shall be tested.
C. Place no concrete on frozen ground.
D. Place all concrete from the delivery truck within 90 minutes of batching of the truck.
E. Freefall from concrete truck discharge chute, pump hose and hopper hose: 4 feet maximum
F. Do not place partially hardened concrete.

G. Consolidate concrete by vibrating. Conform to ACI 309.
H. Conform to ACI 306R for placing, curing and maintaining concrete in cold weather. Conform to ACI 306R for placing, curing and maintaining concrete in cold weather
I. Conform to ACI 305R for placing, curing and maintaining concrete in hot weather.
J. Temperature of concrete placed shall not exceed 90°F.
K. Provide concrete Delivery Slip prepared at batch plant with each truck load of concrete showing ticket number, date, truck number, mix strength, maximum stone size, weight of coarse aggregate, weight of fine aggregate, cement weight, volume of concrete, gallons of water added at plant, time water added at plant, quantities of all admixtures used and gallons of water withheld at the plant.
L. Thoroughly moisten subgrade materials prior to placing slabs on grade.
M. Thoroughly clean the surface of the concrete at construction and control joints and remove laitance prior to placing adjoining concrete. Do not place concrete against the hardened side of a joint for at least 48 hours.
N. When placing new concrete directly against existing concrete apply epoxy bonding agent to the existing concrete to bond to new concrete.

3.5 FINISHING SLABS AND FLATWORK

A. Screed to bring concrete surface to proper contour and elevation.
B. Highway straightedge, bull float or darby float the concrete surface immediately after screeding.
C. Allow bleed water to evaporate or remove.
D. After completion of the above listed procedures, provide one of the concrete finishes listed below as indicated in the Schedule of Finishes:
   1. (STF) Steel Troweled Finish: Float the surface with magnesium or cast aluminum float or with a power finishing machine. Steel trowel surface immediately after floating to produce smooth surface. Steel trowel again after concrete has hardened enough so that mortar does not adhere to trowel edge. Ringing sound should be apparent when performing second troweling due to tilted, compacting motion.
   2. (WFF) Wood Float Finish: allow concrete to stiffen; float surface twice or more to a uniform sandy texture.
   3. (LBF) Light Broom Finish: wood float finish as in E above; while plastic draw a soft-bristled broom, over the concrete in long even strokes with downward pressure. Broom transverse to traffic or at right angles to the slope of the slab.
E. Flatness and Levelness: All concrete slabs with a steel trowel finish shall be finished to achieve the following "Face Floor Profile Numbers" for composite flatness (F_F) and composite levelness (F_L) in accordance with Section 8.15 of ACI 302.1:
   1. Specified Overall Value: F_F 20/F_L 15.
   2. Minimum Local Value: F_F 15/F_L 10.

3.6 FINISHING VERTICAL SURFACES

A. (RFF) Rough Form Finish: Repair structural defects only and patch tie holes. Fins exceeding 1/4 in. in height to be removed by grinding and/or rubbing.
B. (SFF) Smooth Form Finish: The concrete surface shall be of uniform color, texture

and free of all irregularities. The arrangement of the facing material shall be orderly and symmetrical, with the number of seams kept to the minimum. Material with raised grain, torn surfaces, worn edges, patches, dents, or other defects which will impair the texture of the concrete surface shall not be used. Remove fins and other surface projections flush by grinding and/or rubbing. Repair surface and structural defects as specified in this section.

C. Curbs: Provide monolithic finish to curbs by stripping forms while concrete is still green and steel-toweling surfaces to a hard, dense finish with corners, intersections, and terminations chamfered.

3.7 FINISHING OTHER MISCELLANEOUS CONCRETE SURFACES

A. Curbs: Provide monolithic finish to curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations chamfered.

B. Top of walls:

a. Exposed to view - Provide a steel trowel finish as defined above

b. Not exposed to view – Provide a rough form finish as defined above.

3.8 CURING

A. Curing: Curing shall begin immediately following the initial set of concrete or after slab surface finishing has been completed and shall continue after form removal. All concrete shall be cured to attain strength and durability by one of the following methods for a minimum of seven days after placement regardless of the ambient air temperature:

1. Ponding or continuous sprinkling. Intermittent wetting and drying is not an acceptable curing method.
2. Application of absorptive mats of fabric kept continuously wet.
3. Application of concrete curing compounds. When using dissipating resin curing compounds, use dissipating resin curing compound. Allow dissipating resin curing compound to chemically break-down, and remove residuals and other foreign material, prior to applying slab sealing compound.

B. Moisture loss from surfaces placed against wooden or metal forms exposed to heating by the sun shall be minimized by keeping the forms wet until they can be safely removed. All exposed concrete (tops of walls) within vertical forms shall begin moist curing within 24 hours of placement, regardless of the duration that the forms will remain in place. After form removal, the concrete shall be cured by one of the methods described above, for the balance of time remaining as specified above.

C. Schedule of Finishes and Curing Requirements:

1. Provide finishes on concrete surfaces according to the following schedule:

Location	Finish	Curing Requirements
Exterior Exposed Walls to 6" below grade	SFF	Moist cure or apply two coats curing and sealing compound

Exterior unexposed walls	RFF	Moist cure or apply two coats curing and sealing compound
Exterior slabs-on-grade	LBF	Moist cure and apply two coats of slab sealer
Slabs	STF	Apply two coats of curing and sealing compound.
Equipment Pads	WFF	Apply two coats of curing and sealing compound.

NOTE:
1. When two (2) coats of materials are required as indicated above, second coat shall be applied perpendicular to the first coat.

D. Cold Weather:
1. Unless otherwise superseded by the requirements of this Specification, conform to ACI 306 for placement of concrete in cold weather.
2. Maintain concrete temperature between 50°F and 70°F for a minimum of seven days after placement. Enclose heat and insulate the concrete as required.
3. Reapply curing compounds every two days during heating period.
4. The maximum allowable temperature drop of the concrete surfaces during the first 24 hours after the end of the curing period shall not exceed 5°F in any 1 hour and shall not exceed a total of a 40°F drop in the first 24 hours.

E. Hot Weather: Unless otherwise superseded by the requirements of this Specification, conform to ACI 305 for placement of concrete in hot weather. Concrete temperature shall not be greater than 90°F. Protect from loss of slump, flash set, plastic cracking and rapid evaporation of water. Place concrete quickly, shade from direct sun and protect from wind.

3.9 MODIFICATIONS OR REPAIRS TO EXISTING CONCRETE

A. When removing materials or portions of existing structures and when making openings in existing structures, all precautions shall be taken and all necessary barriers and other protective devices shall be erected to prevent damage to the structures beyond the limits necessary for the new work, and to prevent damage to the structures or contents by falling or flying debris.

B. Remove concrete to the depths shown or required. Roughen concrete surfaces by chipping, sandblasting or scarifying.

C. Surfaces must be clean and sound. Surfaces may be dry, damp, or wet, but free of standing water. Remove dust, laitance, grease, curing compounds, impregnations, waxes, foreign particles, and disintegrated materials by mechanical abrasion methods such as sandblasting.

3.10 CORING OF HOLES

A. Core drill holes where shown.
B. Coring shall be performed with a non-impact rotary tool with diamond core drills, size shall be suitable for pipe conduit, sleeves or mechanical seals to be installed. All equipment shall conform to OSHA standards. Protect all existing equipment, utilities and critical areas against water or other damage caused by the drilling operation.
C. No structural members shall be cut without any exceptions taken by the Engineer.

3.11 TOLERANCES

A. Maximum allowable deviations from dimensions, elevations, slopes and position shall conform to ACI 117. Tolerances apply to concrete dimensions only, not to positioning of vertical reinforcing steel, dowels, or embedded items.

3.12 DEFECTIVE CONCRETE

A. Defective concrete is defined as concrete in place which does not conform to strength, shapes, alignments, appearances and/or elevation as shown on the drawings and/or presents faulty surface areas.
B. Reinforcing steel size, quantity, strength, position, or arrangement at variance with the Drawings will be considered defective.
C. Concrete which differs from the required dimensions or locations in such a manner as to reduce the strength will be considered defective.
D. Concrete surfaces not finished or cured in accordance with this Section shall be classified as defective concrete. Surface defects include all form tie holes, honeycombed areas and surface blemishes including air voids and bug holes (areas on the surface of the concrete with an accumulation of entrapped air voids) with a nominal diameter or depth greater than ¼ inch and less than 1 inch, visible construction joints, fins, burs, non-uniform concrete color and appearance and other defects.
E. Formed surfaces larger or smaller than dimensional tolerances specified in this Division may be rejected. If the Engineer permits the Contractor to correct the error, such correction shall be as directed and in such a manner as to maintain the strength, function and appearance of the structure.
F. Concrete members cast in the wrong location may be rejected and shall be removed at no additional cost to the Owner if the strength, appearance or function of the structure is adversely affected.
A. Inaccurately formed surfaces exposed to view may be rejected and shall be repaired or removed and replaced at no additional cost to the Owner. Concrete with an overall non-uniform color or appearance as determined by the Engineer shall be repaired with a complete cementious overlay.
G. Concrete exposed to view with defects which adversely affect the appearance of the specified finish shall be repaired. If, in the opinion of the Engineer, the defects cannot be repaired, the concrete may be accepted or rejected in accordance with the decision of the Engineer.

3.13 PROTECTION

A. Protect concrete from high and low temperatures for seven days.
B. Protect against vibration until concrete has attained 33% of its 28-day strength.

C. Protect against premature loads until the 28-day strength has been attained.
D. Concrete structures shall be covered, insulated and heated as required to prevent frost penetration beneath the structures until the Date of Substantial Completion.

END OF SECTION

SECTION 04200

UNIT MASONRY

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Concrete Masonry Units
B. Mortar
C. Grout Fill for Reinforced CMU Cores
D. Reinforcement, Anchorage, and Accessories

1.2 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

A. Section 03300 - Cast-in-Place Concrete: Vertical and horizontal deformed bar reinforcing in masonry walls.
B. Section 15092 - Pipe Sleeves and Seals

1.3 RELATED SECTIONS

A. Section 01050 - Coordination
B. Section 01340 - Submittals
C. Section 01710 - Project Cleaning
D. Section 03300 - Concrete
E. Section 07270 - Firestopping
F. Section 07900 - Joint Sealers
G. Section 08110 - Steel Doors and Frames
H. Section 09900 - Painting
I. Division 15 - Mechanical
J. Division 16 - Electrical

1.4 REFERENCES

A. ASTM A82 - Cold-Drawn Steel Wire for Concrete Reinforcement
B. ASTM A153 - Specification for Zinc-Coating (Hot Dip) on Iron and Steel Hardware.
C. ASTM A615 - Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
D. ASTM C05a - Hollow Load-Bearing Concrete Masonry Units
E. ASTM C91 - Masonry Cement
F. ASTM C109 - Standard Test Method for Compressive Strength of Hydraulic Cement Mortors
G. ASTM C140 - Sampling and Testing Concrete Masonry Units
H. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar
I. ASTM C150 - Portland Cement
J. ASTM C207 - Hydrated Lime for Masonry Purposes
K. ASTM C270 - Mortar for Unit Masonry
L. ASTM C404 - Standard Specification for Aggregates for Masonry Grout
M. ASTM C476 - Grout for Masonry

N. AC1 530 - Building Code Requirements for Concrete Masonry Structures
O. AC1 530.1 Specification for Concrete Masonry Construction

1.5 SUBMITTALS

A. Submit product data for each item under provision of Section 01340.
B. UL Certification that the components meet the fire rating or UL system indicated on the Drawings.
C. Mason shall coordinate reinforcing steel layout for dowel placement in reinforced concrete foundation walls and masonry walls.
D. Cold Weather Construction Procedures as specified.
E. Hot Weather Construction Procedures as specified.
F. Mortar and Grout Mix Design.
G. Submit sieve analyses for mortar and grout aggregates taken within the last 3 months.

1.6 QUALIFICATIONS

A. Masonry Subcontractor: Company specializing in performing the work of this Section with a minimum of five years of experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store cementitious materials off the ground, under cover and in a dry location.
B. Store aggregates such that grading and other required characteristics can be maintained and contamination avoided.

1.8 SEQUENCING AND SCHEDULING

A. Coordinate work under provisions of Section 01050.

PART 2 - PRODUCTS

2.1 CONCRETE MASONRY UNITS

A. Concrete Masonry Units: Normal weight hollow concrete masonry units, ASTM C90.
B. Open top concrete masonry channel bond beam and lintel block: ASTM C90.
C. Bullnosed Concrete Masonry Units: ASTM C90, Grade N.
D. Solid Load Bearing Concrete Masonry Units: ASTM C90, Grade N.
E. Prism tests to ASTM-1314, fm'=1350 psi - inspected.
F. All units indicated for use in fire rated assemblies shall be tested and approved for the hour ratings indicated on the Drawings.

2.2 REINFORCEMENT AND ANCHORAGE

A. All masonry reinforcing shall be ASTM A153, hot dipped galvanized with a minimum thickness of 1.5 oz./ft. of wire and ASTM A123 for all other shapes.

B. Single wythe joint reinforcement: Ladder type; cold-drawn steel conforming to ASTM A82, nine (9) GA. side rods with nine gage cross ties.
C. Deformed reinforcement shall be ASTM A615, Grade 60.
D. Rebar Positioner: Rebar positioner shall be nine gage hot dip galvanized, 1¼“ deep bends to diagonally lock into CMU cores.

2.3 ACCESSORIES
A. Expansion Joint Filler: Cork Board by W.R. Grace, W.R. Meadows or equal, size as indicated on the Drawings.

2.4 MORTAR AND GROUT MATERIALS
A. Portland cement: ASTM C150, Type I or Type II, gray color.
B. Masonry Cement: ASTM C91, Type S.
C. Mortar aggregate: ASTM C144, standard masonry type.
D. Grout aggregate: ASTM C476, Fine Grout.
E. Hydrated lime: ASTM C207, Type S.
F. Water: Clean and potable.

2.5 MORTAR MIXES
A. Mortar shall be: ASTM C270, Type S with a minimum 28 day compressive strength of 1800 PSI.

2.6 GROUT MIXES
A. Grout for bond beams, lintels and reinforced CMU cores shall have 2000 PSI compressive strength at 28 days; mixed in accordance with ASTM C476 fine grout.

PART 3 PART 3 - EXECUTION

3.1 EXAMINATION
A. Verify that field conditions are acceptable and are ready to receive work.
B. Verify items provided by other sections of work are properly sized and located.
C. Verify that built-in items are in proper location, and ready for roughing into masonry work.
D. Request inspection of spaces to be grouted.
E. Beginning of installation means installer accepts existing conditions.

3.2 PREPARATION
A. Direct and coordinate placement of metal anchors supplied in other sections.
B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.
C. Install mortar and grout to requirements of the specific masonry sections.
D. Work grout into masonry cores to eliminate voids.

E. Do not displace reinforcement while placing grout. Reinforcement shall remain centered in the width of the cell.
F. Remove grout spaces of excess mortar.
G. Cover and protect the top of the masonry walls at the end of each work day and during inclement weather. Cover partially completed masonry when construction is not in progress.
   1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
   2. Where one wythe of multi wythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.
H. Stain Prevention: Prevent grout, mortar and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar and soil that come in contact with such masonry.
   1. Protect base of walls from rain-splashed mud and mortar splatter by covering spread on ground and over wall surface.
   2. Protect sills, ledges and projections from mortar droppings.
   3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
   4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt on completed masonry.

3.3 MORTAR MIXING

A. Thoroughly mix mortar ingredients in quantities needed for immediate use in accordance with ASTM C270:
   1. Proportions by volume for Portland cement-lime-sand mixture:
      a. 2 parts Portland cement
      b. 1 part hydrated lime
      c. 9 parts masonry sand
   2. Properties by volume for masonry cement - sand mixture:
      a. 2 parts masonry cement
      b. 6 parts masonry sand
B. The sequence for mixing mortar:
   1. Add 2/3 of the water to the mixer.
   2. Add sand to the mixer.
   3. Add cement and lime to the mixer.
   4. Add additional water as necessary.
   5. Mix a minimum of 5 additional minutes after all materials have been added to the mixer.
C. Do not use anti-freeze compounds to lower the freezing point of mortar.
D. If water is lost by evaporation, retemper only within two hours of mixing.
E. Use mortar within two hours after mixing at temperatures of 80 degrees F, or 2½ hours at temperatures under 50 degrees F.

F. Use care when mixing to provide a consistent mixture.

3.4 GROUT MIXING

A. Thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C476:
   1. Proportions by volume:
      a. 1 part Portland cement
      b. 1/10 part hydrated lime
      c. 3 parts sand
B. Do not use anti-freeze compounds to lower freezing point of grout.

3.5 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.
B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness to provide a neat, uniform appearance.
C. Lay concrete masonry units in running bond. Course one unit and one mortar joint to equal eight inches. Form concave mortar joints to provide a neat, uniform appearance where exposed to view; strike the joints within the cavity flush.

3.6 PLACING AND BONDING

A. Lay hollow masonry units with face shell bedding on head and bed joints.
B. Buttering corners of joints or excessive furrowing of mortar joints are not permitted.
C. Remove excess mortar which has splashed or been smeared on finished surfaces with stiff bristle brushes as work progresses.
D. Place full mortar bed around each core that is to be grouted.
E. Interlock intersections and external corners.
F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
G. Perform jobsite cutting of masonry units with electrically operated carborundum saws to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges. Do not break units with hammers or other tools.
H. Use Ivany or open top channel blocks for bond beams.

3.7 JOINT REINFORCEMENT AND ANCHORAGES

A. Install horizontal joint reinforcement as shown on Drawings.
B. Place joint reinforcement continuous in first joint below top of walls.
C. Lap joint reinforcement ends minimum six inches.
D. Install horizontal joint reinforcing at 16" on center at all masonry walls.

3.8 GROUTED COMPONENTS

A. Reinforce channel bond beam with two bars, placed continuously, size as shown on the Drawings.
B. Lap splices in vertical reinforcing minimum 48 bar diameters.

C. Support and secure reinforcing bars from displacement. Vertical reinforcing shall be centered in the width of the core.
D. Place and consolidate grout fill without displacing reinforcing.
E. All cells to receive epoxy or expansion anchors shall be grouted solid.
F. Grouting:
   1. Request the Engineer to inspect the cells. Allow three days advance notice of inspection.
      a. Provide cleanout opening no less than four inches high at the bottom of each cell to be grouted by cutting one face shell of masonry unit.
      b. Clean out masonry cells with high pressure water spray. Permit complete water drainage.
   2. After cleaning and cell inspection, seal openings with masonry units.
   3. Place grout into spaces. Maintain water content in grout to intended slump without aggregate segregation.
   4. Limit grout lift to 48 inches, stop each lift at least one inch below the top of a masonry unit and rod for grout consolidation. Wait 30 to 60 minutes before placing next lift.

3.9 PLACING REINFORCING STEEL

A. Mason shall coordinate dowel placement and coordinate vertical reinforcing splices for constructability.
B. Install reinforcing before laying masonry. Installation shall be done per the Masonry Reinforcing Shop Drawing marked "No Exceptions Taken".
C. Prior to placing grout, clean all reinforcement of loose, flaky rust; scale; grease; mortar; grout; or other coating which might destroy or reduce its bond with grout. The details of reinforcement shall conform to ACI 315. Do not bend or straighten reinforcing. Do not use bars with kinks or bends not shown on the Drawings. Placement of reinforcement shall be inspected by the Engineer prior to placing grout.
D. Position vertical bars accurately at the centerline of the reinforced wythe within a tolerance of 1/2 inch. Maintain a minimum clearance between the bars and masonry units of 1/2 inch and between parallel bars of one diameter of the reinforcement. Hold vertical reinforcing in place using metal supports, centering clips, spacers, or caging-devices located near the ends of each bar and at intermediate intervals of not more than 160 diameters of the reinforcement. Wire column and pilaster ties in position around the vertical steel, laying ties in mortar joints will not be permitted.
E. Stagger splices in adjacent bars. Lay bars a minimum of 48 diameters of the reinforcement or two feet whichever is greater. Welded or mechanical connections shall develop the full strength of the reinforcement.
F. Vertical reinforcing shall extend into the bond beam located at the top of the wall.

3.10 BUILT-IN WORK

A. As work progresses, build in metal door and glazed metal frames, wood nailing strips, plates and other items furnished by other sections.
B. Build in items plumb and level.
C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout or batt insulation as shown on the Drawings.
D. Do not build in organic materials subject to deterioration.

3.11 TOLERANCE

A. Maximum variation from unit to adjacent unit: 1/32 inch.
B. Maximum variation from plane of wall: 1/4 inch in 10 feet and 1/2 inch in 20 feet or more.
C. Maximum variation from plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.
D. Maximum variation from level coursing: 1/8 inch in three feet and 1/4 inch in 10 feet; 1/2 inch in 30 feet.
E. Maximum variation of joint thickness: 1/8 inch in three feet.
F. Maximum variation from cross sectional thickness of walls: 1/4 inch.

3.12 CUTTING AND FITTING

A. Cut and fit for chases, pipes, conduit, sleeves, grounds and other penetrations. Coordinate with other sections of work to provide correct size, shape, and location.
B. Obtain Engineer approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.13 CLEANING

A. Clean work under provisions of Section 01710.
B. Remove excess mortar and mortar smears.
C. Replace defective mortar. Match adjacent work.
D. Clean soiled surfaces of unpainted surfaces with cleaning solution.
E. Use non-metallic tools in cleaning operations.

3.14 COLD WEATHER CONSTRUCTION PROCEDURE

A. Where ambient temperatures are below 40 degrees F or anticipated to drop below 40°F within 24 hours, provide "weather protection" for the masonry under construction and use heat sources to maintain temperatures above 40 degrees F within the enclosure. Maintain the heated enclosure for a minimum of 24 hours after construction.
B. Heat mortar sand or mixing water to produce mortar temperatures between 40 degrees F and 90 degrees F at the time of mixing. Maintain mortar above freezing until used in masonry.

C. Temperature of stored masonry units shall not be less than 20 degrees F when laid in the masonry. Remove visible ice on masonry units before the unit is laid in the masonry.
D. Provide a High/Low thermostat within the enclosure or at the work.

3.15 HOT WEATHER CONSTRUCTION PROCEDURE

A. When the ambient temperature exceeds 90 degrees F:
   1. Lightly wet the mortar bedding surface areas.
   2. Keep mortar moist, and do not string out on the wall so far ahead of units being placed that drying will take place prior to placement of units.
   3. After the units are in place, a very light fog spray shall be applied sufficient times during the first 24 hours for proper curing.
B. Provide a High/Low thermostat within the enclosure or at the work.

END OF SECTION

SECTION 06100

ROUGH CARPRENTRY

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Temporary enclosures.
B. All rough lumber, including wood nailers, posts, plates, blocking, strapping, and lumber bases for mechanical and electrical equipment
C. Plywood Sheathing
D. Interior Plywood Sheathing
E. Wood Trim
F. Rough hardware, such as nails, bolts, screws, clips, as required to install rough carpentry work.
G. Lumber Preservatives

1.2 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

A. Section 07190 - Vapor and Air Infiltration Barriers.
B. Section 07210 - Building Insulation. Perimeter and under slab insulation - fiberglass insulation - sill sealer - Rigid wall insulation.
C. Section 08110 - Steel Doors and Frames: Flush metal doors and pressed steel frames.
D. Section 08710 - Finish Hardware: Finish hardware for doors and frames.

1.3 REALTED SECTIONS

A. Section 01340 - Submittals
B. Section 03300 - Cast-in-Place Concrete
C. Section 07190 - Vapor and Air Infiltration Barriers
D. Section 07215 – Spray Foam Insulation
E. Section 07310 - Asphalt Shingles
F. Section 07461 - Vinyl Siding
G. Section 07620 – Sheet Metal Flashing and Trim
H. Section 09900 - Painting

1.4 REFERENCES

A. Standard pressure process shall conform to Federal Specification TT-W-573.
B. Plywood shall conform to American Plywood Association APA Grade trademark and Product Standard PS-l.
C. WIC A-4-2002 - Wood Truss Council of America.
D. BCSJ 1-03 - Building Component of Safety Information. Guide to Good Practice for Handling, Installing and Bracing of Metal Plate Connected Wood Trusses

1.5 QUALITY ASSURANCE

A. All lumber except as otherwise specified herein shall:
   1. Be new, dressed 4 sides (S4S), clean, and free from warping and other defects.
   2. Conform to U. S. Department of Commerce Simplified Practice Recommendations R-l6 for sizes and use Classifications.
   3. Have a moisture content not exceeding l9 percent when delivered to the project.
   4. National Forest Products Association - "National Design Specification for Wood Construction - 2005 including Design Values for Wood Construction".
B. Plywood shall conform to American Plywood Association APA Grade Trademark and Product Standard PS-1.

1.6 SUBMITTALS

A. Submit product data under provision of Section 01340.
B. Submit lumber species and grade.
C. Submit plywood thickness, grade and structural type.
D. Submit hardware and hangers indicated on the Drawings.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store all materials in an elevated dry location, protected by waterproof coverings. Do not store within the building until masonry, concrete, and other such wet work has been completed and allowed to dry.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Wolmanized Pressure-Treated Lumber
   1. Hickson Corp.
   2. Hoover Treated Wood Products
   3. Koppers

2.2 LUMBER TREATMENTS

A. Pressure Preservative Treatments: All dimension lumber, wood blocking and nailers which will be embedded or in contact with concrete and masonry, and all nailers which will be concealed by roofing and flashing, shall be treated with ACQ (Type D). The minimum retention shall be 0.25 pounds of preservative per cubic foot of wood.
B. Brush Preservative Treatment: Brush coat all end cuts after cutting with ACQ or equal. Apply in two heavy coats on all surfaces prior to installation of lumber.

2.3 MATERIALS

A. Roof rafters shall be 2 x14 Southern Yellow Pine Number 1.
B. All other dimensional lumber to be used in exterior and bearing walls shall be Spruce-Pine-Fir No. 2 or better unless indicated otherwise on the Drawings.

C. Nailers, blocking, equipment bases, and all other lumber of actual l-l/2 inches or greater thickness - Douglas fir, spruce, pine, number two (2) or better, unless indicated otherwise on the Structural Drawings.
D. Furring and other lumber less than l-l/2 inches in thickness - No. 2 spruce or Douglas fir.
E. Plywood Sheathing - Shall be thicknesses, exposure rating and structural type indicated on the Drawings.
F. Plywood Panels for Electrical Panel Mountings - INT DFPA A-C, 3/4 inch thick.
G. MDO plywood base for exterior mounted electrical equipment.
H. Interior Plywood Finish - APA ACX in thickness indicated on the Drawings.
I. Interior Wood Trim - White Pine No. 2 or better. The longest lengths available shall be used and shall be 10 foot minimum.

2.4 ROUGH HARDWARE

A. Joist hangers, truss anchors, framing anchors, nail plates and other fasteners as indicated on Drawings.
B. Expansion anchor and anchor bolts shall be as shown on the Drawings. For other non-specified conditions the following minimums shall apply:
   1. Top plates and sill plates at masonry bond beams - 3/4-inch diameter galvanized anchor bolts
   2. Sill plates at wood framed walls attached to concrete - 3/4-inch diameter anchor bolts.
   3. Other nailers and blocking in excess of 7/8 inch thick - 3/4-inch diameter galvanized steel anchor bolts or expansion bolts, as applicable.
   4. Furring, strapping and blocking 7/8 inch thick or less attached to concrete or masonry- 5/16 inch diameter galvanized steel anchor bolts or expansion bolts.
   5. Secure other non-specified lumber with galvanized steel fasteners, of a type most suitable for the application.
C. Hardware and fasteners in contact with pressure treated lumber shall be stainless steel.

PART 3 EXECUTION

3.1 TEMPORARAY BRACING

A. Provide and maintain, until such time as permanently built into the structure, all temporary bracing for walls, door frames, sills, and other work requiring bracing and which is not specified as being provided under other SECTIONS of the specifications.

3.2 PROTECTION

A. Do such work as is necessary to cover and protect all finishes and other work from damage during construction.

3.3 NAILERS AND BLOCKING

A. Fasten nailers and blocking to concrete and masonry with specified bolts, as shown on Drawings. Space bolts not over 32 inches on centers. Stagger lines of bolts on nailers wider than nominal 3-1/2 inch width. Use not less than two (2) bolts per piece of nailer length. Counterbore nailers so that nut and ends of bolts are recessed below top surface. Install wood shims behind nailers and blocking against masonry, as required, to ensure completely true surface.

3.4 FRAMING AND SHEATHING

A. Install wood rafters, studs and other framing as indicated on the Drawings.
B. Install plywood sheathing, stagger all joints and block all edges with 2x6.
C. Nailing shall be as per the nailing schedule.
D. All plywood shall be installed such that the long direction is perpendicular with the main framing members.

3.5 FURRING

A. Install furring to the underside of ceiling framing. Secure with two No. 8x2-1/2 inch screws at each member. Shim to level.

3.6 INSULATION

A. Below Grade Insulation
   1. Install rigid insulation under all slabs or equipment pads on grade.
B. Sills
   1. Install fiberglass sill sealer at the base of all exterior stud walls.
   2. Install fiberglass sill sealer at the top of all exterior masonry walls with wood top plates.
   3. Tops of concrete and masonry walls shall be true and level so the sill sealer will close all gaps.
C. Walls, Ceilings and Attics
   1. Insulation shall consist of spray foam insulation as indicated on the drawings.
D. Rigid Wall Insulation
   1. Install rigid wall insulation at all locations indicated on the Drawings.
   2. Cut insulation to fit tightly around all penetrations.

3.7 ERECTION OF DOOR FRAMES

A. Erect all door frames, furnished under Section 08110, in accordance with the final shop drawings and frame schedule.
B. Provide rigid temporary bracing for door frames, as required to ensure maintenance of positioning, and remove only after frames have been permanently anchored.

3.8 HANGING AND FITTING OF DOORS

A. Receive, store, and be responsible for hardware as furnished under Section 087l0, Finish Hardware.
B. Fit all hinged doors to their respective openings.

C. Fit all hardware accurately, from templates supplied with hardware, apply securely, and adjust carefully.
D. Prior to Substantial Completion of the Contract, and before building is occupied, inspect entire building with the Engineer and see that each piece of finish hardware is undamaged and in perfect order and that the proper key for each lock is identified.

3.9 INTERIOR PLYWOOD FINISH

A. All plywood used for finished interior wall or ceiling surface shall be:
B. Sealed at all joints
C. Patched at any cracks or holes.
D. Have screw holes filed.
E. Shall be painted as specified in 09900.

3.10 INSTALLATION OF MISCELLANEOUS SPECIALTIES

A. Receive all such items, and install in accordance with the instructions of the various manufacturers, using installation accessories furnished with the specific item.

END OF SECTION

SECTION 07190

VAPOR AND AIR INFILTRATION BARRIERS

PART 1 - GENERAL

1.1 SECTION INCLUDES
A. Air Infiltration Barrier

1.2 RELATED SECTIONS
A. Section 01340 - Submittals
B. Section 01700 - Project Cleaning
C. Section 06100 - Rough Carpentry
D. Section 07461 - Vinyl Siding

1.3 REFERENCES
A. ASTM E96 - Test Methods for Water Vapor Transmission of Materials.

1.4 QUALITY ASSURANCE
A. Install in one area where directed and obtain approval of installation. Sample area will establish quality of workmanship for remaining work.

1.5 SUBMITTALS
A. Submit product data and manufacturer's installation instructions under provision of Section 01340.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. Air Infiltration Barriers
   1. Dupont "Tyvek"
   2. Raven Industries "Rufco-Wrap"
   3. Covalence Coated Products "Barricade Building Wrap"

2.2 MATERIALS
A. Air Infiltration Barrier: Six mil thickness.
B. Accessories: Tapes, sealant, prefabricated accessories and terminations recommended by the manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Apply air infiltration barrier to sheathing, stapled at 30 inches on center each way with eight inch end laps and twelve inch vertical laps.

B. Do not damage barriers; repair all penetrations with a patch extending a minimum of six inches in all directions and seal as specified by manufacturer.

END OF SECTION

SECTION 07210

BUILDING INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Perimeter and Underslab Insulation.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Rigid Wall Insulation: Installed under Section 06100 - Rough Carpentry
B. Sill Sealer: Installed under Section 06100 - Rough Carpentry

1.3 RELATED SECTIONS

A. Section 01340 - Submittals
B. Section 02200 - Earthwork
C. Section 03300 - Cast-in-Place Concrete
D. Section 04200 - Unit Masonry
E. Section 06100 - Rough Carpentry
F. Section 07190 - Vapor and Air Infiltration Barriers
G. Section 07215 - Spray Foam Insulation

1.4 REFERENCES

A. ASTM C272 - Test Method for Water Absorption of Core Materials for Structural Sandwich Construction.
B. ASTM C518 - Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter.
C. ASTM D1621 - Test Method for Compressive Properties of Rigid Cellular Plastics.
D. ASTM E96 - Test Method for Water Vapor Transmission of Materials.
E. ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace @ 750 degrees C.

1.5 SUBMITTALS

A. Submit product data under provision of Section 01340.
B. Submit manufacturer's installation instructions.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to project site in manufacturer's original unopened packaging.
B. Identify contents, manufacture, brand name, thermal values, and applicable standards.
C. Store materials in area protected from weather, and moisture.
D. Remove damaged materials from site.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Under-slab and Rigid Wall Insulation
   1. Dow Chemical Company
   2. U.C. Industries, Inc.
   3. Or equivalent

2.2 INSULATION

A. Insulation: Closed cell polystyrene foam board
B. Aged "R" Value - "R" = 5.0 per inch, ASTM C518.
C. Water Absorption - 0.1 percent, ASTM C272.
D. Water Vapor Permeance - 1.1 perm (max) ASTM E96
E. Compressive Strength - 25 pounds per square inch, ASTM D1621.

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 07215

SPRAY FOAM INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Closed Cell Spray Foam Insulation.

1.2 RELATED SECTIONS

A. Section 06100 – Rough Carpentry

1.3 REFERENCES

A. ASTM C 518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
B. ASTM C 177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
C. ASTM C 1338 - Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings.
D. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
E. ASTM E 96 - Standard Test Methods for Water Vapor Transmission of Materials.
F. ASTM E 283 - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
G. ASTM D 1621 - Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
H. ASTM D 1622 - Standard Test Method for Apparent Density of Rigid Cellular Plastics.
I. ASTM D 1623 - Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics.
J. ASTM D 2126 - Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging.
K. ASTM D 2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics.

1.4 SUBMITTALS

A. Submit under provisions of Section 01340.
B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
C. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with a minimum of ten years experience manufacturing products in this section shall provide all products listed.
B. Installer Qualifications: Products listed in this section shall be installed by a single organization with at least five years of experience successfully installing insulation on projects of similar type and scope as specified in this section.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation.
B. Storage: Store materials in dry locations with adequate ventilation, protected from freezing rain, direct sunlight and excess heat and in such a manner to permit easy access for inspection and handling. Store at temperature between 55 and 80 degrees F.
C. Handling: Handle materials to avoid damage.

1.7 SEQUENCING

A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.8 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
B. Do not apply insulation when substrate temperatures are under 40 degrees F prior to installation.
C. Surfaces must be dry prior to application of spray foam. Excess humidity may cause poor adhesion, and result in product failure.
D. To avoid overspray, product should not be applied when conditions are windy.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. CertainTeed Corp
B. Icynene, Inc.
C. Or Equal

2.2 SPRAY FOAM INSULATION

A. HFC-blown type Closed Cell Foam: Medium-density, MDI-based polyurethane thermoset riged foam
B. Core Density: 1.9-2.4 pcf when tested in accordance with ASTM D 1622.

C. Thermal Resistance (aged): 5.8 less than or equal to 2-1/2 inches / 6.4 when greater than 2-1/2 inches when tested in accordance with ASTM C 518 at 75 degrees F, (h-ft2- degrees F)/Btu.
D. Closed Cell Content: 88-95 percent when tested in accordance with ASTM D 2842.
E. Compressive Strength: Greater than 25 psi when tested in accordance with ASTM D 1621.
F. Tensile Strength: 23 psi when tested in accordance with ASTM D 1623.
G. Water Absorption: Less than 2 percent by volume when tested in accordance with ASTM D 2842.
H. Water Vapor Transmission: 1.3 perm/inch when tested in accordance with ASTM E 96.
I. Air Permeability: <0.02 when tested in accordance with ASTM E 283 at 1 inch thickness, L/s/m2.
J. Fungi Resistance: Pass, with no growth when tested in accordance with ASTM C 1338.
K. Dimensional Stability: Less than 9 percent by volume when tested in accordance with ASTM D 2126 at 75 degrees F/95 percent RH, 28 Day.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.
B. Verify that all exterior and interior wall, partition, and floor/ceiling assembly construction has been completed to the point where the insulation may correctly be installed.
C. Verify that substrate and cavities are dry and free of any foreign material that will impede application.
D. Verify that mechanical and electrical services in ceilings, walls and floors have been installed and tested and, if appropriate, verify that adjacent materials are dry and ready to receive insulation.
E. If substrate preparation is the responsibility of another installer, notify Engineer of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.
B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
C. Mask and protect adjacent surfaces from overspray or dusting.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions. Product must be installed according to local code, and must be applied by a qualified applicator.
B. Apply insulation by spray method, to uniform monolithic density without voids.

C. Apply to minimum cured thickness as indicated on the Drawings.
D. Shave and cut insulation flush with the proposed finish where indicated.
E. Patch damaged areas.

3.4 PROTECTION

A. Protect installed products until completion of project.
B. Touch-up, repair or replace damaged products before Substantial Completion.
C. Clean all areas that were over sprayed.

END OF SECTION

SECTION 07270

FIRESTOPPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Firestopping for penetrations in concrete and masonry walls and ceilings.
B. Firestopping for PVC and insulated pipe penetrations.

1.2 RELATED SECTIONS

A. Section 01050: Coordination
B. Section 01340: Submittals
C. Section 03300: Cast-in-Place Concrete
D. Section 04200: Unit Masonry
E. Section 07900: Joint Sealers
F. Division 16: Electrical

1.3 REFERENCES

A. ASTM E814 - Methods for Fire Tests of Through-Penetration Fire Stops.
B. Underwriters Laboratories 1479.
C. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
D. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

1.4 PERFORMANCE REQUIREMENTS

A. Provide firestopping systems that meet or exceed the fire rating of the construction assembly being penetrated, when tested in accordance with ASTM E814 and UL 1479.

1.5 SUBMITTALS

A. Submit product data under provisions of Section 01340.
B. Submit manufacturer's specification and installation instructions.
C. Submit design data indicating methods of closure.
D. Submit test reports indicating that the system meets the specified performance requirements.
E. Submit shop drawing indicating large scale details for each type of penetration through each type of construction assembly.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to project site in manufacturer's original unopened packaging.
B. Store materials in area protected from weather and moisture.

1.7 SEQUENCING AND SCHEDULING

A. Coordinate work under provisions of Section 01050.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Gold Bond Building Products
B. United States Gypsum
C. 3M Products
D. Hilti
E. Johns Manville
F. Or equal

2.2 MATERIALS

A. The materials specified herein are the generic components of typical firestopping systems. The components shall be as required by the manufacturer to provide a complete firestopping system complying with the performance requirements specified.
B. Insulation Packing Material: A combination of mineral fiber manufactured from glass and thermosetting resins, with a minimum density of 6 PCF, complying with ASTM C665, Type 1.
C. Sealing Compound: A setting type sealing compound for use with gypsum wallboard assemblies. Material must be as required by the manufacturer of the gypsum wallboard system utilized and have passed testing in accordance with ASTM E814.
D. Intumescent-type Wrap: Flexible rubber like material capable of expanding up to ten times in volumes when subjected to heat.
E. Mortar: A cementious fire resistant material.
F. Steel Collar: As required by the manufacturer to provide the complete firestopping system.
G. Sealant: Elastomeric caulking resistant to temperatures up to 2000°F, as required by the manufacturer of the firestopping system.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that openings are ready to receive work.
B. Verify that all penetrations are adequately prepared and that all back-up and systems required to support the firestopping has been provided.
C. Beginning of installation means installer accepts existing conditions.

3.2 PREPARATION

A. Protect materials surrounding the work of this section from damage.

3.3 INSTALLATION

A. Install firestopping at all new penetrations through both new and existing fire rated assemblies.
B. Products shall be installed as per the manufacturer's submitted instructions to provide a complete firestopping system at all fire rated assemblies.
C. Fill all annular spaces of penetrations in gypsum wallboard assemblies with insulation packing material and apply sealing compound.
D. Fill all annular spaces of penetrations in masonry and concrete with insulation packing material and apply mortar on other approved sealing compound.
E. Install intumescent wrap around all plastic pipe and insulated pipe penetrating fire rating assemblies.
F. Install sealant as required per manufacturer's instructions.

3.4 CLEANING

A. Clean work under provisions of Section 01710.

END OF SECTION

SECTION 07310

ASPHALT SHINGLES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Asphalt Shingles
B. Ice and Snow Guard
C. No. 15 asphalt saturated roofing felt.

1.2 RELATED SECTIONS

A. Section 01340 - Submittals
B. Section 01710 - Project Cleaning
C. Section 06100 - Rough Carpentry
D. Section 07461 - Vinyl Siding
E. Section 07620 - Sheet Metal Flashing And Trim

1.3 REFERENCES

A. ASTM D226 Specification for Organic Felt Used in Roofing and Waterproofing.
B. ASTM D 3018 Specification for Class A asphalt shingles surfaced with mineral granules.
C. ASTM D 3462 Specification for asphalt shingles made from glass felts and surfaced with mineral granules.
D. UL Fire Resistance
E. UL 2390/ASTM D6381 - Test Method for Wind Resistant Shingles with Sealed Tabs.

1.4 SUBMITTALS

A. Submit product data under provisions of Section 01340.
B. Submit one shingle in each color available.
C. Manufacturer's printed literature for review (CSI "Spec-Data" sheet or equivalent) stating product information correlated to specified requirements.
D. Copies of the manufacturer's specifications and installation instructions.

1.5 WARRANTY

A. Manufacturer shall warranty shingles for a period of thirty (30) years.

PART 2 - PRODUCTS

2.1 SHINGLE MANUFACTURERS

A. Certainteed
B. Georgia, Pacific
C. Owens Corning

D. Or equal.

2.2 ICE AND SNOW GUARD MANUFACTURERS

A. Bird Roofing Division
B. W.R. Grace
C. Or equivalent

2.3 MATERIALS

A. Shingles - Fiberglass Asphalt Base ASTM D3018 Class A Shingles, Type 1: UL Class "A" Fire Resistance, UL 2390/ASTM D6381 Class "H" Wind Resistance, 30-year, laminated architectural shingle, self-sealing, having 5-inch exposure and 2-inch head lap, in colors as selected by the Engineer.
B. Ice and Snow Guard at Fascia, Rakes, Ridges and Valleys, and as indicated on the Drawings- 40 mil rubberized asphalt and polyethylene membrane. Primer as by manufacturer.
C. Underlayment - 15 pound non-perforated felt roofing paper, meeting ASTM D226, Type 1.
D. Nails - Hot dipped galvanized shingle roofing nails of length adequate to penetrate plywood deck, and having a minimum head diameter of l/2 inch.

PART 3 - EXECUTION

3.1 PRE-INSTALLATION CONDITIONS

A. The Contractor shall be responsible for the providing of proper receiving surfaces for roofing and flashing items. Inspect all surfaces receiving roofing and flashing work and correct all defects or other characteristics in the new receiving surfaces which may be detrimental to the installation and performance of the items to be furnished and installed hereunder. Do not commence work until defects have been corrected. Commencement of roofing and flashing work shall constitute acceptance by the Contractor of surface conditions. The Contractor shall be responsible for leakages in roof and flashed surfaces and any other defects in these surfaces.
B. Ensure that all openings through the roof decks for fans, vents, and other such items, have been either temporarily or permanently covered, to prevent the entry of water into the building, prior to commencing the Work.
C. Have sufficient materials on the project to complete each day's work. The complete roofing system for any one section of the roof, must be finished by the end of each day. Phased roofing operations will not be permitted. Do not leave shingles exposed to the weather overnight or when inclement weather is imminent.

3.2 INSTALLATION OF SHINGLES

A. Install felt underlayment laid in a shingled pattern overlapping half the width of each sheet. Install with a six inch lap over ice and snow guard. Nail with specified nails spacing not to exceed l2 inches in any direction.

B. Install ice and snow guard over a primed surface with a six-inch head and side lap and as indicated below.
   1. At eaves, provide 66-inches (two rows with 6-inch side laps).
   2. At rakes, provide 36-inches (one row).
   3. At ridges and hips provide 66-inches centered on the ridge (two rows with 6-inch side laps).
   4. At additional locations, as indicated on the Drawings.

C. Apply shingles in strict accordance with the shingle manufacturer's instructions and recommendations, using specified nails. Use at least six nails per shingle, nails long enough to penetrate plywood sheathing. Install shingles with five-inch exposure and two-inch headlap.

3.3 CLEANING

A. At the completion of the Work, clean and remove from the site, all rubbish and accumulated materials and leave the Work in a satisfactory condition.

B. Clean, remove, or replace, as directed by the Engineer, all stains and/or damage to the exterior finish of building caused by faulty workmanship and/or improper handling of materials in regard to the installation of roofing and flashing work.

END OF SECTION

SECTION 07461

VINYL SIDING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Vinyl siding
B. Vinyl accessories and trim
C. Prefabricated mounting system and accessories

1.2 RELATED SECTIONS

A. Section 01340 - Submittals.
B. Section 06100 - Rough Carpentry.
C. Section 07620 - Sheet Metal Flashing and Trim.
D. Section 07900 - Joint Sealers.
E. Section 08110 - Steel Doors and Frames.

1.3 REFERENCES

A. ASTM D 638 - Standard Test Method for Tensile Properties of Plastics.
B. ASTM D 696 - Standard Test Method of Coefficient of Linear Thermal Expansion of Plastics Between -30 Degrees C and 30 Degrees C.
C. ASTM D 790 - Standard Test methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
D. ASTM D 1435 - Standard Test Method for Outdoor Weathering of Plastics.
E. ASTM D 1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
F. ASTM D 1929 - Standard Test Method for Ignition Properties of Plastics.
G. ASTM D 2843 - Standard Test Method for Density of Smoke from the Burning or Decomposition of Plastics.
H. ASTM D 3679 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Siding.
I. ASTM D 4101 - Standard Specification for Propylene Plastic Injection and Extrusion Materials.
J. ASTM D 4226 - Standard Test Method for Impact Resistance of PVC Building Products.
K. ASTM D 5206 - Standard Windload Resistance Test.
L. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
M. ASTM E 119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

1.4 PERFORMANCE REQUIREMENTS

A. PVC Fire Resistance: Provide vinyl siding products that meet or exceed the following ratings:

1. Flame spread 25, fuel contribution 0, smoke density 330, per ASTM E 84.
2. Minimum self-ignition temperature of 824 degrees F, per ASTM D 1929.
3. Fire endurance classification of 1 hour, per ASTM E 119.

1.5 SUBMITTALS

A. Submit product data under provisions of Section 01340.
B. Submit manufacturer's specification and installation instructions.
C. Submit color chart for color selection by the Engineer.
D. Submit installer's qualifications and sample warranty.

1.6 QUALITY ASSURANCE

A. Installer: Provide installer specializing in this type of work, with not less than three years of experience with products specified.

1.7 WARRANTY

A. Provide manufacturer's standard lifetime limited warranty on siding products.
B. Installer shall provide a 2-year warranty on the completed installation.

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to project site in manufacturer's original unopened packaging.
B. Store materials in area protected from weather and moisture.
C. Remove damaged materials from site.

PART 2 - PRODUCTS

2.1 VINYL SIDING MANUFACTURERS

A. Certainteed Vinyl Building Products Div.
B. All-Side
C. Or equivalent.

2.2 PREFABRICATED MOUNTING SYSTEM AND ACCESSORIES MANUFACTURERS

A. Mid-America Building Products
B. Richwood Building Products Incorporated
C. Or equal

2.3 GENERAL MATERIALS

A. Polyvinyl Chloride: Provide siding materials made of PVC resin with cell classification of 13344-B, as defined by ASTM D 1784, meeting or exceeding the following properties:

1. Impact strength: 2.20 ft-lbs. per inch at test temperature of 73 degrees F., and 1.30 ft-lbs per inch at test temperature of 32 degrees F, per ASTM D 4226.
2. Tensile strength: 7,344 psi.
3. Flexural modules of elasticity in tension: 455,750 psi.
4. Deflection temperature under load of 264 psi: 168 degrees F.
5. Coefficient of expansion: .000034 in/in/degree F.
6. Chemical resistance: Excellent.

B. Vinyl Components: Provide products made of extruded polyvinyl chloride as specified in this section and manufactured to comply with requirements of ASTM D 3679.
1. Provide elongated nailing slots on nailing flanges to allow for movement.
2. Factory-notch ends of horizontal panels to form overlapping joints.
3. Provide products that meet weathering requirements of ASTM D 1435.

2.4 CLAPBOARD VINYL SIDING

A. Vinyl siding shall be Certainteed Monogram siding.
B. Provide siding panels testing per ASTM D 5206 to withstand 78 psf negative wind pressure.
C. Nominal Panel Thickness: .046 inches, with .088 inch nail hem thickness.
D. Nominal Butt Height: 3/4 inches, with interlocking, self-aligning joint system.
E. Style: Double 5 inch clapboard profile, rough cedar finish.
F. Color: As selected by Engineer from manufacturer's standard colors from a color pallet of at least 20 colors available.

2.5 ACCESSORIES

A. Provide coordinating vinyl accessories for complete and proper installation.
B. Provide accessories in matching or contrasting color as selected by Engineer.
C. Profiles: Provide types as indicated on the drawings.
D. Schedule of Accessories:
1. Starter strip: 2½" metal starter strip
2. Undersill trim: Standard type
3. Outside corners: Traditional super corner 5½ inch with foam insert in up to 20-foot lengths.
4. J Channel: Manufacturer's Standard to match siding thickness.
5. Miscellaneous channels and dividers to suit project conditions.

E. Prefabricated mounting system and accessories to supplement the vinyl siding and trim shall be as indicated on the Drawings and as required for the complete vinyl siding system.

2.6 FASTENERS

A. Provide galvanized or aluminum nails as recommended by manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to commencing installation, verify governing dimensions of building and condition of substrate.

B. Verify that the air barrier system is installed and is complete.

3.2 PREPARATION

A. Examine, clean, and repair as necessary any substrate conditions which would be detrimental to proper installation.

B. Do not begin installation until unacceptable conditions have been corrected.

3.3 INSTALLATION

A. General: Install products in accordance with the latest printed instructions of the manufacturer, with all components true and plumb.

B. Nailing: Nail horizontal panels by placing nail in center of slot. Nail vertical panels by placing first ail at top of top slot and remaining nails in center of slots. Drive nails straight, leaving 1/16 inch space between nail head and flange of panel.

C. Spacing: Allow space between both ends of siding panels and trim for thermal movement. Overlap horizontal panel ends one-half the width of factory pre-cut notches.

D. Provide furring or shim as required for the various siding systems of all fasteners.

E. Joints in Horizontal Siding: Stagger lap joints in uniform pattern a successive courses of siding are installed.

F. Install aluminum trim and flashing as detailed.

3.4 CLEANING

A. Clean all vinyl siding as necessary to remove soiled areas.

B. At completion of work, remove debris caused by siding installation from project site.

END OF SECTION

SECTION 07620

SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Sheet Metal Flashing and Trim
   1. Aluminum Drip Edge
   2. Aluminum Fascia
   3. Aluminum Soffit
   4. Formed Aluminum Trim and Closures, including flashing at siding

1.2 RELATED SECTIONS

A. Section 01340 - Submittals
B. Section 06100 - Rough Carpentry
C. Section 07310 - Asphalt Shingles
D. Section 07461 – Vinyl Siding
E. Section 07900 - Joint Sealers

1.3 REFERENCES

A. SMACNA - Architectural Sheet Metal Manual
B. ASTM B209 - Specification for Aluminum and Aluminum-Alloy Sheet and Plate

1.4 SUBMITTALS

A. Submit product data under provision of Section 01340.
B. Submit large scale shop drawings detailing: Roofing, eave and rake trim, soffit and accessories; include all splice plates and method of anchorage.
C. Submit color chips for color selection by Engineer.
D. Submit manufacturers catalog cuts, spec data sheets, and installation instructions.

1.5 QUALITY ASSURANCE

A. Field measurements shall be taken prior to fabrication to assure symmetry and verify as built conditions.
B. All sheet metal flashing and trim shall be fabricated and installed in accordance with the recommendations in the SMACNA - Architectural Sheet Metal Manual.
C. Hem all exposed edges.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver materials with a protective vinyl masking.
B. Store all materials in properly protected and dry storage facilities until ready for use. Do not use materials which have been damaged in any manner.

C. Protect work from damage during construction period so that it will be without any indication of abuse or damage at time of acceptance.

PART 2 - PRODUCTS

2.1 MANUFACTURER'S

A. Firestone Metal products
B. Metal Era
C. W.P. Hickman Co.
D. Petersen Aluminum Corporation
E. Or equal

2.2 FINISH

A. Unless indicated otherwise, finish on all materials shall be Kynar 500, Hylar 5000, or equal, Fluoropon resin finish, color selected by Engineer.

2.3 MATERIALS

A. Drip Edge and Fascia - 0.032 inch aluminum, formed as detailed on the Drawings.
B. Aluminum Soffits - 0.032 Aluminum 12-inch wide vee panel, vented or solid as indicated on the Drawings. Windlock as manufactured by Atlas, PAC-750 as manufactured by Peterson Aluminum, UC-750 as manufactured by firestone or equal.
C. All other formed metal - 0.032 Aluminum.
D. All formed sheet metal flashing and trim shall conform to "Sheet Metal and Air Conditioning Contractors National Association, Inc. - Architectural Sheet Metal Manual".
E. Hem all exposed edges.
F. Reglect Flashing - .020 stainless steel as manufactured by Fry Reglect, Dayton Richmond, or equal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspect all surfaces and notify general contractor of any defects or other characteristics which may be detrimental to the installation and performance of the materials to be installed.
B. Commencement of work shall constitute acceptance of surface conditions.
C. Field verify all dimensions of the prefabricated items prior to fabrication to ensure ease of installation with a proper and tight fit.

3.2 INSTALLATION OF SHEET METAL FLASHING AND TRIM

A. Ensure a watertight installation at all points where prefabricated items meet the roofing.

3.3 CLEANING

A. At the completion of the work, clean, and remove from site, all rubbish and accumulated materials and leave the work in a satisfactory condition.

END OF SECTION

SECTION 07900

JOINT SEALERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Preparing sealant substrate surfaces.
B. Sealant and backing.

1.2 RELATED SECTIONS

A. Section 01340 - Submittals
B. Section 01710 - Project Cleaning
C. Section 03300 - Cast-in-Place Concrete
D. Section 04200 - Unit Masonry
E. Section 07270 - Fire Stopping
F. Section 07310 - Asphalt Shingles
G. Section 07620 - Sheet Metal Flashing and Trim
H. Section 08110 - Steel Doors and Frames

1.3 REFERENCES

A. ASTM C790 - Recommended Practices for Use of Latex Sealing Compounds.
B. ASTM C920 - Specification for Elastomeric Joint Sealant
C. ASTM C834 - Specification for Latex Sealing Compounds
D. FS-TT-S-227 - Sealing Compound: Elastomeric Type, Multi-Component
E. FS-TT-S-230 - Sealing Compound: Elastomeric Type, Single Component
F. Sealing and Waterproofers Institute - Sealant and Caulking Guide Specification

1.4 SUBMITTALS

A. Submit product data under provisions of Section 01340.
B. Submit color charts or samples.
C. Submit manufacturer's installation instructions.
D. Submit schedule of all items to be installed. Indicate intended use of each product.

1.5 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum ten years experience.
B. Applicator Qualifications: Company specializing in applying the work of this Section with minimum five years experience.
C. Compatibility: Verify sealants used are compatible with joint substrates.
D. Joint Tolerance: Compliance with the manufacturer's limitation is required.
E. Conform to Sealant and Waterproofers Institute requirements for installation.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

B. VOC Standards - All sealants shall be in accordance with all applicable State and Federal VOC standards.

1.7 SEQUENCING AND SCHEDULING

A. Coordinate work in this Section with related sections.

1.8 WARRANTY

A. Installer to provide five year warranty to include coverage of installed sealants, caulking and accessories which fail to achieve air tight and watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 - PRODUCTS

2.1 MATERIALS

A. C-1, Acrylic Latex Sealant: Single component, non-staining, non-bleeding, non-sagging; color as selected by Engineer; AC-20 as manufactured by Pecora Sealants, Tremco or equal.

1. Durability (Bond and Cohesion) +/- 7½ percent - 12½ percent
2. Service Temperature Range 0 to 180 degrees F
3. Shore "A" Hardness Range 15 to 40

B. S-1, Epoxidized Polyurethane Sealant: Multi-component, chemical curing, non-staining, non-bleeding, non-sagging type; color as selected by Engineer; Dymeric 240 FC, as manufactured by Tremco, Sika Corporation or equal.

1. Durability (Bond and Cohesion) - 25 percent + 40 percent
2. Shore "A" Hardness Range 25

C. S-2, Polyurethane Sealant: Multi-component, chemical curing, non-staining, non-bleeding, non-sagging type; color as selected by Engineer; Sikaflex 2C as manufactured by Sika Corporation, Tremco or equal.

1. Durability (Bond and Cohesion) +/- 50 percent
2. Service Temperature Range - 40 to 170 degrees F
3. Shore "A" Hardness Range 25 (40 for self leveling)

D. S-6, Polyurethane Sealant: One component, moisture curing, non-staining, non-bleeding, non-sagging type; color as selected by Engineer; Sika-flex 1A as manufactured by Sika Corporation, Tremco or equal.

1.	Durability (Bond and Cohesion)	± 25 percent
2.	Service Temperature	- 40 to 170 degrees F
3.	Shore A Hardness	40

E. S-8, Sealants for fire rated assemblies shall be coordinated with Section 07270 - Fire Stopping.

2.2 ACCESSORIES

A. Primer: Non-staining type, recommended by sealant manufacturer.

B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

C. Joint Backing: ASTM D1056; round, closed cell polyethylene foam rod; oversized 30 to 50 percent larger than joint width; as recommended by sealant manufacturer.

D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces and joint openings are ready to receive work and field measurements are as shown on Drawings and recommended by the manufacturer.

B. Beginning of installation means installer accepts existing conditions.

3.2 PREPARATION

A. Clean and prime joints in accordance with manufacturer's instructions.

B. Remove loose materials and foreign matter which might impair adhesion of sealant.

C. Verify that joint backing and release tapes are compatible with sealant.

D. Perform preparation in accordance ASTM C790 for latex base sealants.

E. Protect elements surrounding the work of this Section from damage or disfiguration.

3.3 INSTALLATION

A. Install sealant in strict accordance with manufacturer's instructions.

B. Measure joint dimensions and size materials to achieve required width/depth ratios.

C. Install joint backing to achieve a neck dimension no greater than 1/3 the joint width.

D. Install bond breaker where joint backing is not used.

E. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot apply within these temperature ranges.

F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

G. Tool joints concave.

3.4 CLEANING AND REPAIRING

A. Clean work under provisions of Section 01710.
B. Clean adjacent soiled surfaces.
C. Repair or replace defaced or disfigured finishes caused by work of this Section.

3.5 PROTECTION OF FINISHED WORK

A. Protect sealants until cured.

3.6 SCHEDULE

Sealant Type	**Location**
C-1, S-1, S-2 or S-6	Interior Door Frames Other Joints Designated to Receive Caulking Joints in Interior Wood Finish
S-1, S-2 or S-6	Exterior Door Frames Expansion Joints At Penetrations in the Exterior Walls Other Joints Designated to Receive Sealant
S-2	Joints Between Exterior Concrete Pavement or Concrete Pads Around the Building.
S-8	At Joints in Fire Rated Assemblies

END OF SECTION

SECTION 08110

STEEL DOORS AND FRAMES
(HOLLOW METAL)

PART 1 - GENERAL

1.1 SECTION INCLUDES
A. Steel Doors.
B. Steel Frames.

1.2 RELATED SECTIONS
A. Section 01340 - Submittals
B. Section 06100 - Rough Carpentry
C. Section 07641 - Vinyl Siding
D. Section 07900 - Joint Sealers
E. Section 08710 - Finish Hardware
F. Section 09900 - Painting

1.3 REFERENCES
A. ASTM A366 - Specification for steel, carbon, cold-rolled sheet, commercial quality.
B. ASTM E152 - Methods for fire tests of door assemblies.
C. ASTM A 525 - Specification for general requirements for steel sheet, zinc-coated (galvanized) by the hot-dip process.
D. ASTM B117 - Method of salt spray (fog) testing.
E. ASTM D1735 - Method for water fog testing of organic coatings.
F. SDI - Steel Door Institute - 100.
G. SDI - Steel Door Institute - 105.
H. DHI - Door Hardware Institute.
I. ANSI - American National Standard Institute.

1.4 SUBMITTALS
A. Submit product data under provisions of Section 01340.
B. Submit a complete door and frame schedule, large scale details of door and frame construction, indicating all gauges, reinforcing, cutouts, anchors and anchor clips.
C. Do not fabricate hollow metal work without final shop drawing review.
D. Submit manufacturers certification that door and frame hardware reinforcing gages comply to ANSI/SDI 100.
E. Submit verification that all existing dimensions and conditions have been field verified.

1.5 QUALITY ASSURANCE

A. Conform to requirements of SDI-100.
B. Doors and frames shall be factory fabricated. All field modifications shall be approved by the Engineer.

1.6 QUALIFICATIONS

A. The Steel Doors and Frames - Section 08110, and the Finished Hardware - Section 08710 shall be provided by a single supplier.

1.7 PACKAGING

A. Doors shall be fully wrapped in corrugated cardboard, single faced paper 42-pound with a 26-pound liner medium "B" flute, protecting all surfaces of the door. Flute shall be run the full height of the door.
B. Wood strips, 3/8 inches, 2 inches commercial grade, finished one side for marking, extending 1/2 inch beyond the top and bottom of the door shall be temporarily applied to the edges of the door.
C. The corrugated cardboard and wood strip shall be held firmly in place by three (3) 3/8 inch by 18 GA steel bands on each door.
D. Wood strips shall be marked clearly giving door type, size, hand lock preparation, and mark number. The metal banding shall not interfere with the marking.

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver doors, frames and windows to the job site in manufacturer's unopened packaging.
B. Store doors and frames upright in a protected area on wood runners or skids and covered with vented plastic.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Curries
B. Steel Craft
C. Or equivalent.

2.2 DOOR CONSTRUCTION

A. 16 gauge stretcher level steel, galvanized for all doors.
B. 1/8 inch bevel in two inches on hinge and lock edge.
C. Seams shall be continuously welded and ground smooth.
D. Top and bottom 16 gauge, cold-rolled steel reinforcing channels spot welded within door.
E. Mortise and reinforce doors for finish hardware in accordance with template. Requirements are furnished under finish hardware.
F. Hinge reinforcement - 12 gage, channel shape.

G. Lock face, flush bolts, surface mounted closers - 14 gage
H. All other surface mounted hardware - 14 gage.
I. Provide flush top cap sealing against water on all exterior doors.
J. Prepare exterior door bottoms to receive door bottoms.
K. Doors shall have, rigid polystyrene foam board, bonded to the inside of both faces. The strength developed on the laminated assembly shall be 1500 PSF in compression and a shear strength of not less than 2500 PSF. R-6.37 minimum.
L. Any additional modifications to specified door construction, as required by Underwriters Laboratories and National Board of Fire Underwriters, to meet required fire rating, shall be performed at the factory, and doors must bear the U.L. seal for each rating so required.

2.3 FRAME CONSTRUCTION

A. Frames - 14 gauge, Galvanized.
B. All frame joints shall be continuously welded and ground smooth. Where galvanized coating has been burned or damaged, paint with Z.R.C. liquid zinc or equal. All joints in frame shall be watertight.
C. Hinge, Lock and Strike Reinforcement - 10 Gauge
D. Door Closer Reinforcement - 14 Gauge
E. Floor Clips - 18 GA minimum
F. Frame Anchors - Provide minimum three anchors per jamb as required for the adjoining wall construction; a base angle and one anchor for every 2 vertical feet.
G. Reinforcement, stiffeners, and base angle clips shall be welded to inside surfaces of frames.
H. Locate hardware cutouts and reinforcing from templates obtained from the hardware supplier. Weld sheet steel dust covers over all cutouts in frames to prevent contact of mortar with reinforcing and lock strikes..
I. Before shipping, provide removable angle spreaders securely fastened to bottom of each jamb; do not remove until frames are secured in place.

2.4 FINISHING

A. Doors and frames shall be hot dipped galvanized, A60 coating.
B. Clean all surfaces of doors, frames, anchors and related items specified hereunder, by hot or cold phosphate treatment standard with the manufacturer. Following cleaning, apply one coat of rust-inhibitive prime paint and bake on. Prime all surfaces, including those which will be inaccessible after erection.
C. The finished work shall be strong and rigid, neat in appearance, and free from warp and buckle. Miters shall be well formed and in true alignment.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install frames in accordance with Steel Door Institute.

B. Install doors in accordance with Door Hardware Institute.

3.2 TOLERANCES

A. Maximum diagonal frame distortion: 1/16 inch measured with straight edge, corner to corner.

3.3 ADJUSTMENTS

A. Adjust hardware for smooth and balanced door movement.

END OF SECTION

SECTION 08710

FINISH HARDWARE

PART 1 - GENERAL

1.1 SECTION INCLUDES
- A. Finish Hardware for All Doors
- B. Thresholds
- C. Weather Stripping
- D. Keying to coordinate with the Owner's existing master key system.

1.2 RELATED WORK
- A. Section 01340 - Submittals
- B. Section 06100 - Rough Carpentry
- C. Section 08110 - Steel Doors and Frames

1.3 REFERENCES
- A. ANSI A115 - Standards for Door and Frame Preparation
- B. ANSI A156 - Standards for Finish Hardware
- C. Other Applicable Life Safety and Building Codes.

1.4 SUBMITTALS
- A. The finish hardware supplier shall submit for review a complete and detailed finish hardware schedule using a vertical typewritten format. The finish hardware schedule shall contain a listing of the name of each manufacturer and the product listing for the series included in the hardware schedule.
- B. Provide catalog cuts on specified hardware.
- C. It shall be the responsibility of the finish hardware supplier to obtain from the owner or the owner's representative, a detailed keying schedule listing the respective key symbol and location for the locksets having the corresponding key symbol.
- D. The finish hardware supplier shall make available to the general contractor a detailed list of template numbers and templates required for each of the door manufacturers that require templates.
- E. Submit the finished hardware suppliers field report indicating that the finished hardware has been installed and is working properly. The report shall note all deficiencies and conditions required to correct them. Refer to "Field Quality Control" as specified herein.

1.5 QUALITY ASSURANCE
- A. The hardware supplier shall have in his employ an architectural hardware consultant (AHC) or a person with equivalent number of years required for AHC qualifications. This person shall be recognized as having the ability to be fully

responsible for the scheduling, detailing and execution of this section of the specifications and related items. This qualified consultant shall be responsible for processing all submissions, correspondence, technical matters related to the finish hardware and it's application specified in this section.

1.6 QUALIFICATIONS

A. The Steel Doors and Frames - Section 08110, and the Finished Hardware - Section 08710 shall be provided by a single supplier.

1.7 DELIVERY, STORAGE AND HANDLING

A. The finish hardware shall be delivered to the job site and received there by the General Contractor. The General Contractor shall prepare a locked storage room with adequate shelving, for all hardware. The storage room shall be in a dry, secure area, and shall not include storage of other products by other trades.

B. All finish hardware shall have the necessary screws, bolts and other fastenings required for correct installation of each item. The cylinders, locksets, exit devices, door closers, shall be clearly marked with the respective individual door or heading number.

C. After the hardware has been installed and prior to the acceptance of the building by the Owner, it shall be the General Contractors responsibility to properly protect the hardware and the hardware finish from all dents, scratches, defacing that may occur during the construction period. Hardware that is considered damaged or scratched during the construction period shall be replaced by the General Contractor at no cost to the owner or hardware supplier. Hardware items with paint on them shall be cleaned and/or replaced by the General Contractor at no charge to the owner.

1.8 WARRANTY

A. The finish hardware specified for this project shall be guaranteed against defects in material and workmanship for a period of one (1) year from date of completion and acceptance of this building. In addition, door closers shall carry a guarantee of five (5) years from date of completion and acceptance of this building.

B. If an item of hardware is found to be defective by reasons of defects in material and workmanship, it shall be replaced by the hardware supplier at no charge to the owner. The installation of the replacement item shall be the responsibility of the General Contractor if within the building guarantee period specified under general conditions, or by the Owner if beyond the building guarantee period.

1.9 MAINTENANCE SERVICE

A. Provide special wrenches and tools applicable to each different or special hardware component.

B. Provide maintenance tools and accessories supplied by hardware component manufacturer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Hinges
   1. Stanley Hardware Division
   2. Hager
   3. McKinney
   4. Or equal

B. Exit Devices
   1. Sargent
   2. Von Duprin
   3. Corbin/Russwin
   4. Or equal

C. Door Closers
   1. Sargent
   2. LCN
   3. Corbin/Russwin
   4. Or equal

D. Kick Plates
   1. Burns
   2. Rockwood
   3. Or equal

E. Flush Bolts
   1. Rockwood
   2. Glynn Johnson
   3. Or equal

F. Weather Stripping
   1. National Guard Products
   2. Pemco
   3. Or equal

G. Thresholds
   1. National Guard Products
   2. Reese
   3. Wooster Safety Products (cast aluminum)

2.2 HINGES

A. All hinges for this project shall be stainless steel, ball bearing type.

B. The following is a guide for hinge size and type required for this specification:

1-3/4 inch	Stanley	FBB191-4 1/2 inches
Doors up to	Hager	BB1191-4 1/2 inches
3'0" wide	McKinney	TB2314-4 1/2 inches
1-3/4 inch	Stanley	FBB199-4 1/2 inches

Doors over 3'0" wide	Hager	BB1199-4 1/2 inches
	McKinney	T4B3386-4 1/2 inches

1. The width of hinges shall be sufficient to clear all trim.
2. Hinges of foreign manufacture shall not be considered acceptable for this project.

C. Two hinges shall be provided for each door leaf up to and including five feet (5'0") in height. An additional hinge shall be required for each additional two and one half feet (2'-6") or fraction thereof in height.

D. All exterior doors, and any interior doors so indicated in hardware sets, shall be furnished with non-removable pins (NRP).

E. Refer to finish section for hinge finish.

2.3 EXIT DEVICES

A. All exit devices for this project shall be of the same series and design, and shall be manufactured by one manufacturer.

B. All exit devices shall have a 14 gauge, stainless steel continuous horizontal mounting rail with a 16 gauge, stainless steel touch pad with a Lexan touch pad protection plate and shall be of the same design, and of similar configuration, for all doors throughout.

C. The chassis shall be a solid cast pressure formed almag or non-ferrous alloy and shall be mounted directly to the door with four (4) wood screws, machine screws, or, through bolted where required for positive attachment for wood fire rated doors.

D. All exit devices for this project shall have the chassis, end cap, and horizontal mounting rail, mount directly to, and flush with, the door surface. No gaps or space shall be permitted between the back of the horizontal mounting rail and the door surface. If required, a continuous solid stainless steel or bronze dull chrome plated spacer bar shall be used to fill the space between the back of the devices and the door surface.

E. The chassis cover shall be 16 gauge, cold formed stainless steel, fastened to the solid cast pressure formed chassis, by four (4) Phillip head machine screws, at the side of the chassis cover.

F. The rail assembly shall be 14 gauge, heavy wrought stainless steel. The rail assembly shall consist of a stainless steel case with a 16 gauge, heavy wrought stainless steel touch pad with a Lexan touch pad protection plate.

G. The end cap shall be a high impact resistant black lexan, fastened to the rail assembly by means of two, stainless steel Phillip head machine screws.

H. The touch pad shall retract the latch bolt by means of a sliding motion of the touch pad towards the lock stile, activating the lever arm for easy operation and reduced friction.

I. All exit devices, regardless of function, except for fire rated devices, shall have one point cylinder dogging. The cylinder for cylinder dogging shall be a six (6) pin

cylinder keyed to the building master key system as specified under Section, "Keying."

J. Trim for exit devices shall be cast stainless steel lever handle with cast escutcheon.

K. Devices for fire rated doors shall be listed for three (3) hour A label doors by Underwriters Laboratories. Exit devices with ratings of less than three (3) hours or listed with Laboratories other than Underwriters Laboratories shall not be considered acceptable for this project. Fire exit devices shall be installed only on fire doors bearing the marking.

L. Exit devices, as manufactured by Sargent & Company 88 Series, and Von Duprin Division 98, meeting all of the specification requirements set forth above, shall be considered acceptable for this project.

M. Provide rim exit devices for single doors and mortise lock devices with open back strike and vertical rod devices for pairs of doors.

N. The following is a list of the functions referred to under hardware sets (1, 2, 3) and the model numbers of the acceptable manufacturers:

TYPE	SARGENT	VON DUPRIN	CORBIN/RUSSWIN
R-1 (Exit Only)	8810	98EO	N950
R-2 (Night Latch)	8804	98NL	N957
R-3 (Key Lock)	8813	98L	N955
R-4 (Passage)	8815	98LBE	N910

2.4 KEYING

A. All locks and cylinders shall be keyed-a-like and shall match the Owner's existing key system.

B. Provide construction keys to be supplied with the locksets to the General Contractor. The construction key shall operate all locks and cylinders, and shall permit access to all areas by the General Contractor, during the construction period, prior to the Owner assuming control of the building.

C. Upon completion of the building, the Contractor or Owner shall remove the construction master key biting section by means of an extractor key to be supplied by the finish hardware contractor. The removal of the construction master key biting section shall prohibit the operation of the construction master key from that moment on.

D. Provide a total of four (4) keys to the Owner.

2.5 DOOR CLOSERS

A. All door closers for this project shall be the product of one manufacturer, and shall have heavy cast cases with full cover and be full rack and pinion type construction, non-handed and non-sized with adjustable back-check effective at 70 degrees for both standard and parallel arm mounting.

B. The following products will be acceptable:

Manufacturer	Model

Corbin/Russwin	-	DC6200
LCN	-	4111/4011
Sargent	-	280
Norton	-	7500

C. The hardware contractor shall insert in the hardware schedule, beside each door listing, the required degree of opening for each door. If the door swing is over 140 degrees, parallel arm type closers shall be used. Door closers mounted on corner brackets, or top jamb application, shall not be permitted.

D. Door closers with cush-n-stop arms shall be provided for all exterior, out-swing doors and other openings as specified under hardware sets. They shall have heavy forged steel parallel arms and soffit plates attached to the frame by six (6) screws. The forged steel arm shall have a positive stop bracket with an adjustable tension hold-open feature controlled with a slotted screw permitting adjustment from no hold-open to full restraint of door movement, Cush-N-Stop hold open function. The hold open feature does not apply to fire doors.

E. Where door closers are noted to require delayed action feature, provide closers as specified herein, but having a separate delayed action valve, to permit adjustment of delayed action cycle. When adjusted, the door closer shall close at a controlled rate of speed, through the delayed action cycle range.

F. The installing contractor shall be responsible for proper installation of door closers in accordance with degree of opening indicated on hardware schedule. Adjustment of all valves, for proper control of closing speed, latching speed, delayed action, backcheck, and spring power adjustments, shall be the responsibility of the installing contractor as set forth in Part III Execution.

G. Where top rail of door is insufficient in height to mount the closer directly to the rail, drop brackets shall be provided.

2.6 FLUSH BOLTS

A. Extension flush bolts shall have forged bronze face plate with extruded brass lever and with wrought brass guide and strike. Rods for flush bolts shall be 12 inch steel or brass for doors up to 7'-6" in height. Where doors are over 7'-6" in height the flush bolt rod length shall be increased in increments of six (6) inch for each six (6) inch of additional door height. Plate size shall be 6 3/4 inch x one (1) inch to meet ANSI A115 and SDI specifications. Bolt projection shall be 5/8 inch.

B. Floor strikes for flush bolts shall be dustproof type cast or extruded bronze with cast bronze floor plate minimum 3-1/2 inch x 1-5/8 inch with masonry anchors for concrete floors. Provide a dustproof strike, for sill application, for all bottom flush bolts for all pairs of doors.

C. The following products will be acceptable:

Ives	- 458
Glynn Johnson	- FB6
Door Controls	- 780

Rockwood - 555

2.7 THRESHOLD AND WEATHER STRIPPING

A. All exterior doors shall have, at a minimum, threshold, weather stripping, and door bottoms.
B. Provide an extruded aluminum threshold by full width of door opening. Anchor thresholds with no less than four (4) machine screw anchors for 3'0" lengths. Provide nonferrous solid brass or stainless steel screws.
C. Extruded aluminum saddle thresholds shall have factory installed vinyl foot seals, Model 425E, as manufactured by National Guard Products or equal.
D. For all exterior hollow metal doors and where indicated, provide an extruded aluminum perimeter seal with neoprene gasketing material (weather-stripping) for head and jambs. The neoprene seals shall be an airfoil design to permit full and positive closure between door and jamb. The continuous aluminum brackets shall be applied on the stop with stainless steel sheet metal screws at the corner of the rabbet located so as to provide full closure at the head and jamb perimeters. Where the door comes in contact with the frame, the maximum projection for the continuous aluminum weather stripping brackets shall be no more than 1/4 inch.
E. Astragal weather-stripping shall be an overlapping aluminum astragal with silicone bulb. Model 178S by NGP or model 355S by Pemko or equal.
F. Weather stripping (gasketing material) shall be classified by Underwriters Laboratories for application on fire door frames, for openings rated up to 3 hours.
G. The finish for the exposed continuous aluminum weather stripping brackets, shall be natural anodized aluminum finish.
H. Provide a door bottom at all doors indicated to have weather stripping.
I. The door bottom seal shall be concealed in the bottom of the door and shall be a flexible synthetic vinyl that will not take a formal set, nor break or flake in cold weather. The door bottom seal shall extend the full width of the door and shall also extend below the door bottom and compress against the top of the threshold, for complete closure. The door bottom seal shall be fastened to the recessed channel with 3 or 4 screws through the seal or the seal chassis.
J. Concealed door bottoms must be installed before the door is in place.

2.8 FINISH

A. With the exceptions of door closers, plates, coordinators, thresholds and weather stripping, all hardware items shall be furnished in satin stainless steel finish 32D.
B. Exceptions are as follows:

Door Closers:	Sprayed Aluminum
Thresholds:	Natural Anodized Aluminum
Weather stripping:	Natural Anodized Aluminum

PART 3 - EXECUTION

3.1 INSPECTION

A. It shall be the General Contractor's responsibility to inspect all door openings and doors to determine that each door and door frame has been properly prepared for the required hardware. If errors in dimensions or preparation are encountered, they are to be corrected by the responsible parties prior to the installation of hardware.

3.2 PREPARATION

A. All doors and frames, requiring field preparation for finish hardware shall be carefully mortised, drilled for pilot holes, or tapped for machine screws for all items of finish hardware in accordance with the manufacturer's templates and instructions.

3.3 INSTALLATION

A. All materials shall be installed in a workmanlike manner following the manufacturer's recommended instructions.
B. Exit devices shall be carefully installed so as to permit friction free operation of crossbar, touch bar, thumb latch, lever or knob. Latching mechanism shall also operate freely without friction or binding.
C. Door closers shall be installed in accordance with the manufacturer's instructions. Each door closer shall be carefully installed, on each door, at the degree of opening indicated on the hardware schedule. Arm position shall be as shown on the instruction sheets and required by the finish hardware schedule.
D. Installation of all other hardware, including locksets, push-pull latches, overhead holders, door stops, plates and other items, shall be carefully coordinated with the hardware schedule and the manufacturer's instruction sheets.
E. Locations for finish hardware shall be in accordance with dimensions listed in the pamphlet "Recommended locations for Builders' Hardware" published by the Door and Hardware Institute.

3.4 FIELD QUALITY CONTROL

A. Upon completion of the installation of the finish hardware, it shall be the responsibility of the finish hardware supplier to visit the project and to examine the hardware for each door on which he has provided hardware and to verify that all hardware is in proper working order. Should he find items of hardware not operating properly, he should make a report, in writing, to the general contractor, advising him of the problem and the measures required to correct the problem.

3.5 ADJUSTING

A. The adjustments for all door closers shall be the contractor's responsibility and these adjustments shall be made at the time of installation of the door closer. The closing speed and latching speed valves, shall be adjusted individually to provide a smooth, continuous closing action without slamming. The delayed action feature or back check valve shall also be adjusted so as to permit the corrected delayed action cycle

or hydraulic back check cushioning of the door in the opening cycle. All valves must be properly adjusted at the time of installation.

B. Each door closer has adjustable spring power capable of being adjusted, in the field, from size 2 through 6. It shall be the contractors responsibility to adjust the spring power for each door closer in exact accordance with the spring power adjustment chart illustrated in the door closer installation sheet packed with each door closer.

3.6 CLEANING

A. It shall be the responsibility of the general contractor to clean all items of finish hardware and to remove any remaining pieces of protective materials and labels.

3.7 PROTECTION

A. All exposed portions of finish hardware shall be carefully protected, by use of cloth, adhesive backed paper or other materials, immediately after installation of the hardware item on the door. The finish shall remain protected until completion of the project. Prior to acceptance of the project by the engineer and owner, the general contractor shall remove the protective material exposing the hardware finish.

3.8 INSTRUCTIONS AND TOOLS

A. It shall be the responsibility of the finish hardware supplier to provide installation and repair manuals and adjusting tools, wrenches, etc...for the following operating products:
   1. Exit devices (all types)
   2. Door closers

3.9 HARDWARE SET NUMBERS

A. The Hardware Sets listed below indicate the items of hardware required for each opening. It is the bidders responsibility to accurately furnish the proper quantities, items, sizes, weights and functions as required by the plans and this specification. If an opening has, through error, been omitted from the following hardware set numbers listings, it shall be the bidders responsibility to supply hardware of equivalent quality and quantity, as that which is specified for a comparable opening.

Single Leaf Exterior Door
Each leaf shall have:
Hinges, Exit Device R-3, Closer with Cush-n-Stop/Hold Open Function, Weather-stripping, Threshold.

Double Leaf Exterior Door
Each leaf shall have:
Hinges, Closer with Cush-n-Stop/Hold Open Function, Kickplate, Weather-stripping, Threshold.

Active Leaf: Exit Device R-3, Astragal Weather-stripping.
Inactive Leaf: Flush Bolts.

END OF SECTION

SECTION 09900

PAINTING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Examine the various SECTIONS of the SPECIFICATIONS and be thoroughly familiar with all provisions regarding painting and finishing work included therein.
B. Apply specified finish coats of paint to all preprimed surfaces and complete finishing system to unprimed items.
C. Paint all existing items as noted in this Specification and as indicated on the Drawings.
D. Backprime, with specified interior first coat, all surfaces of wood finish and trim which will be concealed after installation.
E. Paint all ferrous metals on the building exteriors.
F. Apply paint on finish surfaces to the extent specified herein and indicated on the Drawings.

1.2 RELATED SECTIONS

A. Section 01340 - Submittals
B. Section 03300 - Cast-in-Place Concrete
C. Section 04200 - Unit Masonry
D. Section 06100 - Rough Carpentry
E. Section 07900 - Joint Sealers
F. Section 08110 - Steel Doors and Frames
G. Section 09905 - Surface Preparation and Shop Coatings
H. Division 16 - Electrical

1.3 PREFINISHED ITEMS NOT REQUIRING PAINT OR FINISH

A. Items and equipment that are specifically specified to receive the manufacturer's standard primer and finish coats in the factory, except as noted for color and for touch-up painting.
B. Copper, bronze, brass, chromium plate, nickel, stainless steel, aluminum or monel metals (unless otherwise noted).
C. Concrete slabs and foot traffic surfaces.
D. Parking lines on bituminous concrete specified under Section 02513.

1.4 REFERENCES

A. ASTM D2247 - Practice for Testing Water Resistance of Coatings in 100 Percent Relative Humidity.
B. ASTM D 2794 - Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
C. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
D. D ASTM D6386 - Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Products for Painting

E. Federal Test Method No. 141 - Method 6141, Stain Removal.
F. SSPC - Steel Structures Painting Council.
G. SSPC-PA1, “Standard for Shop, Field, and Maintenance Painting.”
H. SSPC-PA2, “Measurement of Dry Paint Thickness with Magnetic Gauges.”
I. SSPC-SP1, “Solvent Cleaning.”
J. SSPC-SP2, “Hand Tool Cleaning.”
K. SSPC-SP3, “Power Tool Cleaning.”
L. SSPC-SP6, “Commercial Blast Cleaning.”
M. SSPC-SP7, "Brush Off Blast."
N. SSPC-SP10, “Near-White Blast Cleaning.”
O. SSPC-SP16, "Brush Blast Cleaning of Non Ferrous Metals"
P. SSPC-PA Guide 3, Standard “A Guide to Safety in Paint Application,” latest revision.
Q. VOC Standards - All coatings shall be in accordance with all applicable State and Federal VOC Standards.
   1. OSHA 29 CFR 1925.55 Gases, Vapors, Fumes, Dusts and Mists.
   2. Ozone Transportation Commission (OTC) 2005 VOC Regulation.
R. OSHA 29 CFR 1926.62 Lead.
S. SSPC - Guide 61 (COH) Guide for Containing Debris Generated during Paint Removal Operations.
T. SSPC - Guide 71 (DIS) Guide for Disposal of Lead-Contaminated Surface Preparation Debris.
U. SSPC Publication 91-18 Industrial Lead Paint Removal Handbook.
V. USEPA 40 CFR Part 261 Identification and Listing of Hazardous Waste.
W. USEPA 40 CFR Part 262 Standards Applicable to Generators of Hazardous Waste.
X. USEPA 40 CFR Part 263 Standards Applicable to Transporters of Hazardous Waste.
Y. USEPA 40 CFR Part 268 Land Disposal Restrictions.
Z. USDOT 49 CFR Parts 173, 178 and 179.

1.5 SUBMITTALS

A. Submit product data under provisions of Section 01340 including tested performance characteristics.
B. Submit a minimum of three (3) color charts for color selection by Engineer.
C. Submit schedule on manufactures letter head with list of items to be coated, type and manufacturer of shop coating and type of field coating, including primers, details on surface preparation methods, application procedures and dry mil thickness.
D. Color scheme shall be in accordance with schedules provided by the Engineer, and all tinting and matching shall be to the satisfaction of the Engineer.
E. Submit coating manufacturer’s certification that proposed field coatings are compatible with shop coatings.
F. Submit coating manufacturer’s certification that the proposed coatings meet all state and federal VOC regulations.

1.6 QUALITY ASSURANCE

A. All materials used on work shall be exactly as specified in brand and quality. No

claim by the Contractor as to unsuitability or unavailability of any material specified, or his unwillingness to use same, or his inability to produce first class work with same, will be entertained unless such claims are made in writing and submitted to the Engineer at least seven (7) days prior to the date established for receipt of General Bids.

B. Before purchasing materials for the work, the Contractor shall submit to the Engineer a list of the products he proposes to use, and the list shall be reviewed by the Engineer and no exceptions taken and reviewed by him before commitment for materials is made.

C. Materials selected for coating systems for each type of surface shall be the products of a single manufacturer.

D. Include on label of all containers:
   1. Manufacturer's name
   2. Type of paint
   3. Manufacturer's stock number
   4. Color
   5. Instructions for reducing, where applicable
   6. Label analysis
   7. Shelf life dates

E. Field Quality Control:
   1. Contractor shall request review by the Engineer, of first finished room, space or item of each color, texture and method of applications, prior to proceeding with additional painting.
   2. Use first acceptable room, space or item as the project standard for each color scheme.
   3. For spray application, when applicable, paint a surface not smaller than 100 square feet as the project standard.
   4. Repainting of materials failing to meet the requirements of the Specifications or Drawings, shall be performed by the Contractor, at no additional cost to the Owner.
   5. The number of coats and total mil thickness specified in the paint schedule are minimums. If the specified minimum film thickness is not achieved, additional coats shall be applied to achieve the total film thickness specified.

F. Paints submitted shall meet all Federal and State regulations pertaining to Volatile Organic Compounds (VOC) compliance, and be in accordance with OTC 2005 Standards.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver coating materials in sealed containers with labels legible and intact.

B. Store only acceptable project materials on the project site.

C. All painting materials shall be stored and mixed in a single location coordinated with the Engineer. The Contractor shall not use any plumbing fixture or pipe for mixing or for disposal of any refuse. The Contractor shall carry all necessary water to the mixing room, and shall dispose of all waste outside of the building in a suitable receptacle.

D. Restrict storage location to paint materials and related equipment and supplies.

E. Keep storage location neat and clean.

F. Remove all soiled and used rags, waste and trash from the storage location and building at the end of each work day.
G. Repair all damage to the storage location, caused by painting materials and equipment at no additional cost to the Owner.
H. Comply with all applicable health and fire codes and regulations including safety precautions recommended by the manufacturer. Storage space shall be provided with a suitable fire extinguisher fully charged at all times.
I. Heat shall be provided in the storage area if paints are to be stored during winter months. The temperature shall be maintained above 40 degrees F at all times.

1.8 ENVIRONMENTAL REQUIREMENTS
A. Comply with manufacturer's recommendations as to environmental conditions under which coatings and coating systems shall be applied.
B. Do not apply coatings in areas where dust is being generated.
C. Do not apply coatings when the air or material surface temperature is below 50 degrees Fahrenheit and unless the temperature is at least 5 degrees Fahrenheit above the dew point.
D. Do not apply exterior coatings in frosty, damp or rainy weather or while surfaces are exposed to hot sunlight.

1.9 EXTRA MATERIALS
A. For all materials with a shelf life of greater than 12 months, provide one gallon of each type and each color of touch-up paint shall be provided to the Owner by the Contractor in unopened containers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS (PAINT)
A. Sherwin Williams
B. Tnemec Company, Inc.
C. AkzoNobel

2.2 MATERIALS
A. Refer to the paint schedule for specific products and application.

2.3 COMPONENTS
A. All finish coats shall be compatible with shop prime coats.
B. Turpentine shall be pure spirits of turpentine.
C. Shellac shall be four pounds and shall meet the U.S. Government specifications as issued by the Bureau of Commerce.

2.4 MIXING AND TINTING
A. Deliver paints and enamels ready-mixed to project site.
B. Accomplish job mixing and job tinting only when required and no exceptions taken by the Engineer.
C. Mix only in mixing pails placed in suitably sized nonferrous or oxide resistant

metal pans.

D. Use only tinting colors recommended by the manufacturer for the specific type of finish.

E. Fungicidal agents, when applicable, shall be incorporated into the paints and stains by the manufacturer.

F. Mix and prepare paints in strict accordance with Manufacturers recommendations.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine surfaces scheduled to receive paint and finishes for conditions that will adversely affect execution, permanence or quality of work and which cannot be put into an acceptable condition through preparatory work as included in Part 3.2, Surface Preparation.

B. Immediately notify the Engineer in writing when a surface to be finished cannot be put into an acceptable condition.

C. Do not proceed with surface preparation or coating application until conditions are suitable.

D. The Contractor shall be responsible for and shall rectify, at no additional cost to the Owner any unsatisfactory finish resulting from the application of coatings on surfaces not in acceptable condition.

3.2 SURFACE PREPARATION

A. Wood and Plywood to be Painted:

1. Clean soiled surfaces.
2. Except when rough surface is specified, sand to smooth and even surface, then dust off.
3. Apply shellac to all knots, pitch and resinous sapwood after washing with mineral spirits and, before priming coat is applied.
4. Fill nail holes, cracks, open joints and other defects with paste wood filler before priming coat surface and color to match finish color.

B. Masonry:

1. Clean all dust, dirt, oil and efflorescence from surfaces.
2. Fill cracks and irregularities with Portland cement grout to provide uniform surface texture.
3. Fill concrete masonry unit surfaces with block filler in sufficient thickness to produce a final result which shall fill all voids and pin holes.
4. Allow surfaces to thoroughly dry prior to application of first coat.

C. Ferrous Metal Surfaces (Items not shop primed):

1. All ferrous metals shall be sandblast cleaned in accordance to SSPC-SP6 immediately prior to priming.
2. Remove dirt, oil and grease by washing surfaces with mineral spirits.
3. Surfaces shall be dry and free of dust, oil, grease and other foreign material before priming.
5. Feather edges of sound existing paint by grinding, if necessary.
6. Clean and touch up weathered, worn or damaged shop coats of paint with the specified primer.

7. Restore shop coats of paint with identical materials if removed for welding and fabrication.

D. Galvanized Metal (Indicated to be painted):
1. Solvent clean in accordance with ASTM D6386.
2. Surfaces shall receive SSPC-SP-16 and shall be surfaced prepared in accordance with ASTM D6386.
3. Surfaces shall be dry and free of dust, oil, grease and other foreign material before priming.
4. Restore shop coats of paint with identical materials if removed for welding and fabrication.

E. Previously Coated Surfaces (including existing items and new items that are shop primed):
1. The areas of the coated surface that are blistered, eroded, brittle or otherwise failed shall be completely removed before beginning the specified surface preparation.
2. The areas where the existing coating is intact shall be sanded to dull the finish.
3. Before applying the new coating over an existing coating, a test section must be done to ensure compatibility of the new and old coatings.
4. All other existing coatings shall be prepared as recommended by the manufacturer and as specified in this section.
5. Ferrous metals arriving at the job site with shop primers other than the polyamide epoxy or rust inhibitive primers specified shall be provided with an intermediate coat as necessary for compatibility with specified topcoats.
6. Special attention shall be paid to the potential for epoxy shop and intermediate coats to chalk upon exposure to sunlight. The Contractor shall follow the manufacturer's required surface protection/covering and surface preparation recommendations before any intermediate or top coats can be applied over chalked surface. Epoxy primers and intermediate coats shall be top coated no later than 45 days after the application of the epoxy coating. If topcoats are to be applied later than 45 days, the following surface preparation shall be provided:
   a. The existing finish shall be etched by sanding with 80 grit paper or cloth.
   b. Surfaces shall be pressure washed with 3000 to 5000 pounds of pressure.
   c. The Engineer, at his discretion, can require the Contractor to conduct adhesion tests of the topcoats.

3.3 APPLICATION

A. Workmanship:
1. Employ skilled workmen to insure workmanship of the highest quality.
2. Materials shall be applied only by craftsmen experienced in the use of the specific products involved.

B. General Requirements:
1. Apply all coatings under adequate illumination.
2. Perform no work in the rain, dew, or fog, when the temperature is below 50 degrees Fahrenheit and at least 5 degrees Fahrenheit above the dew point, or

before the other coats have thoroughly dried.

3. Do not apply coatings until the material surfaces are thoroughly dry.
4. Apply paints and varnishes with suitable brushes, rollers or spraying equipment.
   a. The rate of application shall not exceed that as recommended by the paint manufacturer for the surface involved.
   b. Keep brushes, rollers and spraying equipment clean, dry and free from contaminates and suitable for the finish required.
   c. Apply stain by brush. Cover surfaces with a uniform coat and wipe off if required.
   d. Make each coat a different tint from that of the preceding coat, with final coat tinted to the exact shade selected by the Engineer. Lightly sand surfaces between each coat of gloss and semi-gloss finishes, and wipe clean.
5. Comply with the recommendation of the product manufacturer for drying time between succeeding coats. Contractor shall follow the manufacturer's specific curing requirements for rust inhibitive primer shop coats prior to allowing topcoating.
6. Sand and dust between each coat to remove defects visible from a distance of five feet.
7. Finish coats shall be smooth, free of brush marks, streaks, laps or pile up of paints and skipped or missed areas.
8. Inspection:
   a. Do not apply additional coats until the completed coat has been inspected by the Engineer.
   b. Only inspected and reviewed coats will be considered in determining the number of coats applied.
9. Leave all parts of moldings and ornaments clean and true to details with no undue amount of paint in corners and depressions.
10. Make edges of paint adjoining other materials or colors clean and sharp with no overlapping.
11. Refinish entire wall where portion of finish has been damaged or is not acceptable.
12. Back prime all wood trim.
13. Runs on face are not permitted.

3.4 PROTECTION

A. Furnish and lay drop cloths in all rooms and areas where painting and finishing is being done to adequately protect flooring and other work from damage during the prosecution of the painting work.

B. Remove all canopies of lighting fixtures, all electric switch plates, and similar equipment, set them carefully away, and cover adequately, protect the fixtures, etc.; replace the canopies, plate, etc. in as good condition as when found.

C. Do not paint over any code-required labels, such as Underwriter's Laboratories and Factory Mutual, or any equipment identification, performance rating, name, or nomenclature plates.

3.5 CLEANING

A. At the completion of the work of this Section, remove all paint spots and oil or grease stains, caused by this work from floors, walls, fixtures, hardware and equipment, leaving their finishes in a satisfactory condition. Remove all materials and debris and leave the site of the work in a clean condition so far as this work is concerned.

3.6 FINAL INSPECTION

A. Protect all painted and finished surfaces against damage until the date of final acceptance of the work. The Engineer will conduct a final inspection of all painters' work. As part of the final inspection the Contractor shall demonstrate compliance with the specified film thickness with appropriate paint gauges. The Contractor shall be required to repaint, refinish, or retouch any areas found which do not comply with the requirements of this Section.

3.7 PAINT SCHEDULE

A. General: Existing Facility
   1. Paint and finish all new piping, equipment and other items installed, modified or relocated in the existing facility.
   2. Correct and refinish all interior and exterior surfaces in the existing facility affected by the new work. Materials and their application shall be as required to most closely match the existing finishes and as specified in this Section.
   3. Refinish additional existing items on the existing facility as noted on the Drawings and in this Specification.
   4. Finish all new items and components installed or constructed in the existing facilities.

B. Schedule: The following product model and coatings system numbers are listed below to establish the standard of quality. Equivalent products from other manufactures will be accepted provided they meet or exceed the performance of the listed products.

SURFACE/ITEM	SURFACE PREPARATION	PRIMER	INTERMEDIATE	FINISH
MASONRY & CONCRETE				
Masonry Surfaces	Clean & Dry	SW Heavy Duty Block Filler	SW DTM Acrylic Coating at 3 to 4 mils	SW DTM Acrylic Coating at 3 to 4 mils
METALS				
Galvanized steel Indicated to be painted	ASTM D6386 Solvent Cleaning Followed by SSPC-SP16	SW Macropoxy 646 at 3 to 5 mils	SW Macropoxy 646 at 3 to 5 mils	SW Acrolon 218 HS Acrylic Polyurethane

SURFACE/ITEM	SURFACE PREPARATION	PRIMER	INTERMEDIATE	FINISH
Ferrous Metals	SSPC-SP6	SW Macropoxy 646 at 3 to 5 mils	SW Macropoxy 646 at 3 to 5 mils	SW Acrolon 218 HS Acrylic Polyurethane
Exposed electrical conduit, conduit fittings and outlet boxes	Not Painted			
WOOD & CARPENTRY				
Interior Plywood and Wood Trim		SW PrepRite 200 Latex Primer at 1.0 to 2.5 mils	SW DTM Acrylic Coating at 3 to 4 mils	SW DTM Acrylic Coating at 3 to 4 mils

NOTES:

1. Surface preparation shall be as specified within this section and as noted in the table above.
2. All dry film thickness indicated are the minimum required.
3. All ferrous in contact with concrete or masonry shall receive a POLYAMIDE epoxy primer with a minimum dry film thickness of 4 mils applied to the contact area.
4. If the polyurethane top coats are not compatible with the manufacturer's alkyd primer apply a polyamide epoxy as the intermediate coat.
5. Epoxy primers and intermediate coats that have been in place for more than 45 days shall be prepared as indicated under the "Surface Preparation" Section of this Specification.

END OF SECTION

SECTION 13081

SEISMIC RESTRAINT REQUIREMENTS FOR NONSTRUCTURAL COMPONENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Seismic restraint requirements for Electrical components

1.2 RELATED SECTIONS

A. Section 01340 - Submittals
B. Section 01400 - Quality Control
C. Section 03300 - Cast-In-Place Concrete
D. Section 05500 - Metal Fabrications
E. Section 16010 - Electrical - General

1.3 REFERENCES

A.	ACI 318-08	Building Code Requirements for Structural Concrete and Commentary
B.	ACI 350-06	Code Requirements for Environmental Engineering Concrete Structures and Commentary
C.	ASTM A36/A36M-08	Specification for Carbon Structural Steel
D.	ASTM A53/A53M-10	Specification for Pipe, Steel, Black and Hot-Dipped Zinc-Coated Welded and Seamless
E.	ASTM A123/A123M-09	Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron & Steel Products
F.	ASTM A153/A153M-09	Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
G.	ASTM A193/A193M-11a	Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature Service
H.	ASTM A276-10	Specification for Stainless Steel Bars and Shapes
I.	ASTM A307-10	Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
J.	ASTM A325-10	Specification for Structural Bolts, Steel, Heat Treated 120/105 KSI minimum Tensile Strength
K.	ASTM A490-11	Specifications for Heat-Treated Steel Structural Bolts, 150KSI Minimum Tensile Strength
L.	ASTM A500/A500M-10a	Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
M.	ASTM A563-07a	Specification for Carbon and Alloy Steel Nuts
N.	ASTM A572/A572M-07	Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
O.	ASTM A603-98 (2009) e1	Specification for Zinc-Coated Steel Structural Wire Rope
P.	ASTMA653/A653M-11	Specification for Steel Sheet, Zinc-Coated

		(Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
Q.	ASTM A992/A992M-11	Specification for Steel for Structural Shapes for Use in Building Framing
R.	ASTM A1011/A1011M-10	Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low Alloy, and High Strength Low Alloy with Improved Formability
S.	ASTM B209-10	Specification for Aluminum and Aluminum - Alloy Sheet & Plate
T.	ASTM B221-08	Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wires, Profiles and Tubes
U.	ASTM B308/B308M-10	Specification for Aluminum-Alloy 6061-T6 Standard Structural Shapes, Rolled or Extruded
V.	ASTM B429/B429M-10e1	Specification for Aluminum-Alloy Extruded Structural Pipe and Tube
W.	ASTM C881 / C881M - 10	Specification for Epoxy-Resin-Base Bonding Systems for Concrete
X.	ASTM F436-11	Specification for Hardened Steel Washers
Y.	ASTM F593-02 (2008) e1	Specification for Stainless Steel Bolts, Hex Cap Screws and Studs
Z.	ASTM F594-09e1	Specification for Stainless Steel Nuts
AA.	ASTM F1554-07ae1	Specification for Anchor Bolts, Steel 36, 55 and 105 KSI Yield Strength
BB.	AWS D1.1/D1.1M-2010	Structural Welding Code - Steel - American Welding Society
CC.	AWS D1.2/D1.2M-2008	Structural Welding Code – Aluminum - American Welding Society
DD.	AWS D1.6-1999	Structural Welding Code – Stainless Steel - American Welding Society
EE.	ASCE 7-10	American Society of Civil Engineers Minimum Design Loads for Building and Other Structures
FF.	Aluminum Association	Aluminum Design Manual (2010)
GG.	Aluminum Association	Aluminum Standards And Data (2009)
HH.	American Institute of Steel Construction (AISC)	Manual of Steel Construction (13th Edition)
II.	Steel Construction Institute	Design Manual for Structural Stainless Steel (3rd Edition)
JJ.	Sheet Metal & Air Conditioning Contractors' National Association (SMACNA)	Seismic Restraint Manual Guidelines for Mechanical Systems (3rd Edition)

KK. International Building Code (2009)

1.4 QUALITY ASSURANCE

A. Perform work in accordance with all appropriate references.

B. The specific requirements of this specification shall be in addition to those requirements of all referenced documents and will supersede less stringent requirements.

1.5 SYSTEM REQUIREMENTS

A. The requirements for seismic restraint described in this Section shall be applied to all specified Electrical components. The requirements of this Specification pertains to the support and bracing of individual components to fixed structures in order to maintain stability and functionality of the components during a seismic event. This Specification does not pertain to the support of the internal parts of a component (such as the internal controls of an electrical control panel) or support of gravity loads. Those requirements are covered within the individual Specification Sections.

B. The seismic restraint systems specified herein shall provide resistance to lateral forces induced by a seismic event. The seismic induced design lateral forces are in addition to the gravity forces acting on the specified components. General Contactor shall coordinate the location and layout of the seismic restraint bracing system with that of the gravity support system.

C. Seismic restraint shall consist of the following:
   1. Floor or platform mounted equipment - Anchorage to the floor or platform structure
   2. Wall mounted equipment - Anchorage to the wall or an isolated support structure

D. The requirements for seismic protection shall apply to the following components:

   1. Electrical: All electrical components and appurtenances listed below as specified in Division 16
      a. Control panels
      b. Motor control centers
      c. Switchboards and Switchgear
      d. Transformers

1.6 SUBMITTALS

A. Submit complete seismic restraint calculations and complete layout drawings and details stamped by a Professional Structural Engineer registered in the State of New Hampshire experienced in the analysis and design of seismic restraints (hereafter referred to as Seismic Restraint Engineer).

B. Calculations shall include but not be limited to the following:
   1. Size, type and material of braces and supports.
   2. Concrete anchor type (anchor bolt or epoxy anchor) including embedment depth, assumed concrete compressive strength, spacing between anchors and distances of anchors from concrete edges.
   3. Allowable and applied stresses for all components.
   4. Structural calculations verifying that existing structures are structurally adequate to be used as support for bracing.
   5. Computer software generated calculations will be permitted.

C. Layout drawings shall show the location and extent of all seismic restraint systems including but not limited to the following:
   1. Equipment:
      a. Description, layout, and location of equipment to be anchored or braced with anchorage or brace points noted and dimensioned.
      b. Details of anchorage or bracing with all members, connections, bolts, welds etc. clearly identified and specified.
      c. Numerical value of design seismic brace loads.

D. Submit letter from the General Contractor stating that the following has been coordinated:
   1. Each seismic restraint system will not interfere with other seismic restraint or gravity support systems.
   2. Components from the seismic restraint systems shall not extend within a building means of egress.
   3. Components from the seismic restraint systems shall not interfere with the normal maintenance or operation of a component or equipment.
   4. All existing structures that will be used to support the bracing have been analyzed and verified to be structurally adequate to support the additional load from the bracing.

1.7 DESIGN

A. Seismic analysis and design shall utilize lateral forces derived in accordance with Chapter 13 of ASCE 7

B. Calculate the seismic forces (Fp) using equations and coefficients from ASCE 7 . Seismic coefficients shall be as follows:
   1. Seismic Design Category *C*.
   2. Importance Factors (I_p) shall be:
      a. All other components of which seismic restraint is required: $I_p = 1.0$
   3. Other pertinent seismic criteria shall be as indicated on the Structural Drawings

C. The analysis and design of seismic restraint systems shall be based on actual equipment data (dimensions, weight, center of gravity) obtained from submittals reviewed with no exceptions taken by the Engineer. Resisting friction forces developed form gravity loads between the equipment and substructure shall not be considered in the design.

D. The seismic restraint design shall clearly indicate the attachment points to the building structure and all design forces (in X, Y, and Z direction) at the attachment points. The Seismic Restraint Engineer shall coordinate all attachments with the Structural Engineer of Record and also shall confirm that the structure that will support the bracing has adequate structural capacity for the additional load from the bracing. The Structural Engineer of Record shall review all attachment points to existing structures and determine whether the existing structures may be used to support the bracing. If the existing structure is not suitable to support the bracing, the Seismic Restraint Engineer shall use another structure for support, introduce new support structures or reinforce the existing structure.

E. Seismic bracing and components shall not extend within any means of egress or any areas that will interfere with the operation or maintenance of the equipment.

F. General Contractor shall coordinate the location and arrangements of all seismic restraint systems to eliminate interference between all seismic and gravity support systems for Electrical Components.

1.8 COMPONENT CERTIFICATION

A. Mechanical and electrical equipment within a Seismic Design Category C through F must remain operable following a seismic event and shall demonstrate operability by shake table testing or experience data in accordance with Section 13.2.2 of ASCE 7. Submit manufacturer's certificate of compliance indicating the equipment meets the requirements of this specification and will remain operable following a seismic event.

PART 2 - MATERIALS

2.1 STEEL SUPPORTS AND BRACES

A. Materials:
   1. Structural beams ("W" shapes): ASTM A992
   2. Structural angles and channels ("L", "C" and "MC" shapes): ASTM A36 or ASTM A992
   3. Structural tubing ("HSS" shapes): ASTM A500 Grade B
   4. Plates - ASTM A36 or ASTM A572
   5. Rods - ASTM A193 Grade B7
   6. Cable - Galvanized steel aircraft type cable wire rope (ASTM A603) or Type 316 stainless steel wire rope
   7. Light Gage members - ASTM A653

B. Minimum bracing member sizes: All members shall be the following minimum sizes regardless of those required by design.
   1. Beams - W4x13
   2. Angles - L2x2x1/4
   3. Channels - C4x4.5 or MC4x13.8
   4. Plates - ¼ inch thick
   5. Rods - ½ inch diameter
   6. Cable - ¼ inch diameter
   7. Light Gage - 16 gage

C. Welding:
   1. All welding shall be in accordance with AWS D1.1.
   2. E70XX electrodes.
   3. Minimum 3/16 inch fillet welds

D. Finish: Galvanized ASTM A123.

E. All structural steel bracing shall be designed in accordance with the AISC Manual of Steel Construction.

2.2 ALUMINUM SUPPORTS AND BRACES

A. Material:
   1. Structural shapes: Aluminum Alloy 6061-T6: ASTM B308.
   2. Cable - Type 316 stainless steel wire rope

B. Minimum sizes:

1. Beams - W4x2.64
2. Channels - C4x1.85
3. Angles - L2x2x1/4
4. Plates - ¼ inch thick
5. Rods - ½ inch diameter
6. Cable - ¼ inch diameter

C. Welding:
1. All welding shall be in accordance with AWS D1.2.
2. Filler alloy 5356.
3. Minimum 3/16 inch fillet welds.

D. Finish: Mill.

E. All aluminum bracing shall be designed in accordance with the Aluminum Association Design Manual.

2.3 STAINLESS STEEL SUPPORTS AND BRACES

A. Material:
1. Structural shapes: Type 316 stainless steel: ASTM A276.
2. Cable - Type 316 stainless steel wire rope.

B. Minimum sizes:
1. Beams - W4x13
2. Channels - C4x5.4
3. Angles - L2x2x1/4
4. Plates - ¼ inch thick
5. Rods - ½ inch diameter
6. Cable - ¼ inch diameter

C. Welding:
1. All welding shall be in accordance with AWS D1.6.
2. 316L-XX electrodes.
3. Minimum 3/16 inch fillet welds.

D. Finish: Mill.

E. All aluminum bracing shall be designed in accordance with the Design Manual for Structural Stainless Steel.

2.3 PREFABRICATED PIPE HANGERS, CLAMPS AND SUPPORTS

A. Prefabricated pipe hangers, clamps and supports shall be as specified in Section 15094 "Pipe Hangers and Supports"

2.3 FASTENERS

A. Concrete anchorage:
1. Epoxy Anchors. ASTM C881. Non-expanding two component epoxy resin with AISC Type 316 Stainless Steel threaded rod with washer and nut. Provide a minimum 1/2" diameter anchor with a minimum concrete spacing and embedment of 6 inches.
   a. HIT RE500SD by Hilti Fastening Systems
   b. Chemset Capsule Series by Ramset Fastening Systems
   c. AC100 Plus by Powers Fasteners
   d. Or equivalent.

2. Expansion Anchors - Stainless steel AISI Type 316 for galvanized and aluminum fabrications; cadmium plated for painted steel fabrications. Provide a minimum 1/2" diameter anchor with a minimum concrete spacing and embedment of 6 inches.
   a. Kwik-Bolt III by Hilti Fastening Systems or
   b. Tru Bolt Stud Anchor by Ramset Fastening System
   c. Power Stud by Powers Fasteners
   d. Or equivalent.
3. Anchor Rods
   a. Material: ASTM F1554 Grade 55
   b. Finish: Hot-Dipped Galvanized ASTM A153
   c. Provide a minimum 1/2" diameter rod with a minimum concrete embedment of 12 inches.
4. All concrete anchors shall be anchored to a structural concrete member.
5. Epoxy or Expansion Anchors shall not be used in overhead pullout applications without prior review with no exceptions taken by the Structural Engineer of Record.

B. Bolted Joints:
   1. Aluminum and Stainless Steel Fabrications:
      a. Bolts, Nuts and Washers: Stainless Steel ASTM F593 & F594 Alloy Group 2 (Type 316)
   2. Steel Fabrications:
   a. Bolts: ASTM A325. Coating: Hot-Dipped Galvanized: ASTM A153.
   b. Nuts: ASTM A563. Coating: Hot-Dipped Galvanized: ASTM A123.
   c. Washers: ASTM F436. Coating: Hot-Dipped Galvanized: ASTM A153.

C. Provide all fasteners with nuts, flat washers and lock washers of the same material as the anchors or bolts. Provide beveled washers for sloped surfaces.

D. Provide a minimum of 2 fasteners per connection.

PART 3 - EXECUTION

3.1 GENERAL

A. Provide seismic bracing and anchorages in conformance with recommendations of the equipment manufacturer and as shown on shop drawings and calculations reviewed with no exceptions taken by the Engineer.

B. Provide either a coat of epoxy paint or a non-conductive barrier between dissimilar metals

C. Bracing for individual components shall not be attached to two separate or dissimilar structural supports of a building that may behave differently during a seismic event or during expansion/contraction.

END OF SECTION

SECTION 13441

CONTROL NARRATIVES

PART 1 - GENERAL

1.1 SUMMARY

A. The work of this section includes modification to the existing SCADA system database and process control network to display power monitoring functions as listed below.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.1 CONTROL DESCRIPTIONS

A. The new circuit breakers will be provided with Ethernet communication adapters and connected into the existing process control network at the facility (refer to Section 16406).

B. Provide integration services to modify the existing GE iFIX tag database to include the power monitoring functions for each breaker (a total of 276 functions) as listed in Table 1A and Table 1B below. Provide a numeric listing with units of measure for each function on new Power Monitoring Screen(s) at the existing SCADA HMI.

Table 1A: Electronic Power Measurement Data Requirements

Switchboard	Circuit Breakers	Required Data per Circuit Breaker
GEN	Main Generator Camlock Connector	• Phase A Voltage L-N (VAC) • Phase B Voltage L-N (VAC) • Phase C Voltage L-N(VAC) • Phase A Current (A) • Phase B Current (A) • Phase C Current (A) • Neutral Current (A) • Real Power Phase A (kW) • Real Power Phase B (kW) • Real Power Phase C (kW) • Reactive Power Phase A (kVAR) • Reactive Power Phase B (kVAR) • Reactive Power Phase C (kVAR) • Apparent Power Phase A (kVA) • Apparent Power Phase B (kVA) • Apparent Power Phase C (kVA) • Power Factor Phase A (%) • Power Factor Phase B (%) • Power Factor Phase C (%) • Peak Demand last interval (kW) • Peak Demand since power up (kW) • Energy Usage (kWh) • Frequency (Hz)

Table 1B: Electronic Power Measurement Data Requirements (continued)

Switchboard	Circuit Breakers	Required Data per Circuit Breaker
MDP	Main Service MCC-HL Feeder MCC-BL Feeder MCC-RS Feeder MCC-FP Feeder MCC-TPA Feeder MCC-TS Feeder MCC-UV Feeder MCC-SD Feeder MCC-PS Feeder	• Phase A Voltage L-N (VAC) • Phase B Voltage L-N (VAC) • Phase C Voltage L-N(VAC) • Phase A Current (A) • Phase B Current (A) • Phase C Current (A) • Neutral Current (A) • Real Power Phase A (kW) • Real Power Phase B (kW) • Real Power Phase C (kW) • Reactive Power Phase A (kVAR) • Reactive Power Phase B (kVAR) • Reactive Power Phase C (kVAR) • Apparent Power Phase A (kVA) • Apparent Power Phase B (kVA) • Apparent Power Phase C (kVA) • Power Factor Phase A (%) • Power Factor Phase B (%) • Power Factor Phase C (%) • Peak Demand last interval (kW) • Peak Demand since power up (kW) • Energy Usage (kWh) • Frequency (Hz)

END OF SECTION

SECTION 15092

PIPE SLEEVES & SEALS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: Furnish and install wall sleeves and seals of the type(s) and sizes(s) and in the location(s) shown on the Drawings and specified herein.

B. Related Work Specified Elsewhere:

1. Firestopping is specified in Section 07270.
2. Sealants are specified in Section 07900.
3. Electrical- General is specified in Section 16010

1.1 QUALITY ASSURANCE

A. Provide and install all sleeves of the types specified herein, as shown on the Drawings and as directed by the Engineer.

B. Provide sleeves that are airtight, gastight or watertight as required.

C. Penetrations through fire rated walls, floors and ceiling shall have proper fire stopping, as specified in Section 07270.

PART 2 - PRODUCTS

2.1 TYPES AND LOCATIONS

A. New Construction:

1. Interior Concrete and Masonry Surfaces - Air to Air:
   a. Schedule 40 galvanized steel pipe with 1 inch x 1/8 inch thick welded sealing and anchoring collar in middle, hot-dip galvanize after fabrication.
   b. Minimum 1/4 inch annular space between sleeve and pipe or insulation.
   c. Firmly pack with oakum and seal both ends with polyurethane sealant, per Section 07900 or Section 07270 for standard penetrations.
2. Exterior Masonry and Wood Walls
   a. Schedule 40 galvanized steel pipe, hot-dip galvanize after fabrication. Minimum ¼-inch annular space between sleeve and pipe or insulation. Firmly pack with oakum and seal both ends with polyurethane sealant, per Section 07900 for standard penetrations.
3. Exterior Concrete Walls - Air to Ground:
   a. Schedule 40 galvanized steel pipe with 1 inch x 1/2 inch integrally cast sealing and anchoring collar in middle, hot-dip galvanize after fabrication.
   b. Size of pipe sleeve as required by seal manufacturer.
   c. Seal with rubber link compression seal.
   d. Alternate wall sleeve system as manufactured by Omni Sleeve, Malden, MA. can be utilized as reviewed and accepted by Engineer, in place of above specified wall sleeve system.

e. For plastic piping systems, sleeve and seals to be in accordance with Concrete Walls - Air to Ground requirements noted above. These type penetrations will be allowable only in those locations specifically depicted on the drawings.

4. Other conditions shall be sleeved or as reviewed and accepted by the Engineer.

B. Penetrations Through Existing Walls:
   1. Interior masonry, drywall, or wood partition - Air to Air:
      a. Cleanly cut brick or block as required. Grout sleeve into place using non-shrink grout.
      b. Cleanly cut wood frames partitions as required. Set sleeve into position and secure.
      c. Sleeves to be as required for New Construction - Interior masonry, drywall, or wood partition - Air to Air.
      d. Holes bored with equipment leaving a smooth hole in masonry walls less than l/2 inch larger than the pipe will not require a sleeve, unless otherwise specified.
      e. Minimum 1/4 inch annular space between cored opening or sleeve and pipe or insulation.
      f. Firmly pack with oakum and seal both ends with polyurethane sealant, per Section 07900 or section 07270 for standard penetrations.
      g. Install split cover plates in all finished areas. Both sides of wall if required. Plates shall be chrome finished, suitably sized to fit pipe in question and cover opening.
   2. Exterior Masonry Walls
      a. Core drill a smooth hole through all layers of the existing masonry. Hole shall be sized to facilitate standard rubber link compression seal installation.
      b. Install rubber link compression seal at each layer of masonry.
      c. Seal each face with polyurethane sealant.
      d. If a clean, smooth hole cannot be achieved, remove the masonry as required to install Schedule 40 galvanized wall sleeve. Grout sleeve in place. Install rubber link compression seal and sealant as noted above.
   3. Concrete Floor Penetrations - Air to Air:
      a. Same as Interior Concrete Partitions - Air to Air, except that sleeve will be required.
      b. Sleeve to extend 2 inches above floor on top side; bottom to be flush with underside.
      c. Pipe riser clamp used on topside.
      d. Refer to details on Process Drawings.
   4. Concrete Walls - Air to Ground:
      a. Core smooth-walled opening with coring machine. Grout smooth any irregularities in opening.
      b. Size of cored opening as required by seal manufacturer.
      c. Seal with rubber link compression seal.
   5. Other conditions shall be installed as reviewed and accepted by the Engineer.

C. Rubber Link Compression Seals:
   1. Multi-rubber link type with pressure plates, bolts, nuts and sealing element providing a leak proof seal.
   2. General Service:
      a. Glass Reinforced Nylon Pressure Plate.
      b. Carbon steel zinc-phosphated nut and bolt.

c. Sealing element: EPDM rubber.
d. -40°F. to 250°F. rating.

3. Corrosive Service: (Where Applicable):
   a. Use: Sludge tanks, scum tanks, digesters, wetwells, manholes, as shown on the Drawings.
   b. Glass Reinforced Nylon Pressure Plate.
   c. Bolt and nut, l8-8 stainless steel.
   d. Sealing element: EPDM rubber.

6. Acceptable Manufacturers:
   a. Link Seal by Thunderline Company
   b. Innerlynx by Advance Products and Systems
   c. Or equivalent.

D. Wall Plates: Provide split type cast iron or brass wall plates on pipes penetrating walls in finished spaces such as labs and offices. Refer to details on Process Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. New construction:
   1. Concrete: Set sleeves in proper location prior to placing concrete. Sleeves set by electrical and HVAC trades as appropriate.
   2. Masonry: electrical and HVAC trades to provide sleeves and locations to masonry trades for installation.
   3. Partitions: Set sleeves in place as work progresses.

B. Existing Construction:
   1. The location will be reviewed and accepted by the Engineer prior to cutting hole.
   2. For concrete, holes shall be located to avoid the reinforcing steel when possible.
   3. Patch all damaged work as required to maintain a neat and clean appearance.

C. Rubber Link Seals: Install as required and in strict accordance with the manufacturer's instructions and recommendations.

END OF SECTION

SECTION 16010

ELECTRICAL - GENERAL

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide all labor, materials, equipment, operations, methods and procedures as indicated in the Contract Documents, together with all items necessary for or incidental to the completion of the work.

B. All systems or additions to existing systems indicated in the Contract Documents shall mean all necessary supervision, labor, equipment and materials required to provide complete, properly functioning systems.

C. All systems shall be adjusted, tested, inspected and turned over to the Owner in perfect working order.

D. The words "provide", "supply", "supply and install", "install", "furnish" or "furnish and install", as used in DIVISION 16 or as indicated on the Drawings related to DIVISION 16 shall mean a complete and properly functioning Electrical installation performed by the Contractor.

E. References:

1. Refer to Architectural and Civil drawings to coordinate material and equipment locations and electrical requirements.
2. Applicable portions of DIVISION 0 - BIDDING AND CONTRACT REQUIREMENTS together with DIVISION 1 - "GENERAL REQUIREMENTS", are part of DIVISION 16.
3. Refer to "SECTION 01630 - SUBSTITUTION AND PRODUCT OPTIONS", for work affecting DIVISION 16. Refer to SECTION A-2 – INFORMATION FOR BIDDERS; SECTION C-1 - GENERAL CONDITIONS: SECTION C-2 - SUPPLEMENTARY CONDITIONS; and as specified herein regarding substitutions of materials and equipment.
4. Definitions indicated in the "GENERAL CONDITIONS", "SUPPLEMENTARY CONDITIONS", "INFORMATION FOR BIDDERS are part of DIVISION 16, unless otherwise noted.

F. Division 16 Contract Requirements and Responsibilities:

1. The requirements of Division 16 - Electrical is based on the information provided in the Contract Documents. This information has been outlined in either the <u>specifications</u> or the <u>drawings</u> or both. The contractor's responsibility of Division - 16 Electrical is to review <u>all</u> information in both the specifications and the drawings in order to determine the complete work required. Whether the work is specified in the Specifications or shown on the Drawings it is <u>required</u> as part of the work. No additional compensation or interpretations stating that it was not shown in both locations will be acceptable or allowed.

G. Work Specified Herein:

1. Visit and examine the project site and become familiar with all existing conditions pertinent to the work to be performed thereon. No additional compensation will be allowed for failure to be so informed. This contractor is responsible to be familiarized with the conditions of the project during the bidding period in order to bring any clarifications or issues to the attention of the Engineer prior to submission of his/her final bid price.
2. The following scope of work is a brief generalization of the type and extent of the work specified under DIVISION 16. Detailed requirements are indicated on the Drawings and in related sections of the Specifications. The work specified under DIVISION 16 includes, but is not limited to the following:

    a. Remove the existing switchgear service and feeder breaker components and provide a new Distribution Switchboards, along with a new Electrical Service as indicated on the "Single-Line Diagrams", related drawings and schedules, and as specified herein. The new Switchboard breakers shall have provisions for power metering over an Ethernet connection. The existing two Solar Generator Units shall be reconnected to the new Switchboard by way of a new switchboards and Automatic Transfer Switch as shown on the one line drawings. There is a significant amount of electrical demolition and feeder splice reconnection to the existing waste water facility motor control centers therefore a thorough understanding of the existing conditions is critical. It is to be understood that the drawings do not intend to show or provide details for all of the existing conditions or equipment to be demolished. In addition, not all existing condition information may reflect exact conditions due to the accuracy of existing data and information. The Contractor's responsibility is to field investigate and determine all existing conditions. No exception will be allowed for any extra compensation to perform this work This contractor is responsible to be familiarized with the conditions of the project during the bidding period in order to bring any clarifications or issues to the attention of the Engineer prior to submission of his/her final bid price.
    b. Provide Ethernet wiring and equipment and hire integrator for integration programming of each switchboard circuit breaker power measurement data. This data shall populate required registers for the existing SCADA system as specified in Division 13.
    c. Provide complete lighting system(s), including all necessary fixtures, hangers, wiring, connections, controls and lamps for areas as shown on the Drawings and as specified herein.
    d. Provide complete branch circuit wiring systems including all raceways, conductors, cables, outlet and junction boxes, wiring devices and device connections as shown on the Drawings and as specified herein.
    e. Provide complete TVSS and/or lightning arrestor and surge capacitor devices for distribution equipment and/or instrumentation devices as

shown on the Drawings and as specified herein. Provide a certified lightning arrestor installation.

f. Provide fire alarm system equipment and hire integrator for integration programming for the existing system as shown on the Contract Drawings and as specified herein.

g. Provide security alarm system equipment and hire integrator for integration programming for the existing system as shown on the Contract Drawings and as specified herein.

h. The electric utility company will be required to modify the primary electrical service (3 phase power) to the Facility including the installation of a new primary service riser pole, overhead primary line work, pad-mounted transformer, and the service and metering into the facility. The Contractor shall provide, in addition to the utility company work, all required equipment, conduits, conductors, etc. for a complete new electrical service as noted on the Contract Drawings. The contract documents have established a bid allowance to pay to complete the utility company work required for the facility. The Contractor shall pay the actual cost associated with the service work using this allowance up to the cost of the work as invoiced by the utility company, and the remainder will be returned to the Owner. Refer to Section 01150 - Measurement and Payment

H. Work Specified Elsewhere:

1. The materials and methods used for all Electrical Work indicated in the Contract Documents shall meet the requirements specified in Division 16.
2. The following Electrical Work and Work relating to the Electrical Work will be performed under other Divisions of the Contract Documents. This Contractor is to review all of the Contract Documents and Drawings and shall work closely with the other related areas which will affect his/her work under this Contract in order to avoid any and all conflicts:
   a. Substitutions, product options, cleaning up and project record documents are specified in DIVISION 1.
   b. Site work and excavation are specified in DIVISION 2.
   c. Concrete Work DIVISION 3.
   d. Painting is specified in DIVISION 9.
   e. Firestops are specified in DIVISION 7.
   f. Power Measurement Integration is specified in DIVISION 13.

I. Removals and Relocations and Rearrangements:

1. Examine the existing site, structure(s) and installation(s) for the work of all trades which will influence the cost of the work under DIVISION 16. This work shall include removals, relocations, rewiring and rearrangements relating to the work of all trades which may interfere with, disturb or complicate the performance of the work under DIVISION 16; and relating to the work involving systems, equipment and related service lines which shall continue to be utilized as part of the finished project.
2. When the Contract Documents indicate elimination of, or structural changes in walls, floors, ceilings, enclosures, pipe chases, etc., remove, relocate,

rearrange and reconnect as required, all existing Electrical Work such that systems to remain shall continue to function properly.

3. Provide in the Base Bid all associated labor, material and costs to include all removals, relocations, rewiring, rearrangements and reconnections herein specified, necessary or required to provide approved operation and coordination of the combined new and existing systems and equipment.
4. Demolition:
   a. Disconnect and remove existing equipment, devices, boxes, conduit, and associated electrical equipment as shown on the contract drawings.
   b. Any demolition, relocation or rearrangement work performed which results in unused openings in existing switchgear, control panels, instrument panels, control stations, pull or junction boxes, etc., which are to remain shall be plugged by appropriate means such that it maintains the integrity of the NEMA classification of the area, as defined on Drawing E-1.
   c. Any demolition, relocation or rearrangements which results in unused openings in walls, ceilings, floors, etc. shall be sealed using approved methods to maintain the fire rating and NEMA classification of the existing structure.
   d. Review all Contract Documents and coordinate with all disciplines for a complete understanding of this demolition work. Provide all new work required to modify these changes along with all requirements for installation of the new work, as shown on the Contract Drawings.
   e. There are areas where the demolition shall require that existing pullboxes, conduit, wiring and associated devices be disconnected, removed, relocated, extended, and in some cases be replaced in order for the new equipment, walls, structures, etc. to be constructed and installed. In most cases, the detail of these existing conditions has not been shown. This Contractor will be responsible to perform all work necessary to demolish all required conduit, wiring, boxes and associated equipment for the noted and intended demolition. At no time shall this Contractor imply that he/she does not understand the responsibility of associated demolition as the Contractor shall visit the site locations and shall become familiar with the areas where this work is to be performed. If there are any concerns or issues regarding this work they need to be addressed and submitted to the Engineer for clarification prior to submission of the final bid price for the work of this Contract. All costs associated with this work is the responsibility of this Contractor and shall be included as part of the overall costs for the electrical work of this project. No additional costs shall be allowed by this Contractor for any demolition work required under the work of this contract.
   f. Disconnect and remove all abandoned conduits, wiring, boxes, equipment, controls, hangers, etc. shown or not shown, which is located within the area of construction under this contract.
5. The Contractor is responsible for providing temporary power associated with Removals, Relocations, Construction Sequencing and Rearrangements to maintain the existing facility operational. Refer to section within this section

for requirements. See section entitled “SUMMARY OF WORK” SECTION 01010 for further information.

J. Codes and Fees:
   1. Comply with the following codes, standards, regulations and specifications:
      a. National Electrical Code (N.F.P.A. No. 70 - most recent edition)
      b. Life Safety Code (N.F.P.A. No. l0l - most recent edition)
      c. Occupational Safety and Health Act (O.S.H.A.) - regarding construction practices.
      d. Utility company standards, specifications and requirements.
      e. State and local electrical codes, building codes, and fire codes for the locale where the work is to be performed.
      f. N.F.P.A. 820 Standards for Fire Protection in Wastewater Treatment and Collection Facilities.
   2. Compliance with the above codes, standards, etc., does not relieve the Contractor from the requirements of the Contract Documents which may exceed these codes, standards, etc. but which are not contrary to them.
   3. If it is observed that the Contract Documents are at variance with any of the above codes, standards, etc., promptly notify the Engineer in writing, and necessary changes shall be adjusted by appropriate modification. If any work is performed which is contrary to such codes, standards, etc., the Contractor shall assume full responsibility therefore and shall bear all costs in correcting such work in order to comply with such codes, standards, etc.
   4. Secure and pay for all permits, fees and licenses necessary for the proper execution of the work under DIVISION 16.

K. Tests and Procedures Prior To Start-up:
   Refer to Section 16950 - Testing Electrical Systems and start-up for testing and scheduling requirements.

L. Demonstration of Complete Electrical Systems:
   1. The Owner will assume no liability or responsibility for any portions of the installation under this Contract until they are demonstrated and accepted in writing. Final demonstrations shall be made only after the Engineer is satisfied that the work has been completed, record drawings received with training and O&M completed in accordance with the intent of the Contract Documents.
   2. Refer to Section 16950 for additional requirements.

M. Identification:
   1. All distribution equipment (switchboards, motor control centers, distribution panelboards, transformers, transfer switches, disconnects, starters, control panels, control stations, etc.) shall have an engraved lamacoid tag, permanently mounted adjacent to the manufacturer's nameplate, indicating the equipment's designation (as called out on the Drawings) and identification number per the Contract Documents.
   2. All switchboard and distribution panel overcurrent devices, motor control center devices, individually mounted motor controllers, disconnect switches, control devices, etc., shall be provided with permanently attached engraved lamacoid tags indicating the equipment which they serve or control per the

equipment designation and identification number indicated in the Contract Documents, and in accordance with OSHA requirements.

3. All branch circuit panelboards shall have, on the inner side of the door, a permanently attached, engraved lamacoid tag with the identification number of that panelboard. Provide and mount under plastic, in the directory frame of each panelboard, a neatly typewritten directory identifying the branch circuit overcurrent devices and the circuits, devices and areas which they serve.
4. All individually mounted panelboards, disconnects, motor controllers, control stations, etc. shall have a second engraved lamacoid tag below the first one which identifies from where the equipment is receiving power. This second label shall be smaller in height.
5. Nomenclature on these nametags shall be project specific and wherever possible shall be full and complete. Excess abbreviations will not be allowed.
6. Power conductors shall be continuously polarized and color coded throughout using the following scheme:
   a. White or gray - All neutral conductors, 208/120V systems
   b. White w/tracer of any color but Green - All neutral conductors, 480/277 volt systems
   c. Green - All ground conductors
   d. Phase Conductors

208/120V Systems	**240/120V Systems**	**480/277V Systems**
Phase A - Black	Phase A - Black/(Red)	Phase A - Yellow
Phase B - Red	Phase B - Red/(Blue)	Phase B - Brown
Phase C - Blue		Phase C - Orange

   e. For Conductors No. 6 and smaller, color coding shall correspond to the color of the conductor insulation. For color coding of wire larger than No. 6, use self-adhesive, wrap-around type markers. These markers shall be used at all panelboards, junction boxes, disconnect switches, circuit breakers, etc.
7. Control conductors shall be identified using numerical tags corresponding to conductor designations indicated on approved shop drawings of schematic diagrams, and as required for clarification of system and equipment connections. Conductors shall be clearly identified at each terminal block, equipment connection and junction. Tags and labels shall be pre-manufactured for intended purpose.
8. Lamacoid tags shall be nominal 1" x 4" with 3/8" white lettering on black background.
9. The following safety signage shall be provided for the following equipment. Signage shall be lamacoid plastic (Large Letters) yellow background with red engraved letters:
   a. All switchboards, motor control centers, VFD equipment, automatic transfer switches, solid-state, reduced-voltage starters, enclosed circuit breakers, etc., shall be provided with signage to read "DANGER - HIGH VOLTAGE". Each section (vertical component of multi-section

enclosure) shall be furnished with an individual signage. Final requirements shall be determined at the discretion of the Engineer.

b. All motor control center motors starters, individual motor starters and/or control panels shall be provided with signage to read "CAUTION - This Enclosure Contains Voltage Sources from Outside of This Enclosure".

c. All switchboards, motor control centers, panel boards, transformers control panels, etc., shall have large letter lamacoid nameplates which reflect the full tag names and designations noted on the Contract Drawings.

d. All switchboards, motor control centers, panel boards, transformers control panels, etc., shall have Arc Flash labels as provided and determined by the Arc Flash Study. Main Service Disconnect shall have the available fault current listed based on the study in compliance with the NEC.

N. All electrical equipment shall be suitable for the areas where mounted in accordance with Area Classifications indicated on Electrical Drawings. In specific, refer to Drawing E-1 NEMA classification for Electrical Equipment and Enclosures for specific requirements and these specifications. In addition, there are several areas which have been indicated to meet NEC National Electrical Code requirements based on the final location of the equipment. Coordinate and provide these NEMA ratings whether or not specifically stated on the Drawings. Contractor shall assure that the proper type, enclosure, mounting and catalog numbers are provided during the Submittal phase.

1.2 QUALITY ASSURANCE

A. Supply all new materials, devices and equipment in conformance with:

1. Underwriter's Laboratory, Inc. listing for all equipment and panels
2. National Electrical Manufacturers Association.
3. American National Standards Institute.
4. National Electrical Code (NEC).
5. Local Power Company.
6. Local Telephone Company
7. OSHA

B. All materials provided under this Contract shall be equal in quality, appearance and performance to that specified herein and shall be subject to no exceptions taken by the Engineer. Verify the availability of all materials proposed to be used in the execution of the work prior to submitting same for the Engineer's review. The discontinuance of production of any material or product after the Engineer's review has been made shall not relieve the Contractor from furnishing an alternate of equal quality and design without additional cost.

C. Materials and equipment furnished under this Contract shall be standard products of manufacturers regularly engaged in manufacture of such products and shall be manufacturer's latest standard design that complies with Specification requirements. Products shall essentially duplicate material and equipment that have been in satisfactory local use at least three years.

D. The Contractor shall have supplied comparable systems to those specified herein and shall maintain engineering and service departments capable of designing and

maintaining these systems. For a period of twelve (12) months from the date of acceptance of the work, provide all necessary supervision, labor, materials, and equipment, in order to correct any defects in any system due to faulty materials, equipment, installation methods, or workmanship and consequent damage resulting from such defects. This work shall be scheduled during normal working hours and at the convenience of the Owner.

E. All switchboards, motor control centers, panelboards, motor starters, transformers, and distribution equipment shall be by the same manufacturer based on providing the Owner with equipment of the same type. This will allow for replacement and spare parts of the same type and also allow efficient maintenance of this equipment.

F. All electrical equipment shall be suitable for the areas where mounted in accordance with Area Classifications indicated on Electrical Drawing E-1. Contractor shall assure all equipment is installed in strict accordance with the latest version of the National Electrical Code.

G. All equipment to be submitted such as low voltage switchboards, motor control centers, panelboards, dry-type transformers, motor starters, disconnect switches, etc. shall be furnished by the same single manufacturer unless otherwise noted. Substitutions of multiple manufacturers for this equipment shall be rejected.

1.3 SEISMIC CONTROL

A. Refer to DIVISION 13 - Seismic Restraint Requirements for Nonstructural Components for electrical system seismic requirements.

1.4 SUBSTITUTIONS

A. General

1. Where new equipment is specified to be provided as part of an extension to an existing system, the manufacturer of the new equipment shall match that of the original. Substitutions will not be considered as equal unless specifically noted so.
2. Certain new equipment and systems have been specified with one or more make(s) followed by the phrase "or equal". In such cases, the Contractor may submit a proposed substitution for review by the Engineer. The decision of equality of a proposed substitution rests fully with the Engineer.
3. Certain new equipment and systems have been specified with one or more make(s) WITHOUT the phrase "or equal". In such cases, only one of the manufactured products listed will be allowed. No other manufacturer is allowed.
4. Where substitutions are allowed as "equal" it shall be the Contractor's responsibility to make any and all necessary modifications required to accommodate the installation of the substituted item(s) at no additional cost to the Owner.
5. The Drawings have been designed and shown with a basis of design being of a specific vendor. This Contractor shall understand that if the submission is by another vendor to be considered as an equal then it shall be his/her responsibility to provide a system which will be thoroughly coordinated to meet the intended design. Any additional equipment, conduit, wiring,

controls, etc., required to make the final installation "as equal" will be the responsibility of the Contractor and shall be included at no cost to the Owner.

6. Systems submitted which require extensive work in order to review will be rejected or the Contractor shall be accessed additional costs for additional resubmissions required for obtaining no exceptions by the engineer for the equipment to be considered as an acceptable equal submission.

1.5 SHOP DRAWINGS

A. General:

1. Submit Shop Drawings in accordance with General Conditions and as indicated herein.
2. Shop Drawings shall be submitted on all items of equipment and systems as indicated in related sections of DIVISION 16.
3. Shop Drawings submitted by equipment vendors shall be thoroughly checked by the Contractor for compliance and completeness with the Contract Documents prior to being submitted to the Engineer for review as follows:
   a. Verify that all equipment and materials proposed to be furnished will fit into the available space.
   b. All required or specified clearances are maintained
   c. All equipment is compatible with the general building construction of the areas into which they are to be installed.
4. The submittal of any Shop Drawing implies that the Contractor has reviewed this Shop Drawing and that the above requirements have been met.
5. Shop Drawings submitted shall be complete and in its entirety in one bound notebook as required by Specification 01340. For example, Specification 16050 Basic Materials shall include all items in this specification which will be required for this project. Except in special instances, previously agreed to by the Engineer, partial submittals will not be reviewed or accepted.

B. Shop Drawings:

1. Shop Drawings Shall Consist of:
   a. Project name and location.
   b. Contractor's name.
   c. Index Sheet - Listing the equipment being submitted utilizing equipment designations, or symbols, indicated on the Contract Documents together with the proposed manufacturer, style/ type and catalog number.
   d. Manufacturer's scale or dimensioned drawings along with standard catalog "cut" sheets. These cut sheets shall be marked up to indicate equipment, sizes, types, etc., of equipment and all options being provided.
   e. Equipment ratings, service clearances and configuration.
   f. Listing of accessories to be furnished.
   g. Single-line and schematic diagrams where applicable. All text and symbols shall be easily legible and submitted on a 11"x17" sized drawing(s) as necessary.
   h. Refer to related sections of the specifications for special shop drawing requirements for individual equipment types.
2. All Cut Sheets shall be marked up to indicate specific equipment, specific sizes, specific types, etc., for all equipment and materials with all options

provided for this project. Catalog cut sheets not properly marked up, or are difficult to read and understand as to what equipment or application that it is used for, will be returned un-reviewed, for re-submittal.

3. The contract drawings have provided detailed customized schematic wiring diagrams for all switchboard equipment as well as individual wall mounted starters, control panels, etc. These are very detailed and a lot of effort has been expended to compile these diagrams. The equipment manufacturer/supplier of this equipment as specified shall be responsible to provide the following detailed and customized schematic wiring diagrams.
   a. A separate customized and detailed schematic for <u>each</u> piece of equipment (i.e. Switchboard Main Breaker SWBD-MDP). Even though the schematic appears to be the same for this equipment a <u>separate</u> schematic for each will be provided with the referenced title (i.e. Main Breaker SWBD-MDP, etc.) noted on the respective schematic.
   b. Each schematic shall indicate and show the specific devices (hand-off-auto, run light, ETM, etc.) and a reference to where this is located.
   c. All contacts and interlocks shall be identified as to their location.
   d. All metering and interface devices such as digital metering, TVSS, lightning protection, etc., shall be shown, identified, and dimensional heights from bottom of equipment shall be noted.
   e. Failure to provide the proper customized schematic wiring diagrams shall be grounds for automatic rejection. Any delays, scheduling issues and additional contract time and cost associated with these delays due to equipment not being approved or being rejected for these reasons shall be the responsibility of the Contractor.
4. Provide samples of such items as lighting fixtures, conduit, and wiring devices upon request of the Engineer.

C. The following example is provided as a suggested formatting guideline. In addition to expediting the review process, this formatting will help ensure that the vendor has included all items applicable to the submittal, reduce the number of re-submittals and ensure a quality project.
   1. Submittal Formatting:
      a. Project information as required by the contract specifications.
      b. Contact page.
      c. Index sheet - this sheet shall list each tab with a description of its contents, i.e., Tab 1 – SWBD-MDP.
      d. Each tab shall be set up as follows:
         (1) Pertinent project specific information and modifications associated with this switchboard, with references to the general information tab number.
         (2) A parts list of all items/devices and accessories associated with this switchboard, breakers, relays, controls, fuses, etc.
         (3) A project specific nameplate data sheet for the switchboard - this shall include, but not limited to, full project specific title descriptions, feeder information and submitted wiring diagram number.

(4) Dimensions layout plans and elevations pertaining only to this switchboard.
(5) Project specific switchboard one line diagram.
(6) A complete set of project specific wiring diagrams for all loads associated with this switchboard. Wiring diagrams shall include the following general information: The full project specific title of the load served and the submitted applicable compartment number. If more than one feeder of a specific load within the applicable switchboard is indicated then separate and identified wiring diagrams shall be submitted for each load description and compartment number. All wiring diagram information and notation shall be clearly defined and referenced. Common wiring diagrams will not be acceptable.

2. As shown, this format is set up for a motor control center submittal, however, the same format shall be used for all switchboards, control panels, lighting panels etc.
3. Each submittal shall be neatly bound with typewritten index sheets.
4. Each control panel, system or equipment package shall be submitted in its entirety with all associated controls, devices, panels, layouts, wiring diagrams etc., included.
5. If the contractor relies on the equipment provider to submit this information, it shall be the Contractor's responsibility to ensure the format is as noted above. Submittals which do not clearly indicate, in an organized manner, what is being provided will be rejected, without being reviewed, for the submittal.
6. Equipment submitted which will be used throughout the facility, such as Local Control Stations, junction boxes, conduit, panels etc., shall clearly indicate which areas these will be located or used for, either on the submittal or a cross referenced list i.e., PVC conduit - Chemical Room, or screw type covered stainless steel enclosure - pull box in NEMA 4X environments, etc. .

1.6 SUBMITTALS TO THE ENGINEER

A. Provide all certificates of inspection and approval from all regulatory agencies having jurisdiction over the Work under Division 16.
B. Maintain properly documented and witnessed test and checkout reports and submit these to the Engineer prior to energizing the Electrical system.
C. Upon completion of the Work and before request for final payment, deliver to the Engineer six (6) bound sets of full and complete directions pertaining to the operation and maintenance of all equipment and systems installed under this Contract in one final, complete submittal. These directions shall be neatly bound, consist of typewritten on 8-1/2" x 11" sheets with index tabs, and shall be accompanied by plans, diagrams, etc. of the work installed, parts lists, warranties, test reports, etc. necessary for the guidance of the Owner in operating, altering or repairing the installation. In addition to the foregoing, furnish the Engineer a written statement from the Owner indicating that he is satisfied with the operating instructions given.

D. Provide the Owner with a list of local service departments of duly authorized distributors of materials and equipment of the type installed, which will stock the manufacturer's standard parts, etc.

1.7 O&M REQUIREMENTS:

A. See section 01340 for requirements.

1.8 RECORD DRAWINGS

A. At the completion of the installation, provide reproducible Record Drawings indicating the final configuration of all Electrical Systems as they were installed. Symbols, equipment designations, etc. shall be consistent with the Contract Documents. Provide exact locations of all work which has been concealed in concrete, masonry or underground.

B. Contractor shall provide detailed instrumentation loop diagrams, control panel diagrams, and motor schematics indicating exact point to point wiring. The electrical contractor and instrumentation vendor shall prepare the diagrams jointly to allow full coordination.

C. During construction a clean set of red lined drawings will be set aside in the construction trailer with markups of changes which occur during the construction of the project. These are required and will be inspected for making sure that the contractor is recording these field changes for implantation to final record drawing submittals. Upon completion of the project these red lined drawings will be used to generate field as-built final drawings by the contractor. A copy will be provided to the Engineer for record proposal.

D. As-Built copies of all shop drawings shall be submitted to the Engineer along with the As-Built drawings prior to final acceptance of the project.

1.9 DELIVERY, STORAGE AND HANDLING

A. Coordinate material and equipment delivery with the project schedule. Notify the Engineer immediately, in writing, if material or equipment delivery will adversely affect the project schedule, include documentation from equipment suppliers indicating the revised delivery dates and the reason for the delay.

B. Exercise care during loading, transporting, unloading and handling of materials to prevent damage.

C. Check for defective or damaged materials, and for incomplete equipment shipments within seven (7) days after equipment delivery to the project site.

D. Store materials and equipment on the construction site in enclosures or under protective covering and off the ground in order to keep materials and equipment undamaged, clean, and dry.

E. Replace or repair, to the satisfaction of the Engineer, all materials and equipment that are defective or that have been damaged during installation, at no additional cost to the Owner.

1.10 GUARANTEE

A. Guarantee all equipment, materials and workmanship in accordance with the General Conditions of the Construction Contract and Section 11000.

B. Warrant all material furnished and work executed is in accordance with all applicable laws and regulations.

1.11 COORDINATION, SHORT CIRCUIT AND ARC FLASH STUDY

A. Furnish and implement a complete and approved coordination, short circuit and Arc Flash study for the complete facility electrical system including existing MCC's and distribution panels at the facility. Refer to Appendix A for a complete facility load listing, transformers and panels associated with each MCC.

B. The following is a summary of the requirements of this study:

1. Bound copy of the complete study information with cover sheet, table of contents, tabbed index markers for each appropriate section, cover letter with stamped and signed P.E. reference as to the preparer of the study and indication of system responsibility.
2. Short circuit and protective device coordination study including complete arc flash system study for the entire project location including all new and existing electrical systems and equipment and a summary of findings.
3. Tables and listings of all equipment and results of short circuit results summarized for review.
4. Description of the study and overview of system and how the study was performed.
5. All single line diagrams, devices shown, identification tags, bus tags for a complete description.
6. Circuit breaker and relay settings table summarizing the final recommendations for breaker coordination settings.
7. Identifying any discrepancies with the system devices and overall short circuit and coordination settings for the system with recommendations for revisions to the equipment.
8. Field testing and setting of all equipment with final field walk-through with the Engineer that these settings have been properly performed. A system check off and sign off must be performed for final acceptance that the actual installed equipment is coordinated with the final study requirements and settings.
9. A complete and acceptable system shall be provided for this portion of the work.
10. Furnish an Arc Flash Hazard Analysis Study per the requirements set forth in the current version of NFPA 70E -Standard for Electrical Safety in the Workplace. The arc flash hazard analysis shall be performed according to the IEEE Standard 1584 – 2002, the IEEE Guide for Performing Arc-Flash Calculations. Studies shall be performed by Square D Engineering Services or approved equal.
11. Arc Flash Hazard Methodology Analysis Results and Recommendations including the details of the incident energy and flash protection boundary

calculations, along with Arc Flash boundary distances, working distances, Incident Energy levels and Personal Protection Equipment levels.

12. Arc Flash Labeling section showing types of labels to be provided. Section will contain descriptive information as well as typical label images. Labeling and Arc Flash results shall be provided for each and every electrical distribution system equipment both existing and new for this facility.

C. Submittals for Review:

1. The studies shall be submitted to the design engineer prior to receiving final review of the distribution equipment shop drawings and/or prior to release of equipment drawings for manufacturing. If formal completion of the study may cause delays in equipment shipments, review from the Engineer may be obtained for a preliminary submittal of data to ensure that the selection of device ratings and characteristics will be satisfactory to properly select the distribution equipment. The formal study will be provided to verify preliminary findings.

D. Qualifications:

1. The short-circuit, protective device coordination and arc flash hazard analysis studies shall be conducted under the responsible charge and approval of a Registered Professional Electrical Engineer skilled in performing and interpreting the power system studies.
2. The Registered Professional Electrical Engineer shall be an employee of the equipment manufacturer or an approved engineering firm.
3. The Registered Professional Electrical Engineer shall have a minimum of five (5) years of experience in performing power system studies.
4. The approved engineering firm shall demonstrate experience with Arc Flash Hazard Analysis by submitting names of at least ten actual arc flash hazard analyses it has performed in the past year.

E. Data:

1. Contractor shall furnish all data as required for the power system studies. The Engineer performing the short-circuit, protective device coordination and arc flash hazard analysis studies shall furnish the Contractor with a listing of required data immediately after award of the contract. The Contractor shall expedite collection of the data to assure completion of the studies as required for final review of the distribution equipment shop drawings and/or prior to the release of the equipment for manufacturing.
2. Source combination may include present and future motors and generators.
3. Load data utilized may include existing and proposed loads obtained from Contract Documents provided by Owner, or Contractor.
4. If applicable, include fault contribution of existing motors in the study. The Contractor shall obtain required existing equipment data, if necessary, to satisfy the study requirements.
5. A complete and acceptable system study shall be provided for final acceptance.

F. Project completion:

1. Upon completion of the study, the contractor shall provide a User SKM file to the owner for use with future upgrades and or changes at the facility.

1.12 SUBCONTRACTOR COORDINATION AND RESPONSIBILITY

A. Coordination with Division 2 and Division 3

1. The electrical subcontractor is required to provide a substantial amount of underground work and coordination relating to the following items:
   - Underground duct banks and installation
   - Pad-mounted transformer
   - Existing and new underground utilities

a. Excavation, bedding and backfilling shall be furnished and installed under Division 2 - Site Work. The electrical subcontractor shall coordinate all excavation for duct bank locations for both new and existing conditions with this section in order to provide a complete understanding of where and how these duct banks are to be installed.

b. Concrete encasement for duct banks if required shall be furnished and installed under Division 3 - Concrete. Duct banks shall be formed up neat and tight to provide for proper encasement of conduits. Reinforcing steel shall also be furnished and installed under Division 3 - Concrete.

c. Concrete pads for pad mounted transformers shall be furnished and installed by Division 3 - Concrete. The excavation; bedding and backfill shall be furnished and installed under Division 2 - Site Work. Coordinate pad sizing, openings and orientation with this section for proper installation.

B. Coordination with Miscellaneous Divisions

a. The electrical contractor shall coordinate all coring, cutting and patching of openings in existing structures and locations with the General Contractor in a timely manner not to delay scheduling of the project.

C. Schedules:

a. The electrical subcontractor shall maintain close contact and coordination at all times with the work of these related Divisions in order to provide a complete electrical system or delay the scheduling of the project.

b. Perform all coordination and scheduling of all cutting, temporary power usage with all other trades. patching, trenching, painting, trench covers, plastering, chases, slots, furring, grounds, masonry foundations, piers, excavating, pole bases, backfilling, pads, duct banks and other work incidental to installation of apparatus as required for electrical work.

1.13 CONDUIT LAYOUT PLANS AND DETAILS FOR CONCEALED AND EXPOSED WORK

A. The Contract documents require that conduit be concealed in walls, floors, ceilings or below floor slab in slab on grade areas due to the configuration and layout of the proposed building construction.

B. In areas of exposed conduits, conduits shall be installed via vertical drops down to equipment in order to maintain a clean and consistent look of conduit for this installation. Horizontal runs shall be limited to ceiling racked installation and shall drop down to equipment. In areas of hung ceilings and accessible space above ceilings conduits shall be installed concealed within these areas with vertical drop down to the equipment to be fed.

C. A detailed conduit layout plan and routing path for the new addition shall be submitted for review and with no exceptions taken by the engineer prior to performing any work. The plan shall clearly indicate the equipment locations and path of runs along with overall sizes of conduits to be installed for a complete layout plan.

D. The contract drawings specifically note areas with blockout structural openings for the installation of conduits into and within the proposed annex. A coordination review of equipment locations and layouts will be required such that the conduit layout plan has been pre-planned and approved prior to the commencing of the work. There is a significant amount of conduit to be installed under this project and this plan will provide an overview of the intended work to be performed.

E. The contractor shall be allowed to reduce the number of conduit runs by combining conduit runs and increasing overall conduit sizes based on the National Electrical Code (NEC) allowable sizing and derating requirements. The contract documents will limit this however based on the allowable sizing of conduits within the slab and also this will be limited to smaller branch circuit feeders. Individual motor feeders to equipment such as pumps, process equipment runs, electrical distribution feeders and HVAC larger loads will not be allowed to be combined as further stated within the contract documents.

F. The Conduit and Wire Schedule has provided a summary of individual conduit runs throughout the project in order to clearly indicate where conduit and wiring is to be installed. The contractor shall utilize the schedule along with the electrical plans to develop the overall Conduit Layout Plan as required under this section. The submitted plans shall be formatted on 2' x 3' full size plans and submitted as part of the shop drawings requirements for this project prior to commencing any and all work.

G. The electrical contract drawings are diagrammatic and may not specifically show exact locations of the equipment. The contractor shall coordinate all conduit layout, and dimensions with the final equipment locations for the entire project for both concealed and exposed conduit runs.

1.14 BID ALLOWANCE AND COST TO BE CARRIED UNDER THIS CONTRACT

A. The Electrical Subcontractor shall include as part of his/her overall bid an allowance for all work to be performed by the respective utility companies or service companies under this Contract.

B. Electric Utility Company direct charges for their own work associated with the required modifications and extension of the existing three-phase overhead and underground distribution lines to the new facility, as well as providing new utility-owned three-phase service equipment and transformer, shall be paid for under this bid allowance. All other required work associated with the new Electrical Service to the facility shall be included in the Base Bid under this contract.

C. The Bid Allowance shall include only work and costs to be paid for work to be performed by the respective utility companies or service companies. All work required by the Electrical Subcontractor shall be included in the Base Bid and not part of this allowance. Refer to Measurement and Payment Section 01150 and Section 00310 of this specification for additional requirements. An allowance amount has been identified and included in the bid items for the work to be performed by the respective utility companies and service companies. This amount is to be included as part of the overall costs for the work of Division 16. Refer to bid items for summary of these costs.

1.15 WORK ASSOCIATED WITH UTILITY COMPANIES AND SERVICE COMPANIES

The Power Company serving this project is PSNH

1. The Power Company contact information is as follows:

Work Order # is	2394273
Contact Person:	Sid Barton
Contact Telephone No:	1-603-286-8374, ext#5555439

2. Coordinate all work required by the Power Company via the contact referenced above and contact this individual concerning any questions regarding this work.
3. The work of the Power Company is shown on the Contract Drawings. The following is a summary of this work:
   a. Leave old service connected to the project location as necessary for the sequence of construction.
   b. Remove existing primary service and related wiring once new service is operational.
   c. Modify overhead primary service for permanent electric service and install a new service riser pole.
   d. Install new primary underground electric service and offload new pad-mounted transformer, metering and work required by them for the permanent electric service. The respective transformer pad, below grade conduit, and secondary wiring shall be furnished and installed by the electrical contractor.

e. Coordinate all required shutdowns and energizations for the existing and new electrical services.
f. All other associated work required by them for the needs of this project.

A. The State Fire Marshall and local jurisdictions having authority for the Town/City shall establish the fire alarm system requirements for this project.
   1. The work of this Contract shall require that the new fire alarm devices are tied into the existing Fire Alarm panel and sent to the local authorities in order to respond to these respective alarms.
   2. The final requirements and related work of the fire alarm system shall be determined by the State Fire Marshall and local jurisdiction having authority. Coordinate all work and requirements with the State Fire Marshall and the local authority for final connections and operations of the complete fire alarm system for final acceptance.

1.16 TEMPORARY POWER, TELEPHONE, AND TELEMETRY REQUIREMENTS

A. It shall be required that the Electrical contractor maintain the existing facility and associated equipment operational during all times of the work of this contract. This Contractor shall be responsible to provide temporary power (both normal and emergency standby power) to energize and maintain system operations.

B. This shall include all power, control, signal, telephone and telemetry system requirements. This shall be based on the sequence of construction required for this project.

C. Temporary light & power.
   1. The Electrical Contractor shall provide all temporary power, and the General Contractor shall pay for all temporary power usage fees. typically the electrical subcontractor will provide the temporary electrical services and exclude energy usage fees. the general contractor or the owner will typically pay for the energy usage fees associated with the project.
   2. Limit temporary service to 100 amperes, 120/240 volt, 1 phase, 3 wire.
   3. Limit power and hand tool usage to motors not exceeding 1/2 HP.
   4. Temporary power shall be separate from process power required to maintain the existing facility operational during sequence of construction and the duration of the project.

1.17 SEQUENCE OF CONSTRUCTION

A. Requirements for Sequence of Construction

1. The present primary and secondary electrical service feeders to the existing treatment facility are fed underground to a pad-mounted transformer located outside the operations building across the facility road way. The location of the existing underground services and pad-mounted transformer falls within the new construction area for the proposed work.
2. The existing underground electrical service feeders, and pad-mounted transformer shall be disconnected and removed in their entirety. In addition, a complete new incoming service is to be provided installed, tested and accepted prior to removal of the existing service and equipment. The electrical contractor shall be responsible to coordinate with the power company for the new power requirements and disconnection of the existing service.
3. Maintain equipment operations as required under Section 01010 "SUMMARY OF WORK" and section 01500 "TEMPORARY FACILITIES AND CONTROLS". The electrical contractor shall be responsible to maintain power, control, and signal to equipment as noted in Sections 01010, 01500 as well as when sequencing the new electrical system equipment and wiring for the existing treatment facility. All necessary material, labor, equipment and associated costs, etc. necessary to maintain the sequence of operation shall be the responsibility of the electrical sub-contractor as specified.
4. It shall be required that this Electrical Contractor maintain the existing treatment facility operational during all times of the work of this contract. Therefore, this contractor shall be responsible to provide temporary power to control and maintain system operation. All temporary power requirements are the responsibility of this contractor based on his/her needs for the sequence of construction for this project. This does not include temporary power necessary for construction trailers or job setup as this is a separate item as defined under the General Conditions, Section 01500 - Temporary Facilities and Controls. In order to be clear about this requirement of the project, it is important to understand that <u>all temporary power requirements and systems operation</u> (which is process related for the sequence of construction) is the <u>responsibility of this Contractor</u> based on the needs to complete any and all work of this project. There is a significant amount of work required to provide and maintain temporary power to existing facility operations during all times during the schedule of this Contract. **Therefore a complete understanding of this requirement is critical.** This shall include any temporary relocations, conduit, wiring, re-wiring, temporary electrical equipment, etc., required during all demolitions and new installations. This shall include all <u>emergency standby power requirements</u> necessary to maintain emergency standby continuous facility operations at all times also during the schedule of this Contract. All costs associated with this work is the responsibility of this Contractor and shall be included as part of the overall costs for the electrical work of this project. No additional costs or

compensation shall be allowed by this Contractor for any temporary power requirements necessary for this project.

1.18 MEASUREMENT AND PAYMENT

A. Measurement and payment for the work described in this section will be made in accordance with the provisions of DIVISION 1 MEASUREMENT AND PAYMENT.

1.19 REQUEST FOR INFORMATION

A. When there is a conflict or coordination issue, or if additional information is necessary for the contractor to proceed with the intended work, a Request of Information (RFI) form shall be submitted through the General Contractor to the Engineer. The specific issue shall be described in the RFI and shall be sent to the engineer for review and a response provided in an appropriate time period. RFI form shall be available via the General Contractor through the Engineer as required for this contract. This process shall be used as part of the work of this contract.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials shall be as specified in the appropriate Sections of DIVISION 16.

B. No exceptions to the Engineer of materials shall be as indicated in these Sections.

PART 3 - INSTALLATION

3.1 INSTALLATION

A. Installation shall be as specified in the appropriate Sections of DIVISION 16.

3.2 TESTS

A. Refer to all related requirements as set forth within SECTION 16950 and additional testing as indicated in the appropriate Sections of DIVISION 16.

3.3 CLEANING

A. Do not allow refuse and surplus materials to accumulate on the project site during the course of the work. Areas shall be cleaned and picked up on a daily basis.

B. Upon completion of the work, remove all refuse and surplus materials and leave the premises neat and clean on a daily basis.

C. Clean all equipment surfaces and touch up all damaged surfaces to the satisfaction of the Engineer.

D. Clean all lighting fixture reflector assemblies, lenses, louvers and lamps upon completion of the installation.

END OF SECTION

SECTION 16050

BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.1 DESCRIPTION

A. The Drawings are diagrammatic, unless detailed dimensioned Drawings are included, and show approximate locations of distribution equipment, fixtures, control panels and wiring devices. Equipment layouts shall be submitted prior to work in these areas with sufficient time for a detailed review. All equipment and locations shall be closely reviewed and coordinated. Coordinate all work and equipment locations with the Engineer prior to performing final installations.

B. While the general run of electrical feeders, branch circuits and conduits are indicated on the Drawings, it is not intended that exact routing be determined there from. Conductors can be combined in conduits for ease of construction as permitted by these specifications and the latest edition of the N.E.C.

C. Circuit designations can be found on the contract drawings in the combination of any of the following formats:

Single Line Diagrams	Wiring Diagrams
Electrical Schematics	Panelboard Schedules
Control and Instrumentation Diagrams	Conduit and Wire Schedule
"Home Runs"	

The Contractor shall be responsible for reviewing all drawings and may modify these designations subject to field conditions and review of the Engineer.

D. Measurements shall be made and coordinated with all approved equipment at the site and in the buildings during construction and all systems installed as the work progresses in such a manner that the equipment, piping, vents, ducts, conduit, etc., will fit in the space provided, maintain head room and if in unfinished areas, be as neatly installed, as obscure and "out-of-the- way" as physically possible.

E. Prior to submission for review any item of equipment, determine whether or not it will fit in the space provided and that no design changes in conduits, wiring or controls will be required. Any changes in the size, location or interconnections of the material or equipment supplied, which may be necessary in order to meet field conditions or in order to avoid conflicts between trades, shall be brought to the immediate attention of the Engineer and no exceptions must be taken before such alterations are made.

F. All equipment and accessories and its interconnecting piping, ductwork, conduits, etc., shall be installed in such a manner that ample maintenance passage and Code-required space/access will be provided.

G. Where more than one trade is involved in an area, space or chase, all shall cooperate and install their own work to utilize the space equally between them in proportion to their individual requirements. In general ductwork shall be given preference (except where grading of piping becomes a problem) followed by

piping then electrical wiring. If, after installation of any equipment, piping, ducts, conduit, etc., it is determined that ample maintenance and passage space has not been provided, the work shall be rearranged and/or furnished with other equipment as required to provide this space at no additional cost to the Engineer. The Contractor shall review the drawings for all other trades to determine any potential interferences and identify and coordinate with those with other trades.

H. When there is a conflict or coordination issue, or if additional information is necessary for the contractor to proceed with the intended work, a Request for Information (RFI) form shall be submitted through the General Contractor to the Engineer. The specific issue shall be described in the RFI and shall be sent to the Engineer for review and a response shall be provided in an appropriate time period. RFI form shall be available via the General Contractor through the Engineer as required for this contract. This process shall be used as part of the work of this contract.

1.2 QUALITY ASSURANCE

A. In General, the workmanship of the electrical installation shall be as described in the N.E.C.A. Electrical Design Guidelines. All methods of construction, details of workmanship, etc. that are not specifically described therein or indicated in the Contract Documents, shall be subject to the control and approval of the Engineer.

B. Equipment and materials shall be of the quality and manufacture indicated in their respective sections of the Specifications.

C. Work determined by the Engineer to be unsatisfactory according to industry standards shall be redone at the Contractor's expense, with no additional compensation.

D. All efforts shall be made in the location and installations of all raceways and equipment for a neat, logical, and safe installation as it pertains to personnel and operations.

E. An electrical conduit and associated electrical devices, etc., shall be installed concealed wherever possible in order to provide for a clean and limited amount of exposed conduit runs. Coordinate all work with the Engineer prior to performing this work.

1.3 SUBMITTALS TO THE ENGINEER

A. The contractor shall be responsible to submit a complete list of conduit type to be used for all locations of the project. A Conduit Layout Plan shall be submitted as a shop drawing with the following:
   1. Shall include a column for exposed and concealed conduit heading. Mark up each location with the type of conduit to be used for the respective space in the appropriate heading of exposed and concealed installation.
   2. Provide detailed drawings indicating intended routing and combination of conductors. Refer to section 16010 for additional requirements.

B. Submit a shop drawing for the following equipment, materials, products, etc.:
   1. Conduit, Raceway and Tubing.
   2. Conductors and Cable
   3. Outlet Boxes
   4. Pull and Junction Boxes and Terminal Cabinets

5. Wiring Devices
6. Control Devices and Equipment
7. Splice Kits
8. Security Door Switches
9. Safety Disconnect Switches
10. Cable Tray
11. Fuses
12. Ground Rods
13. Hand Holes
14. Metal Framing Channel
15. Main Switchboard and Secondary Switchboards
16. Miscellaneous Electrical Distribution Equipment
17. Lighting Fixtures
18. Lighting flexible hangers
19. Conduit and wall and floor link seal fittings
20. Conduit cable sealing fittings
21. Fire Stop Materials

C. Submit Shop Drawings per SECTION 16010.

D. Submit test results on all feeder conductors and heat trace cables as specified in SECTION 16950.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Conduit, Raceway and Tubing

1. Rigid Heavy Wall Steel Conduit (RSC or RGS) shall be constructed of hot dipped galvanized or electro-galvanized steel. Acceptable Manufacturers: Allied, Wheatland, or equivalent.
2. Electrical Metallic Tubing (EMT) shall be constructed of electro-galvanized steel. EMT fittings shall be interlocking compression type of cadmium-plated malleable iron or zinc coated steel, or stainless steel. No die cast, set screw and indenter type fittings shall be used. Acceptable manufactures are Allied, Wheatland or equivalent.
3. Aluminum conduit shall be rigid, heavy wall aluminum. Acceptable manufacturers: Anaconda, Kaiser, VAW, or equivalent.
4. Flexible Metal Conduit
   a. Flexible Metal Conduit shall be constructed of one continuous length of U. L. Approved electro-galvanized, spirally wound steel strip with interlocking convolutions and interior surfaces free from burrs and sharp edges.
   b. Flexible metal conduit shall be "liquid-tight" with PVC jacket. Acceptable Manufacturers: Alflex, Electri-Flex, Thomas & Betts, or equivalent.
   c. Flexible metal conduit installed in hazardous, NEMA 7, Class I Div 1 areas shall be UL Listed, and shall have a bronze or stainless steel braid

covering over a flexible brass inner core. Packing shall be woven cotton braid impregnated with asphalt.

d. Acceptable manufacturer: Crouse-Hinds, Killark, Thomas & Betts-XP Series, or equal.

5. Non-Metallic (P.V.C.) Conduit shall be Schedule 80, extra heavy wall or Schedule 40, heavy wall and UL Listed for the use intended. Acceptable Manufacturers: Carlon, Harrison, or equivalent.
6. P.V.C. Coated Rigid Galvanized Steel Conduit. Acceptable Manufacturers: Rob-Roy "Plasti-Bond", Ocal, Perma Cote, Kor Kap or equal.

   a. The PVC Coated Rigid Galvanized Steel conduit, shall fully comply with the following industry listings and manufacturer's standards without exception prior to PVC coated application, shall conform to Federal Specifications WW-C-581E, ANSI Standard C80.1, ANSI Standard C80.5 UL Standard #6 and NEMA RN1-2005.
   b. The PVC coated rigid galvanized steel (RGS) conduit shall comply with the below listed specifications without exceptions allowed. PVC coated rigid galvanized steel (RGS) conduit shall be hot dipped galvanized both internally & externally. The PVC coated rigid galvanized (RGS) conduit shall have hot dipped galvanized threads. The external PVC coating shall be a nominal 40 mils of external PVC coating and 2 mils of blue interior urethane coating. The PVC coating shall applied by the same manufacturer of the hot dipped galvanized rigid steel (RGS) conduit.
   c. Conduit bodies and fittings for PVC coated rigid galvanized steel (RGS) conduit shall be from the same manufacturer as the PVC coated rigid galvanized steel (RGS) conduit. Conduit bodies shall be coated on the entire body both internally and externally with 2 mil of blue urethane and exterior coated with 40mil of PVC coating.
   d. All conduit, conduit bodies, connectors, support systems and accessories in the corrosive areas, above grade or below grade, shall be coated as specified.
   e. The thickness of the coating is to be a nominal 40 mils except where the configuration or application of the unit dictates otherwise.
   f. During the manufacturing of the PVC coated rigid galvanized steel (RGS) conduit, the factory applied hot dipped galvanized coating of both the internal and external (RGS) conduit shall not be disturbed in any fashion prior to the application of PVC coating being applied as per UL 6. The PVC coated rigid galvanized steel (RGS) conduit shall comply with all UL listings providing the hot dipped galvanized coating as the primary means of protection of corrosion protection for the conduit, and the PVC coating shall be listed as a secondary means of corrosion protection as required by UL 6 and NEMA RN-1-2005.
   g. Every female opening shall have a plastic sleeve extending one pipe diameter or 2", whichever is less, beyond the opening. The inside diameter of the sleeve shall be the same as the outside diameter of the pipe used with it. The wall thickness of the sleeve shall be the same as the plastic coating.

h. Fittings and Accessories:
   i. Right angle beam clamps and U-bolts will be provided with PVC encapsulated nuts that cover all exposed parts of the threads.
   ii. U-bolts will be sized to snugly fit the nominal 40 mil coated conduit.
   iii. The screw heads on Form 8 condulets shall be stainless steel encapsulated by the same manufacturer. All conduit bodies used in wash down, wet or outdoor applications shall be NEMA 4X rated. .
   iv. Couplings shall have longitudinal ribs 40 mils in thickness to protect them from wrenches or channel-locks.
   v. All coated conduit and fittings must be installed wherever possible by a certified trained installer using a tool available from the manufacturer for the use intended in order to protect the PVC coating.
i. The interior coating shall be applied in such a manner so as to allow field bending without cracking or flaking of the interior coating.

7. Approved manufacturers shall be: Rob Roy Plasti Bond, Thomas & Betts-OCAL or equal.
8. All fittings shall be of the same material as the respective raceway system.

B. Cable Tray:
1. Materials and Finishes:
   a. Aluminum straight section and fitting side rails and rungs shall be extruded from Aluminum Association Alloy 6063. Fabricated parts shall be made from Alloy 5052.
2. Tray Types:
   a. Ladder type trays shall consist of two longitudinal members (side rails) with transverse members (rungs) welded to the side rails. Rungs shall be spaced 9 inches on center. Rung spacing in radiused fittings shall be measured at the center of the tray's width. Rungs shall have a minimum cable bearing surface of 7/8" with radiused edges. No portion of the rungs shall protrude below the bottom plane of the side rails.
   b. Trough type trays shall be of three piece construction consisting of two longitudinal members (side rails) with a corrugated bottom welded to the side rails. The peaks of the corrugated bottom shall have a minimum flat cable bearing surface of 2-3/4" and shall be spaced 6" on center. To provide ventilation in the tray, the valleys of the corrugated bottom shall have 2¼" x 4" rectangular holes punched along the width of the bottom.
   c. Solid bottom trays shall be of three piece construction consisting of two longitudinal members (side rails) with a solid corrugated bottom welded to the side rails. The peaks of the solid corrugated bottom shall have a minimum flat cable bearing surface of 2-3/4" and shall be spaced 6" on center.
3. Trays shall have an overall nominal depth of 5 inches with a minimum usable loading depth of 4 inches.
4. Straight sections side rails shall be I-beam, C rail or Z rails. All straight sections shall be supplied in standard lengths of 12 feet. Widths shall be 12, 18, 24, 30, or 36 inches.

5. Fitting radius shall be 12 inches minimum. Side rails of straight sections and fittings shall be compatible so that standard splice plates can be used to join straight sections and fittings. Fittings shall have 3" tangents beyond the curved section to accommodate the standard splice plates.
6. Splice plates shall be the bolted type, using either square neck or ribbed-neck carriage bolts and serrated flange lock nuts. The resistance of fixed splice connections between an adjacent section of tray shall not exceed .00033 ohm. The cable tray shall be designed so that a splice plate located anywhere along the span shall not decrease the strength of the cable tray system. Covers and other special accessories shall be furnished as required to protect, support, and install a cable tray system. Specify items in accordance with standards shown in catalog accessories section.
7. Bonding jumpers shall be provided, as required between all vertical channel or tray drops to equipment not rigidly attached to the tray system as required by the N.E.C.
8. Cable trays shall be manufactured by B-Line Systems, Inc. of Highland, Illinois, M.P. Husky Corp., Thomas & Betts, or considered equal with no exceptions to the engineer.

C. Electrical handholes: shall be Composolite as manufactured by Strongwell Corporation or equivalent. Precast concrete handholes and manholes as detailed on the Drawings shall also be acceptable. Handholes and manholes shall be sized per the N.E.C. according to number and sizes of entering conduits. All handholes and manholes shall be rated for H2O wheel loading. Separate handholes, manholes, and conduit systems shall be provided for power, control, and instrumentation systems.

D. Conductors and Cable

1. All power wiring conductors (P-X on drawings) shall be insulated for 600 volts, Type XHHW insulation, unless otherwise noted. Conductors shall be standard AWG and KCMIL sizes. Conductors shall be 98 percent copper, stranded, heat and moisture resistant with cross-linked synthetic polymer insulation for all sizes No. 12 AWG and larger. Smaller sizes shall not be used except for communications and special systems. For lighting and receptacle circuits, solid wire may be used in lieu of stranded wire, for No. 12 and No. 10 AWG only. Conductors shall be labeled with U.L. approval and be marked with the manufacturer's name, wire size and insulation type. All underground power cables shall be UL Listed and Labeled for underground use in wet locations. Acceptable Manufacturers: Okonite, Southwire, Pirelli, or approved equivalent.
2. Control Wiring:
   a. All control wiring (120 or 24 volt, AC or DC) conductors within buildings or above grade shall be insulated for 600 volts, unless otherwise noted, and shall be No. 14 AWG minimum size, or larger if so indicated on the Drawings. Conductors shall be 98 percent copper, stranded, heat and moisture resistant, and thermal plastic insulated and shall be type THWN/THHN.

b. All conductors for control wiring located below grade shall be 600V, 98 percent copper, stranded, heat and moisture resistant, with cross-linked synthetic polymer insulation type XHHW. All underground control cables shall be U.L. Listed and Labeled for underground use in wet locations. Acceptable Manufacturers: Okonite, Southwire, Pirelli, or approved equivalent.

3. Tray cable shall consist of 600V copper conductors, of size and quantity as indicated on the Drawings, protected by a positive PVC outer plastic abrasion resistant fire resistant covering. The conductors shall be twisted together and shall have an overall moisture and fire resistant fibrous covering. The cable shall have a grounding conductor of copper. The cable shall meet the requirements of Article 336 of the National Electrical Code for "Type TC" Tray Cable and shall bear the U. L. Label. Acceptable Manufacturers: U.S. Wire & Cable, Houston Wire & Cable, or approved equivalent.
4. All instrumentation control cables (4-20 mA signal) referred to on the Drawings as "twisted shielded pairs", shall be rated 600V, 80 deg. C, individually shielded twisted pairs, No. 16 AWG, stranded conductors of tinned copper with polyethylene insulation and aluminum-polyester shielding with #18 awg stranded copper drain wire surrounded by a chrome PVC jacket. Control cable shall be UL listed with 100% shield coverage. All underground instrumentation cables shall be U.L. Listed and Labeled for underground use in wet locations. Acceptable Manufacturers: Belden, Alpha Wire & Cable or approved equal. Provide instrumentation control cables equivalent to Belden type 8719 or equivalent unless specified otherwise by the instrument manufacturer.
5. Data Wiring:
   a. Cables for data wiring shall be Category 6, 4-pair, 24 AWG solid bare copper conductor, unshielded, FEP insulation, plenum rated. Acceptable Manufacturers: Belden Type 7813LC, Alpha Wire & Cable, or approved equal.
6. Fire Alarm Wiring:
   a. Signaling circuit conductors for fire alarm wiring installed within buildings shall be 300V (FA cable is rated 300V max LJC 7/25/14), 105 deg C, power limited, type FPLR cable, #14 AWG minimum solid bare copper with PVC insulation encased in a red PVC outer jacket. Acceptable Manufacturers: Belden type 9580 (for two conductors), Alpha Wire & Cable, or approved equal. See drawings for exact number of conductors.
   b. Fire alarm wiring installed within buildings indicated on the drawings to be shielded shall be 300V, 105 deg C, power limited, type FPLR cable, #14 AWG minimum solid bare copper with PVC insulation, aluminum-polyester shield and a #16 awg stranded tinned copper drain wire encased in a red PVC outer jacket. Acceptable Manufacturers: Belden, Alpha Wire & Cable, or approved equal. Provide fire alarm wiring equivalent to Belden type 9581 (for two conductors). See drawings for exact number of conductors.
   c. Conductors for fire alarm wiring installed between buildings either aerially or in underground duct banks, or any location in close proximity

with higher voltage wiring, shall be 300V, 105 deg C, power limited, U.L. Listed and Labeled for underground wet locations, type FPLR twisted shielded pair cable. Cables shall be #12 AWG minimum, solid bare copper with PVC insulation, aluminum-polyester shield and a #16 awg stranded tinned copper drain wire encased in a red PVC outer jacket. Acceptable Manufacturers: Belden, Alpha Wire & Cable, or approved equal. Provide fire alarm wiring between buildings equivalent to Belden type 9583 (for two conductors) or equivalent. See drawings for exact number of conductors.

E. Outlet Boxes

1. Standard, recessed outlet boxes and covers shall be galvanized steel not less than 1-1/2 inches deep, 4 inches square or octagonal, with knockouts. Recessed boxes shall only be used for recessed work. Acceptable Manufacturers: Thomas & Betts, Steel City, OZ Gedney, Raco or equivalent.
2. Outlet boxes exposed to moisture or used for exposed work shall be cadmium cast alloy complete with hubs and gasketed screw fastened covers. Acceptable Manufacturers: Thomas & Betts, Steel City, OZ Gedney, Crouse-Hinds, Raco or equivalent.
3. Outlet boxes used in hazardous, Class I, Div 1, Group C & D locations shall be UL Listed Feraloy iron alloy body with electrogalvanized and aluminum acrylic paint or epoxy powder coat complete with hubs as required for the installation. Provide covers to fit the application. Covers to be utilized for pendant mounted light fixtures shall incorporate flexible cushion or ball type fixture hangers rated for the area in which it is to be installed. Acceptable manufacturer: Crouse Hinds, Appleton or equivalent.
4. Outlet boxes used in corrosive, NEMA 4X areas, shall have a plastic P.V.C. coating as previously described in the conduit, raceway and tubing section. Acceptable manufacturer shall be Rob-Roy "Plasti-Bond", Thomas & Betts, Ocal, or approved equal.
5. In no case shall boxes be sized smaller than as indicated in Article 314 of the National Electrical Code for the conductor sizes installed.

F. Pull and Junction Boxes

1. Boxes shall be with trim for flush or surface mounting in accordance with the location to be installed. Provide screw-on type flush covers. Boxes with hinges and side clips are not acceptable. Boxes installed in damp locations shall be of watertight construction with gasketed cover and conduit hubs. Refer to the Electrical Drawing E-1 for NEMA rated areas for this project and pullbox type and use required.
2. Boxes installed in Class I, Div 1, Group C & D locations shall be constructed of copper free aluminum (body and cover), extruded aluminum hinges with stainless steel cover bolts and neoprene gasket. The box shall be UL Listed for the location and sized as required for the application. Provide NEMA 4/7 pullboxes when installed in these areas.
3. Boxes used in corrosive, NEMA 4X areas, shall have a plastic P.V.C. coating as previously described in the conduit, raceway and tubing section.

Acceptable manufacturer shall be Rob-Roy "Plasti-Bond", Thomas & Betts, Ocal, or approved equal.

4. In no case shall boxes be sized smaller than as indicated in Article 317 of the National Electrical Code for Conduit and Conductor sizes installed.

G. Expansion Fittings

1. Expansion fittings for exposed conduit runs shall be watertight expansion type designed to compensate for up to 8" of movement (4" in either direction). Fittings shall be U.L. listed, shall be malleable iron or ductile iron with exterior and interior zinc plating for corrosion protection. With U.L. listed internal bonding jumper constructed of a tinned copper braid, sized to meet UL fault current test requirements and comply with bonding requirements – NEC 250-.98. Acceptable Manufacturer: O.Z./Gedney Type EX, Thomas Betts Type XJG-TB, or approved equivalent.
2. Expansion/deflection fittings for concealed conduit runs shall compensate for up to 3/4" of movement in any direction. Fittings shall be U.L. listed and be water, rain and concrete tight. Fittings shall be constructed of bronze end couplings, neoprene sleeve with stainless steel bands and a internal braided tinned copper bonding jumper and Ericson type conduit union. Acceptable manufacturer: O.Z. Gedney type DX, Thomas Betts type XD, or equal.

H. Wiring Devices

1. Wiring devices shall be specification grade as described herein. Switch handles, receptacles, etc. shall be installed in a single color. New wiring devices installed in existing facilities shall match previous installed devices. Provide device cover plates of satin finish stainless steel in finished areas and cadmium finished sheet steel in unfinished areas. Acceptable manufacturers are: Hubbell, Coopper-Arrow-Hart, Legrand-Pass, or Seymour. Provide devices as indicated by Contract Documents.
2. Toggle Switches
   a. 20 Ampere, 1-pole, 277 Volt: Hubbell 1221
   b. 20 Ampere, 2-pole, 277 Volt: Hubbell 1222
   c. 20 Ampere, 3-way, 277 Volt: Hubbell 1223
   d. 20 Ampere, 4-way, 277 Volt: Hubbell 1224
3. Receptacles
   a. 20 Ampere, 125 Volt, Single Receptacle: Hubbell 5361
   b. 20 Ampere, 125 Volt, Duplex Receptacle: Hubbell 5362
   b. 20 Ampere, 125 Volt, Duplex G.F.I. Receptacle: Hubbell GF-5362
   c. 20 Ampere, 125 Volt, Duplex, Weatherproof: Crouse Hinds WLGF-FS with GFI receptacle

I. Safety Switches

1. All safety switches shall be NEMA Type HD and Underwriters Laboratories Listed.
2. The handle position shall indicate whether the switch is "ON" or "OFF".
3. All current carrying parts shall be plated to resist corrosion and promote cool operation. Switches shall have removable arc suppressers where necessary to permit easy access to line side lugs. Lugs shall be front removable and UL listed for 60°C or 75°C, aluminum or copper wires.

4. Provisions for padlocking the switch in the "OFF" position with at least three locks shall be provided.
5. Switches shall have a dual cover interlock to prevent unauthorized opening of the switch door when the handle is in the "ON" position, and to prevent closing of the switch mechanism with the door open.
6. Disconnect switches, indicated on the drawing to be used for motors controlled by variable frequency drives shall be as indicated above, except shall be 4 pole type switches. The fourth pole shall be wired directly to the disable input, in series with the safety e-stop, in order to lock-out and immediately shutdown the drive. The auxiliary 4th pole shall open prior to any of the other three power poles and shall be designed for proper use with VFD type load circuits.
7. Enclosures
   a. Safety switch enclosures for non-hazardous locations painted galvanized steel for NEMA 12 area and stainless steel for NEMA 4X areas.
   b. Switches specified as NEMA 7 & 9 shall be furnished in cast aluminum enclosures with conduit provisions as specified. Enclosures shall be provided with a bolted cover and with sealing means for hazardous location protection. "ON" and "OFF" position identification shall be cast into the cover, not painted on or applied with an adhesive.
8. Acceptable Manufacturers: Square-D, Cutler-Hammer, General Electric, Siemens, or approved equal.

J. Ground Rods, Ground Cable, Ground Fittings
1. Ground Rods shall be copper-clad steel at least 3/4-inch in diameter and 10 feet long. The rods shall have a hard, clean, smooth, continuous, surface throughout the length of the rod.
2. Ground System Cable and taps shall be copper stranded, sized as indicated on Drawings and/or in Section 16450. Exothermic welding connections shall be required for underground connections; mechanical fittings are acceptable for above ground connections only. Reference Section 16450. Acceptable manufactures are Erico-Cadweld, Thomas & Betts-Blackburn, or equivalent.
3. Irreversible compression connectors must be factory filled with an oxide inhibitor and installed with the same manufacturers die so that the die index matches the listed index on the connectors.
4. Connector must be fully crimped with a 14 ton or larger hydraulic tool so that the index number is indented on the connector. Connectors must comply with IEEE837, UL467 and CSA22.2. As manufactured by: Thomas & Betts-Blackburn, Hubbell-Burndy or equivalent. Irreversible compression connectors may be used in above ground applications.

K. Metal Framing Channel
1. Channel for all locations shall be roll formed from stainless steel AISI Type 316. Channel shall be 1-58” and comply with the following industry standards: NFPA70, Fed Spec: W-C-582, WW-H-171, MFMA-4, and ASTM B633
2. Use stainless steel fittings and hardware of the same material as channel. Fittings shall be by same manufacturer.

3. All metal framing channel ends shall be furnished and installed with plastic caps for the entire installation of this project at all ends of framing.
4. Provide a complete 4" "C" angle channel mounting channel and hardware system as shown on the drawings. Refer to the electrical detail drawings for structural sizing and rigidity of "C" channel.
5. Metal framing shall be B-Line Systems, Inc. of Highland, Illinois, Thomas & Betts-Super Strut, Unistrut.

L. Splice Kits
1. For splices and taps, No. l0 AWG and smaller, use solderless "Thread-On" connectors having spiral steel spring and insulated with a vinyl cap and skirt, as manufactured by 3M Co. (pre- insulated "Scotch-Lock") or Ideal ("Wing-Nuts").
2. Splicing For splices and taps, No. 8 or larger:
   a. This work will require that all splices be tested and also provide the splices with a compression connector on the conductor. Splice device shall provide mechanical, split resistance, flame retardant, and environmental protection.
   b. Provide a UL listed in line mechanical crimp splice for each connection. Connector shall be rated for 600 V and rated for conductor current at 90 deg. C. Provide heavy walled heat shrinkable splice insulation by means of a thermoplastic adhesive sealant material which shall be applied by a clean burning propane gas torch. Heat shrink heavy wall tube shall be 3M type ITSCF or equal.

M. Link Seal
1. Conduit wall and floor seals for cored holes and sleeved openings shall be Link Seal, Innerlynx or approved equivalent. Refer to the contract drawings for additional requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Unless otherwise noted, wiring for all systems indicated in the Contract Documents shall consist of insulated conductors installed in raceways in accordance with the manufacturer's instructions.
1. Raceways shall be continuous from outlet box to outlet box and from outlet box to cabinet, junction or pull box. Secure and bond raceways to all boxes and cabinets such that each system of raceways will be electrically continuous throughout.
2. Contract drawing **E-1 NEMA CLASSIFICATIONS FOR ELECTRICAL EQUIPMENT AND ENCLOSURES** indicates the NEMA ratings of each location at the facility.

B. Unless otherwise indicated on the Drawings, install all wiring in the following applicable raceway system**:**
   1. Wiring above 600 volts in indoor dry locations (NEMA 1 or 12) Heavywall aluminum conduit.
   2. Wiring 600 volts or less in dry concealed locations [hung above ceilings, attic areas, or within CMU block walls] (NEMA 1 or 12): Galvanized electrical metallic tubing (for raceway sizes up to and including 2" trade size) or galvanized rigid heavy wall steel conduit.
   3. Wiring 600 volts or less in dry exposed indoor locations (NEMA 1 or 12): Rigid heavy wall aluminum conduit. G
   4. Wiring 600 volts or less in indoor wet locations or outdoor above grade locations (NEMA 3R or 4X): Rigid heavy wall aluminum conduit.
   5. Wiring 600 volts or less in indoor or outdoor corrosive chemical areas: use PVC-coated rigid steel conduit in these areas less than 8 feet from finished floor. Use PVC Schedule 80 conduit in these areas 8 feet or more from finished floor in corrosive chemical areas. Where conduits transition, a NEMA 4X stainless steel or PVC coated junction box or pull box must be installed. The metal conduit shall be provided with a grounding bushing and the metal conduit and metal box shall be bonded to the ground conductor within the raceway per NEC.
   6. Wiring 600 volts or less in hazardous locations (NEMA 7 or 9): Galvanized rigid heavy wall steel conduit, PVC galvanized rigid steel conduit, or rigid heavy wall aluminum conduit.
      a. PVC coated rigid galvanized steel (RGS) conduit: manufacturer shall provide field installers certification training. All installers shall be field certified from manufacturer and provide proof of certification for installation upon request.
      b. All field installation and repairs of PVC coated rigid galvanized steel (RGS) conduit shall conform to manufacturer’s recommendation and use of manufacturer patch and repair kits in order to guarantee certified products are used and compliance with all factory warranty guidelines are met.
   7. Use of Miscellaneous Conduit Types
      a. Flexible "liquid tight" metal conduit shall be used for final connection to the following:

         * all motors * rotating or vibrating equipment
         * dry type transformers * recessed lighting fixtures

         Lengths of liquid tight flexible metal conduit shall be kept to a minimum (12 to 18 inches) and maximum length of 2'-6" except when dictated otherwise by a particular installation approved by the Engineer and as allowed by NEC.
      b. PVC Schedule 80 non metallic conduit shall be used as shown on drawings.
      c. Conductors for fire alarm circuits shall be routed in rigid galvanized steel conduit unless otherwise noted on the drawings. Minimum conduit size shall be ¾".

d. Armored direct burial cable shall be installed underground to equipment as shown on drawings.

8. All below grade signal wiring shall be installed in rigid galvanized steel or PVC coated rigid galvanized steel conduit.

C. Cable Tray

1. When shown on drawings, cable tray system shall be utilized for routing conductors. Conductor phase, neutral, and ground conductors shall be bundled for feeders with parallel runs. Contractor shall submit cable tray loading based on planned number of cables in each tray along with maximum load data for the proposed cable tray. Numbers of cables shall meet the NEC requirements for the planned cable tray in accordance with Article 392.
2. Provide bonding and grounding, as required of all raceway systems to ensure electrical continuity back to the power source for a complete system.
3. Conductor drops to electrical loads from the tray system shall be accomplished using either tray, channel or conduit with approved pullbox transition section and fittings and bonding to the tray system to maintain electrical continuity for a complete system.
4. Cable tray shall be installed level, parallel or perpendicular to walls, ceilings and floors.
5. Cable trays installed in a stacked manner shall leave a minimum of 9 inches between top of tray and bottom of additional trays.
6. Fittings and hardware used in connection of tray sections or supports shall be constructed of the same materials as the tray system.
7. Refer to the contract drawings for general cable tray layout and requirements.

D. Requirements for Conduit Below Grade concrete encased or non-encased.

1. Underground Raceways:
   a. All underground raceways shall be Schedule 40 heavy wall PVC conduit except as noted. Encase all underground raceways in a concrete envelope as required.
   b. Refer to drawings for specific concrete encasement duct bank details and requirements.
   c. For all underground raceways, non encased in concrete see electrical drawings for additional electrical installation details. Bottom of trench shall be solid undisturbed earth. Earth showing extensive signs of peat, cinders, rubble or any conditions not suitable for a stable foundation should be reported to the Engineer for recommendation. In areas which have had fill work completed during the progress of work under this contract, verify that the bottom of trench is 95 percent compaction minimum. If compaction is less than 95 percent provide additional compaction in bottom of trench.
   d. Provide underground electrical marking tape for the full length of all trenches for underground raceways. Marking tape shall be SETON #85517 Electrical, Telephone, or equivalent.
2. Raceways In Slabs:
   a. Raceways for embedment within a slab, wall or beam, other than those merely passing through, shall satisfy the following:

i. Power and control conduits shall be rigid heavy wall Schedule 40 PVC conduit.
ii. Instrumentation conduits shall be rigid galvanized steel or PVC-coated rigid galvanized steel conduit.
iii. Shall not be larger in outside diameter than one-third (1/3) the thickness of the slab, wall or beam.
iv. Raceways shall not be spaced closer than 3 diameters on center.
v. Shall not impair significantly the strength of the concrete.
vi. Conduits installed in slab on grade shall have a 3 inch concrete envelope and reinforcing and coverage all sides poured monolithic with the slab. Where raceways are going to remote locations it shall not be required to pour the envelope monolithic with the floor slab.

b. Raceways beneath above grade concrete slabs shall be supported from the underside of the structural slab by means of galvanized pipe hangers spaced 5'-0" on center, maximum. After installation pipe hangers shall be coated with asphalt mastic. Installation shall maintain integrity of waterproofing membrane.
c. Raceways which extend out from a slab, penetrate concrete floor slabs, walls, ceilings, etc., shall be PVC coated rigid galvanized steel and shall extend a minimum of 12-inches on both sides of the concrete structure prior to transitioning to an approved raceway material as specified for the specific location and NEMA area designated.

3. Concrete Encasement of Raceways (Where applicable):
a. All concrete work required for concrete encasement of electrical duct banks shall be provided under Division 3 - Concrete, including all reinforcing steel requirements. All excavation and backfill for electrical duct banks shall be provided under Division 2 - Site Work. This Contractor shall coordinate all requirements noted herein with those Divisions for proper installation.
b. Form concrete envelope around raceways, 3 inch minimum thickness concrete at top, bottom and sides of duct bank 7-1/2 inch minimum center-to-center spacing between raceways. Concrete shall be full width of trench. Top raceway shall be not less than 30 inches below finished grade, except where under building slabs. Open trench for its complete length before concrete is poured; if any obstructions are encountered, make provisions to avoid them. Support raceways minimum 3 inches above bottom of trench before pouring concrete. Provide 12" separation between Power and Control/Signal conduits.
c. Refer to structural drawings for specific concrete encasement and reinforcing requirements and details. All duct banks shall be formed with wooden forms and no other method of installation shall be allowed. Coordinate with Division 2 and 3 for final installation.
d. Furnish and install precast concrete, plastic or fiber spacers in order to achieve consistent spacing between raceways. Stagger couplings. Securely tie raceways in place to prevent floating. Pour concrete as soon as possible after placing and securing of raceways.

e. Pull iron-shod mandrel, not more than l/4 inch smaller than bore of raceway, through each raceway to remove concrete and other obstructions. Clean raceway by drawing through properly sized cylindrical brushes as many times as necessary to remove dirt.
f. All duct banks shall be installed to slope back to the respective manholes, handholes, etc. and away from buildings or structures.
g. All duct banks where they are installed underground and are directed toward a building or structure shall transition from non-metallic conduit to metallic rigid galvanized conduit of the same diameter 5'-0" from the respective building or structure for all locations. The same type of metallic conduit shall continue to its final location per the NEMA rating of the areas that it is installed in. Provide proper transition connections for this change in conduit type. No exceptions will be allowed.
h. Instrumentation cables (signal conduits) shall be installed in steel conduit, either rigid galvanized steel conduit or PVC-coated rigid steel conduit, in accordance with the NEMA rating of the area of installation.

E. General Raceways Installation Requirements:
1. Sized as indicated on the Drawings. Where sizes are not indicated, raceways shall be sized per the National Electrical Code in accordance with the quantity, size, type and insulation of conductors to be installed. However, raceways shall be minimum three quarter (3/4") trade size for all installation unless otherwise noted.
2. Installed to provide adequate grounding between all outlets and the established electrical system ground. Bond conduit systems per NEC.
3. Cut square, free of burrs due to field cutting or manufacture, and bushed where necessary. Spray all ends of threaded conduit with cold galvanizing spray compound.
4. Installed with exterior surfaces not less than six inches (6") from any surface with a temperature of 200 degrees F or higher.
5. Plugged at the ends of each roughed-in raceway with an approved cap or disc to prevent the entrance of foreign materials during construction.
6. Concealed throughout except where exposure is permitted by the Engineer.
7. Installed parallel or perpendicular to floors, walls and ceilings.
8. Installed with a minimum of bends and offsets. All bends shall be made without kinking or destroying the cross section contour of the raceway. Factory made bends shall be used for raceways one-inch (1") trade size and larger.
9. Installed with U. L. approved raintight and concrete-tight couplings and connectors.
10. Firmly fastened within three feet of each outlet box, junction box, cabinet or fitting. Raceways shall not be attached to or supported by wooden plug anchors or supported from Mechanical Work such as ductwork, piping, etc.
11. Arranged in a neat manner for access and allow for access to work installed by other trades.
12. If it is necessary to burn holes through webs of beams or girders, call such points to the attention of the Engineer and receive written approval both as to

location and size of hole before proceeding with work. All holes shall be burned no larger than absolutely necessary.

13. Where raceways puncture roof, install pitch pockets as required in order that the roof warranty is maintained.
14. Where raceways penetrate fire-rated walls, floors, or ceilings, install firestops equal to the rating of the wall, floor, or ceiling, per specification section 07270, "Fireproofing".

F. Wiring Methods

3. Feeder conductors shall be continuous from point of origin to load termination or spliced to the original feeder conductors as shown on the drawings.. If any continuous runs are not practical, contact the Engineer and receive written approval for splicing prior to installation of feeder(s). Refer to Splicing Methods listed below.
1. Do not pull conductors into raceways until raceway system, including all outlets, cabinets, bushings and fittings, is completed. Verify that all work of other trades which may cause conductor damage is completed. Use only U.L. approved cable lubricants when necessary. Do not use mechanical means to pull conductors No. 8 or smaller.
2. In general, conductors shall be the same size from the last protective device to the load.
3. All wiring systems shall be properly grounded and continuously polarized throughout, following the color coding specified. Connect branch circuit wiring at panelboards, as required, in order to provide a "balanced" three-phase load on feeders.
4. All feeder connections shall be made to bus and other equipment using solderless, pressure type terminal lugs, as manufactured by Burndy, National, O.Z., T. & B., or equivalent.

G. Conduit Support

1. Support adequately by malleable iron pipe clamps or other approved methods. **In exterior or wet locations and along outside wall supports shall allow not less than 1/4 inch air space between raceway and wall**. Firmly fasten raceway within 3 feet of each outlet box, junction box, cabinet or fitting. The following table lists maximum spacing between supports. Additional supports may be required due to field conditions, strength of supporting members, etc. Furnish and install such supports at no additional cost to Owner.

Conduit Trade Size	Type of Run	Horizontal Spacing in Feet	Vertical Spacing in Feet
¾"	Concealed	7	10
1:, 1-1/4"	Concealed	8	10
1-1/2" & lgr.	Concealed	10	10
¾"	Exposed	5	7
1", 1-1/4"	Exposed	7	8
1-1/2" & lgr.	Exposed	10	10

H. Installation of Concrete Envelope
   1. Wherever a cluster of four or more raceways rise out of floor exposed, provide neatly formed 6" high concrete envelope with chamfered edges around raceways.

I. Installation of Spare Conduits
   1. At each flush mounted panel-board, terminal cabinet, control cabinet, etc., provide four (4) spare three-quarter inch (3/4) raceways from panel-board, etc. to an area above the nearest accessible ceiling space and floor space in the specific room location. Make 90 degree turn above the ceiling or below the floor and cap all conduits.
   2. Where drawings indicate a "Spare" conduit, install a #14 AWG fish wire in all runs to facilitate future installation of conductors.

J. Installation of Bushings and Grounding Bushings
   1. Provide grounding type insulated bushings on all power conduits regardless of size.
   2. Provide grounding type insulated bushings on all control conduit sizes and signal conduit sizes one and one-quarter inch (l-l/4") trade size and larger.
   3. Provide standard bushings for conduits one inch (l") and smaller unless otherwise stated.
   4. Install cable seal bushings in conduits for all outdoor locations and NEMA 4X locations to prevent moisture from entering enclosures and equipment.
   5. Install cable seals in all conduits where there is a change in temperature such as transitioning from a room to the attic.
   6. Provide a bushing at each conduit termination unless fitting at box where conduit terminates has hubs designed in such a manner to afford equivalent protection to conductors.
   7. Any installations not provided with these requirements shall be removed and reinstalled at no additional cost to the Owner.

K. Myers Hubs
   1. Myers hubs shall be installed on junction boxes and enclosures which do not have cast hubs in non classified areas.

L. Expansion Fittings
   1. All conduit installations where conduits extend up out of the ground at buildings, structures or equipment shall be provided with expansion fittings.
   2. Expansion/deflection type fittings shall be provided at all horizontal or vertical expansion joints, located in new or existing buildings and structures.

M. Link Seals
   1. All penetrations through existing and new concrete floors, and walls shall be core drilled and sleeved, and installed with a link seal.
   2. Refer to all details shown on the Contract Drawings for conduit sealing fittings and weatherproof conduit seals. All conduit penetrations are required to be provided with seals as noted on the Contract Drawings and as specified. Any installations not provided with these requirements shall be removed and reinstalled at no additional cost to the Owner.

N. Raceways through Wall Bond Outs
   1. In specific areas wall bond outs have been designed and shown on the electrical and structural drawings for conduit installations.

O. Splicing Methods
   4. Feeder conductors shall be continuous from point of origin to load termination without splice or spliced to original feeders as noted on the drawings. If any continuous runs are not practical, contact the Engineer and receive written approval for splicing prior to installation of feeder(s).
   5. For splices and taps, No. l0 AWG and smaller, use solderless "Thread-On" connectors having spiral steel spring and insulated with a vinyl cap and skirt, as manufactured by 3M Co. (pre- insulated "Scotch-Lock") or Ideal ("Wing-Nuts").
   6. Splicing For splices and taps, No. 8 or larger:
      c. This work will require that all splices be tested and also provide the splices with a compression connector on the conductor. Splice device shall provide mechanical, split resistance, flame retardant, and environmental protection.
      d. Provide a UL listed in line mechanical crimp splice for each connection. Connector shall be rated for 600 V and rated for conductor current at 90 deg. C. Provide heavy walled heat shrinkable splice insulation by means of a thermoplastic adhesive sealant material which shall be applied by a clean burning propane gas torch. Heat shrink heavy wall tube shall be 3M type ITSCF or equal.
   7. Use cast connections, Cadweld or Thermoweld, for ground conductors.
   8. Make all splices and connections in accessible boxes and cabinets only.
   9. Where feeder conductors pass through junction and pull boxes, bind and lace conductors of each feeder together. For parallel sets of conductors, match lengths of conductors as near equal as possible.
   10. Branch circuit conductors installed in panelboards, and control conductors installed in control cabinets and panels shall be neatly bound together using "Ty-Raps" or equivalent.

P. Installation of Ceiling Hung Devices
   1. Lighting fixtures, detectors, etc., in Mechanical Equipment, Boiler and Pump Rooms shall be installed with exposed conduit after equipment, ductwork, piping, etc., are in place.

Q. Grouping of Conductors
   1. Contractor may group certain wiring with the approval of the Engineer, as follows.
      a. Power 120V may be grouped with power 120V

b. Control 120V may be grouped with control 120V
c. Control 24V may be grouped with control 24V
d. Instrumentation may be grouped with instrumentation
e. Specialty wiring may be grouped with like systems
f. Power wiring at 480V shall not be grouped
g. Fire alarm system wiring shall not be grouped with other systems

The installation shall be installed in accordance with all requirements of the NEC (including wire ampacity derating factors), manufacturer's requirements, and the Engineer. Excessive grouping which interferes with functionality and reliability will not be allowed. The wiring configuration as shown on the drawings is the baseline requirement for the work.

R. Light Switches
1. All light switches shall be installed in close proximity of the door opening where indicated on drawings. Where lights are shown adjacent to strike side of door, locate edge of switch box approximately 6 inches from door frame.
2. Install cover plates for all single and multi-gang switch boxes for all light switches.

S. Outlet Boxes
1. On termination at branch circuit outlets, leave a minimum of eight inches (8") free conductor for installation of devices and fixtures.
2. Consider location of outlets shown on Drawings as approximate only. Study Architectural, Mechanical, Plumbing, Process, and Structural Drawings and note surrounding areas in which each outlet is to be located. Locate outlet so that when fixtures, motors, cabinets, equipment, etc., are placed in position, outlet will serve its desired purpose. Where conflicts are noted between Drawings, contact Engineer for decision prior to installation. Comply with Article 314 of National Electrical Code relative to position of outlet boxes in finished ceilings and walls.
3. Prior to installation, relocate any outlet location a distance of five feet in any direction from location indicated on Drawings if so directed by the Engineer. Prior to completion of wall construction, adjust vertical height of any outlet from height indicated if so directed by Engineer. The above modifications shall be made at no additional cost to the Owner.
4. Where outlets at different mounting heights are indicated on Drawings adjacent to each other (due to lack of physical space to show symbol on Drawings), install outlets on a common vertical line.
5. Where switch outlets are shown adjacent to strike side of door, locate edge of outlet box approximately 3 inches from door frame.
6. Outlet boxes in separate rooms shall not be installed "back-to- back" without the approval of the Engineer.
7. Outlet boxes installed in plaster, gypsum board or wood paneled walls shall be installed with raised plaster covers or raised tile covers.
8. Outlet boxes installed in tile, brick or concrete block walls shall be installed with extra-deep type raised tile covers or shall be 3-l/2 inches deep boxes with square corners and dimensions to accommodate conductors installed.

9. Surface ceiling mounted outlet boxes shall be minimum 4 inches square, l-l/2 inches deep, galvanized sheet metal.
10. Surface wall mounted outlet boxes shall be cast type boxes having threaded or compression type threadless hubs. Exterior boxes shall be cast type with threaded hubs and gasketed cover plates secured by non-ferrous screws.
11. Install a device cover plate over each and every outlet indicated on Drawings. Do not install plates until painting, cleaning and finishing of surfaces surrounding the outlet are complete. Cover plates shall completely cover all edges of openings in the wall around the outlet box for a neat/finished installation.

T. Junction and Pull Boxes

1. Install junction and pull boxes in readily accessible locations. Access to boxes shall not be blocked by equipment, piping, ducts and the like. Provide all necessary junction or pull boxes required due to field conditions and as required by the National Electrical Code, Article 314.

U. Equipment Mounting Heights

1. Unless otherwise noted, mount devices and equipment at heights measured from finished floor to device/equipment base as follows: (Device base to be set at CMU joint unless otherwise noted. The Contractor shall verify all dimensions noted with the Engineer for final approval prior to performing or installing any of this work.)

a. Toggle switches (up position "on")	48"
b. Receptacle outlets (long dimension vertical, ground pole nearest floor)	l6"
c. Receptacle outlets, above baseboard heaters	30" min.
d. Receptacle outlets, hazardous areas	48"
e. Receptacle outlets, at countertops	48"
f. Receptacle outlets, weatherproof, above grade	24" min.
g. Telephone/intercommunication outlets, wall mounted	48"
h. Telephone and data outlets and cable T.V. outlets	16"
i. Fire alarm manual station	48"
j. Fire alarm Audio/Visual Station	96"
k. Branch circuit panelboards, to top of backbox	72"
l. Distribution panelboards, to top of backbox	72"
m. Terminal cabinets, control cabinets, annunciator panels, to top of backbox	72"
n. Disconnect switches, motor starters, enclosed circuit breakers, to top of box	60"

2. Where structural or other interferences prevent compliance with mounting heights listed above, consult Engineer for review to change location before installation.

V. Hangers and Supports

1. Provide steel angles, channels and other materials necessary for the proper support and erection of motor starters, distribution panelboards, large disconnect switches, pendant-mounted lighting fixtures, etc.
2. Panelboards, cabinets, large pull boxes, cable support boxes and starters shall be secured to ceiling and floor slab and not supported from conduits. Small

panelboards, etc., as approved by Engineer, may be supported on walls. Racks for support of conduit and heavy electrical equipment shall be secured to building construction by substantial structural supports with PVC end caps as noted above.

3. All vertical supports for stanchion mount structures and control stations shall be 4" angle channel.
4. Provide PVC end caps for all protruding angles, channels, struts, etc. for personal safety for the entire project installation.

W. Security Systems:

1. Provide switches and wire according to the electrical drawings.
2. Provide full integration and programming by Simplex of the new security devices with the existing Simplex Security System

X. Identification of Conduit Systems, and Cable Tray Wire bundles

1. Provide lamacoid nameplates to mark intrinsically safe conduit systems for all applicable conduit systems for project.
2. Provide plastic PVC tags to indicate the respective bundle wire tags within each cable tray.

3.2 TESTS

A. For testing requirements, refer to Section 16950.
B. For grounding requirements, refer to Section 16450.

END OF SECTION

SECTION 16406

LOW VOLTAGE SWITCHBOARDS WITH GROUND FAULT PROTECTION

PART 1 - GENERAL

1.1 DESCRIPTION

A. The Contractor shall furnish and install, where indicated, a free-standing, dead-front type low voltage distribution switchboard, utilizing group mounted circuit protective devices as specified herein, and as shown on the contract drawings and indicated on the "Single Line Diagrams".

B. For additional required identification nameplates for all distribution equipment, refer to Section 16010.

1.2 QUALITY ASSURANCE

A. The equipment specified herein is based upon the first manufacturer named after the phrase "Acceptable Manufacturer's". Equipment types, device ratings, dimensions, etc. correspond to the nomenclature dictated by that manufacturer. Equipment of other acceptable manufacturer's shall be equivalent in every way to that of the equipment specified.

B. Suppliers deemed equivalent shall be responsible to support and supply equivalent equipment which shall meet the intended design. Any extensive modifications or rework of the design drawings in order to facilitate acceptability shall be the responsibility of this Contractor at no additional cost to the Owner.

C. All equipment shall be tested at the factory. Unless specified elsewhere, standard factory inspection and operational tests will be acceptable.

D. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly and UL Listed and Labeled.

E. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

F. Equipment shall comply with the latest applicable standards of NEMA PB2 and UL 891

G. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

H. Manufacturer shall certify proper installation and provide start-up assistance.

I. Refer to equipment manufacture requirements under 16010, Section 1.2.

1.3 SUBMITTALS TO THE ENGINEER

A. Submit Shop Drawings for all service and distribution equipment, in their entirety, specified herein including the following information:

1. Manufacturer and equipment type.
2. Standard catalog information sheet.
3. Detailed Shop Drawings indicating plan, elevation, end, and isometric views.

4. Single-line diagram.
5. Complete bill of materials.
6. Additional information necessary to verify equipment to be supplied has features specified.

B. Submit complete documentation for coordination, short circuit, and arc flash study and report immediately upon approval of equipment and prior to start-up and testing of any equipment. Selection of equipment in order to make any necessary changes based on the study's findings before the equipment is approved. No start-up will be allowed without this study and report and without the final recommended system settings being implemented and tested in the field. If equipment needs to be ordered prior to receiving the study, all necessary changes will be the responsibility of the contractor at no additional costs.

C. Provide six (6) copies of all correspondence, including verbal communications, with the utility company to the Engineer. Correspondence shall verify approval of the utility company for the proposed service, as designed. This must be submitted as soon as possible based on the intended design indicated on the Contract Drawings and part of the approval process for this Section.

1.4 REFERENCE TO OTHER SECTIONS

A. Refer to Section 16010 for shop drawing formatting requirements.
B. Refer to Section 16010 for identification nameplates requirements.
C. Refer to Section 16010 for coordination, short circuit, and arc flash study requirements.
D. Refer to Section 16900 for control device requirements.
E. Refer Division 13 for Seismic Requirements.

1.5 WARRANTY

A. Manufacturer shall warrant specified equipment free from defects in materials and workmanship for the lesser of one (1) year from the date of installation or eighteen (18) months from the date of purchase.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Distribution Switchboard(s) (480/277V)
   1. General:
      a. The low voltage distribution switchboards and all components shall be designed, manufactured and tested in accordance with the latest applicable following standards:
         i. NEMA PB-2
         ii. UL Standard 891
      b. Switchboard shall be UL Listed and labeled.
      c. Switchboard(s) shall be manufactured by General Electric, Eaton/Cutler-Hammer, or Square D.
         i. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Products in compliance with the

specification and manufactured by others not named will be considered only if pre-approved by the Engineer ten (10) days prior to bid date.

d. Equipment operation and maintenance manuals shall be provided with each assembly shipped and shall include instruction leaflets, instruction bulletins and renewal parts lists where applicable, for the complete assembly and each major component.
e. Small wiring, necessary fuse blocks and terminal blocks within the switchboard shall be furnished as required. All groups of control wires leaving the switchboard shall be provided with terminal blocks with suitable numbering strips.
f. Future Provisions: All unused spaces provided, unless otherwise specified, shall be fully equipped for future devices, including all appropriate connectors and mounting hardware.

2. Ratings
   a. Voltage, Hertz, current, and minimum Short Circuit ratings shall be as indicated on the drawings.
3. Enclosure: Type 1 - General Purpose.
   a. Sections shall be aligned front and rear, dead front type, self-supporting structure.
   b. Removable steel base channels (1.5 inch floor sills) shall be bolted to the frame to rigidly support the entire shipping section for moving on rollers and floor mounting.
   c. The switchboard enclosure shall be painted on all exterior surfaces. The paint finish shall be a medium gray, ANSI #49, applied by the electro-deposition process over an iron phosphate pre-treatment.
   d. All front covers shall be screw removable with a single tool and all doors shall be hinged with removable hinge pins.
   e. Top and bottom conduit areas shall be clearly indicated on shop drawings.
   f. Rear access to this equipment shall not be allowed. All connections to the switchboard shall be accessible from the front of the equipment.
   g. The side and bus connection sections shall be covered with removable screws-on plates.
   h. All edges of front cover panels shall be formed.
   i. Provide the required number of vertical sections bolted together to form one rigid switchboard.
   j. Each switchboard shall be split sectional and arranged for shipping in order to allow this equipment to be appropriately installed within the space as indicated on the Contract Drawings.
4. Nameplates:
   a. Provide 1 inch high x 3 inches engraved laminated (Gravoply) nameplates for each device. Furnish black letters on a white background for all voltages.
   b. Refer to section 16010 for additional requirements
5. Bussing:
   a. All bus bars shall be silver-plated cooper with bolted connections at joints. The bus bars shall be of sufficient size to limit the temperature rise to 65

degree C rise based on UL tests, and rated to withstand mechanical forces exerted during short circuit conditions when directly connected to a power source having an available fault current as indicated on contract drawings.

b. A ground bus shall be furnished firmly secured to each vertical section structure and shall extend the entire length of the switchboard. An incoming ground lug shall be furnished. Other ground lugs for feeder circuits shall also be supplied as shown in the schedules on the drawings.
c. All hardware used on conductors shall be high-tensile strength and plated. All terminals shall be of the anit-turn solderless type suitable for copper or aluminum cable of sizes indicated for 75 degree C cable.
d. Shall be plated copper. Plating shall be applied continuously to all bus work. The switchboard bussing shall be of sufficient cross-sectional area to meet UL Standard 891 temperature rise requirements.
e. The phase and neutral through-bus shall have an ampacity as shown in the plans. Tapered bus is not acceptable.
f. Full provisions for the addition of future sections shall be provided.
g. Bussing shall include all necessary hardware to accommodate splicing for future additions.
h. Ground Bus shall be sized per NFPA70 and UL 891 Tables 25.1 and 25.2 and shall extend the entire length of the switchboard.
i. Provide all required number of lugs/phase at all equipment as required by the installation and as shown on the Drawings.

6. Automatic Transfer Switch
   a. Provide an automatic transfer switch as part of the switchboard configuration as shown on contract drawings. This shall be provided and warranted by the generator supplier. Refer to section 16415 for additional requirements.

7. Cable Pull Section
   a. Furnish cable pull sections complete with cable tie down supports. as shown on the Drawings. Review contract drawings for configuration, quantities and entrance of conduits and cables.
      i. Provide section to match depth, height and width of equipment for proper alignment.
8. Manual Transfer Control
   a. Kirk Key interlocks in a main-main configuration for SWBD-GEN shall be provided as indicated on the Contract Drawings.

9. Protective Devices - Main Circuit Breaker (MCB), Generator Breakers:
   a. Two-step stored energy, fixed mounted, electronic trip circuit breaker
      i. Circuit protective devices shall be two-step stored energy circuit breakers - GE Drawout type SSD or equivalent.
      ii. Circuit breaker trip system shall be a microprocessor-based true rms sensing design with sensing accuracy through the thirteenth (13th)

harmonic. Sensor ampere ratings shall be as indicated on the associated drawings.

iii. The integral trip system shall be independent of any external power source and shall contain no less than industrial grade electronic components.

iv. Circuit breakers shall be equipped with back-up thermal and magnetic trip system.

v. The ampere rating of the circuit breaker shall be determined by the combination of an interchangeable rating plug, the sensor size and the long-time pickup adjustment on the circuit breaker. The sensor size, rating plug and switch adjustments shall be clearly marked on the face of the circuit breaker. Circuit breakers shall be UL Listed to carry 100% of their ampere rating continuously.

vi. The following time/current response adjustments shall be provided. Each adjustment shall have discrete settings and shall be independent from all other adjustments.
Long Time Pickup & Long Time Delay
Short Time Pickup & Short Time Delay (I^2t IN & I^2t OUT)
Instantaneous Pickup
Ground Fault Pickup & Ground Fault Delay (I^2t IN & I^2t OUT) as required.

vii. A means to seal the rating plug and trip unit adjustments in accordance with NEC Section 240-6(c) shall be provided.

viii. Local visual trip indication for overload, short circuit and ground fault trip occurrences shall be provided.

ix. An ammeter to individually display all phase currents flowing through the circuit breaker shall be provided. Indication of inherent ground fault current flowing in the system shall be provided on circuit breakers with integral ground fault protection. All current values shall be displayed in True rms with 2% accuracy. Device shall be furnished with ETU, LSIG Programmer.

x. Long Time Pickup indication to signal when loading approaches or exceeds the adjusted ampere rating of the circuit breaker shall be provided.

xi. The trip system shall include a Long Time memory circuit to protect against intermittent overcurrent conditions above the long time pickup point. Means shall be provided to reset Long Time memory circuit during primary injection testing.

xii. Circuit breaker trip system shall be equipped with an externally accessible test port for use with a Universal Test Set. Provide one (1) Universal Equipment Test Set for this project job for final inspection. This test set shall be suitable for testing all electric circuit breakers specified for this project. No disassembly of the circuit breaker is required for testing.

xiii. Communications capabilities for remote power monitoring of circuit breakers using RS485 to Ethernet converter; data to include voltage/current per phase, frequency, real power, reactive power,

apparent power, power factor demand, and energy. System shall be GE Micro ENT/Multinet or equivalent. Data shall be integrated to the plant SCADA system as specified in Division 13.

xiv. True two-step stored energy mechanism with five (5) cycle closing time shall be provided. All circuit breakers shall have multiple CHARGE/CLOSE provisions allowing the following sequence:

xv. CHARGE, CLOSE, RECHARGE, OPEN/CLOSE/OPEN

xvi. Local control pushbuttons to OPEN and CLOSE circuit breaker shall be provided. Color coded visual indication of contact position (OPEN or CLOSED) shall be provided on the face of the circuit breaker. Local manual charging following CLOSE operation shall be provided. Color coded visual indication of mechanism CHARGED and DISCHARGED position shall be provided on the face of the circuit breaker. Visual indicator shall indicate CHARGED only when closing springs are completely charged.

xvii. All circuit breakers shall be equipped with electrical accessories as noted on drawings.

xviii. Provide Key interlocks as indicated on contract drawings.

xix. Equipment Ground Fault Protection

- Circuit breaker(s) shall be provided with integral equipment protection for grounded systems.
- The ground fault system shall be of the residual type.
- Circuit breaker(s) shall be provided with zone selective interlocking (ZSI) on the Ground Fault function in order to limit thermal stress caused by a fault, yet permit optimum coordination with all other electronic trip circuit breakers.

xx. Terminations

- All lugs shall be UL Listed to accept solid and/or stranded copper and aluminum conductor. Lugs shall be suitable for 90° C rated wire, sized according to the 75° C temperature rating in the NEC. Provide required number of lugs/phase as indicated by the contract drawings and cabling requirements.
- All circuit breakers shall be UL Listed to accept field installable/removable mechanical type lugs.

10. Protective Devices - (Feeder Breakers)

a. Group mounted circuit breakers through 1200A

i. Circuit breaker(s) shall be group mounted plug-on with mechanical restraint on a common pan or rail assembly.

ii. The interior shall have three flat bus bars stacked and aligned vertically with glass reinforced polyester insulators laminated between phases. The molded polyester insulators shall support and provide phase isolation to the entire length of bus.

iii. Circuit breaker(s) equipped with line terminal jaws shall not require additional external mounting hardware. Circuit breaker(s) shall be held in mounted position by a self-contained bracket secured to the

mounting pan by fasteners. Circuit breaker(s) of different frame sizes shall be capable of being mounted across from each other.

iv. Line-side circuit breaker connections are to be jaw type.

v. All unused spaces provided, unless otherwise specified, shall be fully equipped for future devices, including all appropriate connectors and mounting hardware.

vi. Electronic trip molded case standard function 100% rated circuit breakers

- All electronic circuit breakers shall have the following time/current response adjustments: Long Time Pickup, Short Time Pick-up, and Instantaneous settings. Each adjustment shall have discrete settings (fully adjustable) and shall be independent of all other adjustments. Circuit Breaker shall be GE Spectra Series SG Frame or equivalvent.
- Each Feeder breaker shall be furnished with GE MET (LSIGM) programmer.
- Communications capabilities for remote power monitoring of circuit breakers trip system using RS485 to Ethernet converter; data to include voltage/current per phase, frequency, real power, reactive power, apparent power, power factor demand, and energy. System shall be GE Micro ENT/Multinet or equivalent. Data shall be integrated to the plant SCADA system as specified in Division 13.
- Circuit breaker trip system shall be a microprocessor-based true rms sensing designed with sensing accuracy through the thirteenth (13th) harmonic. Sensor ampere ratings shall be as indicated on the associated drawing.
- Long Time Pickup indication to signal when loading approaches or exceeds the adjustable ampere rating of the circuit breaker shall be provided.
- Furnish thermal magnetic molded case circuit breakers for 250A frames and below.
- Overcurrent devices shall have a minimum interrupting rating as specified for each of the switchboards noted within this Section.
- The distribution Section circuit breakers shall be either electronic type or molded case type based on the following criteria:
  - Complete review of the overall single line diagrams and distribution system layout and configuration.
  - Final coordination system study which will allow complete selectability and system coordination based on the overall distribution network.
  - Arrangement and space consideration of overall equipment sizing, layout and existing allocated space where equipment will be installed.
  - Breaker selection shall be as follows:

- Molded case inverse time and instantaneous trip characteristics (250 amps or less)
- Solid-State series with built-in solid state trip, current transformers, adjustable short time, etc. as specified. (Above 250 amps)

- All circuit breakers shall be provided with handle extensions for ease of operation.
  Provide one test kit capable of testing all breakers 600 ampere and above.
- Where indicated on the drawings, provide built-in ground fault protection with adjustable pick-up rating not exceeding 1200 amperes; ground fault time delay shall be adjustable 0.1 to 0.5 seconds. Provide neutral ground fault current transformer for four wire system.
- Where indicated on the drawings, provide zero sequence ground fault protection system with necessary sensor, monitor, test panel, shunt trip and control power source for use with breakers indicated.
- Nameplates:
  Engraved nameplates shall be furnished for all mains and feeder circuit with designation and circuit number as indicated on the drawings. Furnish Master Nameplate giving voltage, ampere rating, short circuit rating, manufacturer's name, general order number and item number.
- Enclosures:
  Enclosures shall be of indoor ventilated construction as shown on the drawings. Control power shall be obtained from an internal control power transformer.
- Finish:
  All exterior and interior steel surfaces of the switchboard shall be properly cleaned and provided with a rust-inhibition phosphatized coating. Color and finish of the switchboard shall be ANSI 61 and use the manufacturer's standard process.
- Control Power Transformers:
  Control power transformers with primary and secondary protection shall be provided as indicated on the drawings or where required to operate ground fault systems, adequately sized for required burdens.

11. Power Monitor:
    a. Where indicated on the drawings, provide a separate customer metering compartment with a front facing hinged door and include the following:
    b. Current transformers for each meter. Current transformers shall be wired to shorting-type terminal blocks.
    c. Potential transformers including primary and secondary fuses with disconnecting means for metering as shown on the drawings.

d. Provide microprocessor metering as shown on the drawings for power metering and loss of normal power monitoring. Metering shall be Allen-Bradley #1404 Power Monitor 3000 or equivalent.

12. Transient Voltage Surge Suppression Device
    a. TVSS equipment and requirements to be installed within the switchboard(s). Refer to section 16408 for additional requirements.
13. Overhead Circuit Breaker Lifter: Switchboard(s), shall be provided with overhead lifter for ease of removal of draw-out breakers above the applicable sections.
14. Nameplates
    a. Nameplates shall be provided for all equipment.
    b. Engraved nameplates shall be provided as specified under Division 16010.
    c. Engraved nameplates shall be furnished for all mains, feeder circuits and transfer switch with designation and circuit number as indicated on the drawings.
    d. Furnish Master Nameplate giving voltage, ampere rating, short circuit rating, manufacturer's name, general order number and item number.
15. Condensation Heater
    a. Provide 120V condensation heater for each separate switchgear section. Each heater shall be sized and rated to protect each individual section from condensation.
    b. Provide necessary primary and secondary circuit breakers, 480/120 volt transformer, and output in its own compartment or section, sized as required, for overcurrent protection for the condensation heaters.
    c. Provide a single, 120V thermostat mounted on the door of the feeder circuit breaker to regulate and control the condensation heaters. Provide lamacoid nameplates labeling its function.
16. Factory Testing:
    a. The following standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of ANSI and NEMA standards.
        i. The switchboard shall be completely assembled, wired, adjusted, and tested at the factory. After assembly, the complete switchboard will be tested for operation under simulated service conditions to ensure the accuracy of the wiring and the functioning of all equipment. The main circuits shall be given a dielectric test of 2200 volts for one (1) minute between live parts and ground, and between opposite polarities. The wiring and control circuits shall be given a dielectric test of 1500 volts for one (1) minute between live parts and ground
    b. The manufacturer shall provide three (3) certified copies of factory test reports.
17. Manufacturer’s Certification:
    a. A certified test report of all standard production tests shall be available to the Engineer upon request.
18. Training:

a. The Contractor shall provide a training session for up to five (5) owner's representatives for 1 normal work day at a job site location determined by the owner.

19. Installation Hardware:
    a. The assembly shall be provided with adequate lifting means and shall be capable of being moved into installation position and bolted directly to the floor without the use of floor sills provided the floor is level to 1/8 inch per 3-foot distance in any direction.
    b. All necessary hardware to secure the assembly in place shall be provided by the Contractor.
    c. Upon installation, lifting eyes shall be removed and replaced with flush mounted threaded bolts for a finished look to equipment.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The Contractors shall install all equipment per the manufacturer's instructions, contract drawings and National Electrical Code.

B. Ground all switchboards in accordance with the National Electric Code and as specified in section 16450.

C. Switchboards shall be mounted on 4" high concrete pads which shall extend 2" on exposed sides. Securely bolt each unit to its pad for proper horizontal and vertical alignment. Use shims where necessary.

D. Install Safety Labels in compliance with NEMA 260.

E. A manufacturer's qualified representative shall conduct the training session. The training program shall consist of instruction on operation of the assembly, circuit breakers, fused switches, and major components within the assembly.

3.3 TESTS

A. Refer to Section 16950 for testing requirements.

END OF SECTION

SECTION 16408

INTEGRATED TRANSIENT VOLTAGE SURGE SUPPRESSION DEVICE(S) LOW VOLTAGE SWITCHBOARDS AND MOTOR CONTROL CENTER

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section describes the materials and installation requirements for an integrated Surge Protective Device (SPD), also referred to as Transient Voltage Surge Suppressor (TVSS), in a Low Voltage Motor Control Center (MCC) and Low Voltage Switchboards (SWBD). These devices are used to protect AC electrical circuits from the effects of lightning induced currents, substation switching transients and internally generated transients resulting from inductive and/or capacitive load switching.

1.2 QUALITY ASSURANCE

A. The equipment specified herein is based upon the first manufacturer named after the phrase "Acceptable Manufacturer's". Equipment types, device ratings, dimensions, etc. correspond to the nomenclature dictated by that manufacturer. Equipment of other acceptable manufacturer's shall be equivalent in every way to that of the equipment specified. The electrical basis of design indicated on the Contract Documents is based on equipment layouts and modifications as provided by Square D Company. Suppliers deemed or equal shall be responsible to support and supply or equal equipment which shall meet the intended design. Any extensive modifications or rework of the design drawings in order to facilitate acceptability shall be the responsibility of this Contractor at no additional cost to the Owner.

B. All equipment shall be tested at the factory. Unless specified elsewhere, standard factory inspection and operational tests will be acceptable.

1.3 REFERENCES

A. UL 1283 Electromagnetic Interference Filters

B. UL 1449 Transient Voltage Surge Suppressors 2nd Edition

C. ANSI/IEEE C62.41 - 1991 - IEEE Recommended Practice on Surge Voltages in Low Voltage AC Power Circuits and ANSI/IEEE C62.45 – 1992 – IEEE Guide on Surge Testing for Equipment Connected to Low-Voltage AC Power Circuits

1.4 SUBMITTALS TO THE ENGINEER

A. Submit Shop Drawings for all service and distribution equipment, in their entirety, specified herein including the following information:

1. Manufacturer and equipment type.
2. Standard catalog information sheet.
3. Detailed Shop Drawings indicating plan, elevation, end, and isometric views.
4. Single-line diagram.
5. Complete bill of materials.

6. Additional information necessary to verify equipment to be supplied has features specified.
7. Certified Installation
8. The above shall be submitted within section of submittal of each respective equipment the device is to be installed.
9. Refer to Section 16010 for additional requirements.

1.5 WARRANTEE

A. TVSS devices shall have a warranty for a period of ten (10) years, incorporating unlimited replacement of suppressor parts. Warranty shall be the responsibility of the electrical distribution equipment manufacturer and shall be supported by their respective field services organization.

1.6 REFERENCE TO OTHER SECTIONS

A. Refer to Section 16406A for Low Voltage Switchboards

PART 2 - PRODUCTS

2.1 MATERIALS

A. Transient Voltage Surge Suppression Device:
   1. Integral Transient Voltage Surge Suppressors
      a. TVSS devices shall be Listed and Component Recognized in accordance with UL 1449 Second Edition to include Section 37.3 highest short circuit current rating (SCCR) of 200kA. TVSS devices shall be UL 1283 listed.
      b. TVSS devices shall be independently tested with the Category C3 high exposure waveform (20kV-1.2/50µs, 10kA-8/20µs) per ANSI/IEEE C62.41 – 1991.
      c. The manufacturer of the TVSS shall be the same as the manufacturer of the switcbboard in which the devices are installed and shipped.
      d. TVSS devices shall provide surge current diversion paths for all modes of protection; L-N, L-G and N-G in switchboards with neutral connected loads or L-L and L-G in switchboards without neutral connections.
      e. TVSS devices shall be modular in design. Each mode including N-G shall be fused with a 200kAIR UL recognized surge rated fuse and incorporate a thermal cutout device.
      f. The TVSS unit shall include a UL Recognized circuit breaker disconnect switch and shall connect to the switchboard vertical power bus through a spring reinforced stab-on connector.
      g. The TVSS unit mounting shelf shall include hanger brackets to support the unit weight during installation and removal. The TVSS plug-on units shall be installable without the assistance of a camming device so as to allow maximum accessibility with the unit installed.
      h. A cast metal handle operator must be provided on the disconnect. With the unit stabs engaged into the vertical phase bus and the unit door closed, the handle mechanism shall allow complete ON/OFF control of the unit

disconnect with clear indication of the disconnects status. The circuit breaker operator shall include a separate TRIPPED position to clearly indicate a circuit breaker trip condition. It shall be possible to reset a tripped circuit breaker without opening the control unit door.

i. A mechanical interlock shall prevent the operator from opening the unit door when the disconnect is in the ON position. Another mechanical interlock shall prevent the operator from placing the disconnect in the ON position while the unit door is open. It shall be possible for authorized personnel to defeat these interlocks.

j. A non-defeatable interlock shall be provided between the handle operator and the structure to prevent installing or removing a plug-on unit unless the disconnect is in the OFF position.

k. The TVSS plug-in unit shall have a grounded stab-on connector which engages the vertical ground bus prior to, and releases after, the power bus stab-on connectors. The grounded stab-on connector shall be cabled directly to the TVSS modules.

l. Provisions shall be provided for locking the disconnect in the OFF position with up to three padlocks.

m. Handle mechanisms shall be located on the bottom left side of the unit and operate horizontally to encourage operators to stand to the left of the unit being switched.

n. Unit construction shall combine with the vertical wireway isolation barrier to provide a fully compartmentalized design.

o. TVSS devices shall meet or exceed the following criteria:
    - Minimum surge current capability (single pulse rated) per phase shall be: **160 kA** per phase
    - UL 1449 Suppression Voltage Ratings:

VOLTAGE	**L-N**	**L-G**	**N-G**	**L-L**
208Y/120V	400V	400V	400V	800
480Y/277V	800V	800V	800V	1600
600Y/347V	1200	1200	1200	2000

p. Pulse life test: Capable of protecting against and surviving 5000 ANSI/IEEE C62.41 Category C3 transients without failure or degradation of clamping voltage by more than 10%

q. TVSS shall be designed to withstand a maximum continuous operating voltage (MCOV) of not less than 115% of nominal RMS voltage.

r. TVSS devices shall have a minimum EMI/RFI filtering of -50dB at 100kHz using MIL-STD-220A methodology.

s. TVSS devices shall be provided with one set of NO/NC dry contacts. The output of the dry contacts shall indicate a failure of a phase or the entire unit.

t. The switchboard shall include a neutral and ground connection terminals for neutral (when specified) and necessary ground connections.

u. There shall be a display panel mounted on the door of the TVSS unit which shall display the status of the unit and shall contain pushbuttons to control the function of the audible alarm.
v. Visible indication of proper TVSS connection and operation shall be provided. The indicator lights shall indicate which phase as well as which module is fully operable. The status of each TVSS module shall be monitored on the front cover of the switchboard as well as on the module. A push-to-test button shall be provided to test each phase indicator.
w. The display panel shall clearly indicate in English or appropriate pictograms/icons each component on the display. Markings on the display shall contrast with the background color so as to be easily read.
x. The display shall have LED's to indicate the surge suppression status of each phase: Green = Full protection to that phase, Red= No protection to that phase.
y. The TVSS unit shall be equipped with an audible alarm which shall activate when any one of the surge current modules has failed. An alarm on/off button shall be provided to silence the alarm. A button shall be mounted on the display to test the audible alarm. The buttons and alarm shall be located on the front cover of the switchboard. The alarm shall emit a minimum sound level of 50dB at one (1) meter from the front of the unit.
z. A surge counter shall provide a means to record the total number of transient line to ground, line to neutral, and line to line voltage surges since the counter was last reset.
aa. The surge counter shall be physically located on the diagnostic display panel and display digits from 0 to 999,999 at a minimum in clearly readable text.
bb. A reset switch shall control the surge counter. When pressed the surge counter will reset to zero.
cc. In the event of a power loss to all phases the surge counter will retain the last number in its memory for a minimum of 30 days after such a power loss.

2. Manufacturers are Square D Company IMA Series, Cutler-Hammer, or General Electric.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The Contractors shall install all equipment per the manufacturer's instructions, contract drawings and National Electrical Code.
B. Install Safety Labels in compliance with NEMA 260.

3.3 TESTS

A. Refer to Section 16950 for testing requirements.

END OF SECTION

SECTION 16415

AUTOMATIC TRANSFER SWITCH

PART 1 - GENERAL

1.1 DESCRIPTION

A. Furnish the automatic transfer switch to automatically transfer between the normal and emergency power source as indicated on the contract drawings and specified within. The equipment shall be new, factory tested, and pre-wired when delivered to the site.

B. The transfer switch shall be designed, built, tested, furnished, and warranted by the manufacturer of the switchboard supplier.

1.2 QUALITY ASSURANCE

A. The automatic transfer switch covered by these specifications shall be designed, tested, and assembled in strict accordance with all applicable standards of ANSI, U.L., IEEE and NEMA.

B. An approved transfer switch manufacturer shall have been regularly engaged in the production of U.L. (Underwriters Laboratory) Standard 1008 Listed transfer switches. The transfer switches shall be documented, and have been offered for sale on the open market for a minimum of five (5) years. The manufacturer shall provide factory trained parts and service support through a factory authorized distributor that is regularly doing business in the area of the installation.

C. All equipment shall be tested at the factory. Unless specified elsewhere, standard factory inspection and operational tests will be acceptable.

1.3 SUBMITTALS TO THE ENGINEER

A. Submit Shop Drawings for all transfer equipment, in their entirety, specified herein including the following information:

1. Manufacturer and equipment type.
2. Standard catalog information sheet.
3. Detailed Shop Drawings indicating plan, elevation, end, and isometric views.
4. Wiring diagram.
5. Complete bill of materials.
6. Additional information necessary to verify equipment to be supplied has features specified.
7. The manufacturer shall supply literature containing diagrams, parts lists and descriptions sufficient for the owner's personnel, or subcontract supplier to install, operate and perform normal maintenance on the equipment.

B. Submit complete documentation for coordination, short circuit, and arc flash study and report immediately upon selection of equipment in order to make any necessary changes based on the study's findings before the equipment is ordered. No start-up will be allowed without this study and report and without the final recommended system settings being implemented and tested in the field. If

equipment needs to be ordered prior to receiving the study, all necessary changes will be the responsibility of the contractor at no additional costs.

1.4 REFERENCE TO OTHER SECTIONS

A. Refer to Section 16010 for shop drawing formatting requirements.
B. Refer to Section 16010 for identification nameplates requirements.
C. Refer to Section 16010 for coordination, short circuit, and arc flash study requirements.
D. Refer Division 13 for Seismic Requirements.

1.5 WARRANTY

A. Manufacturer shall warrant specified equipment free from defects in materials and workmanship for the lesser of five (5) years from the date of installation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General:
1. The transfer switch is to be provided by the switchboard manufacturer and installed under that section as an integral part of the equipment. Refer to section 16406 for additional requirements.
2. Transfer switch shall be 60 Hz. Refer to drawings for the number of transfer switches, number of phases, number of poles, voltage, and ampere rating requirements.
3. The transfer switch shall have a key lockable handle installed on the front door and shall not have any mechanical clips around the outside of the enclosure.
4. Transfer switch shall be rated to carry 100 percent of their rated current continuously when in an enclosure. Transfer switch which must be derated when installed in an enclosure (due to integral overcurrent devices or any other reasons) do not meet this specification. Transfer switch shall be rated for continuous operation in ambient temperatures of -40° C (-40°F) to 67°C (142°F).
5. All transfer switches shall be U.L. Listed per Standard 1008. All transfer switches shall be suitable for use on emergency and legally required standby systems in accordance with ANSI-C1 and NFPA-99, rated for total system load. These loads shall include motors, electric discharge lamps, resistive loads, and tungsten lamps as described in Section 1 of U.L. 1008 Standard.
6. Withstand and Closing Ratings
   a. The automatic transfer switch shall be rated to close on and withstand the available RMS symmetrical short circuit current at the ATS terminals with the type of overcurrent protection shown on the plans.
   b. The ATS shall be UL listed in accordance with UL 1008 and be labeled in accordance with that standard's 1½ and 3 cycle, long-time ratings. ATSs which are not tested and labeled with 1½ and 3 cycle (any breaker) ratings and have series, or specific breaker ratings only, are not acceptable.

c. Where the line side overcurrent protection is provided by circuit breakers at 480 volts AC or less, the short circuit WCR shall be as follows:

TRANSFER SWITCH CONTINUOUS CURRENT RATINGS	K & J/L* FUSES	WITHSTAND AND CLOSING RATINGS
40A, 70A, 100A	125A/200A*	14,000A RMS
150A, 260A	400A/600A*	30,000A RMS
400A, 600A	1200A/1200A*	65,000A RMS
800A, 1000A	2000A/2000A*	65,000A RMS

* Class J and L Fuses WCR = 200,000A RMS

7. Transfer switches with in-phase monitoring for switching between sources are not acceptable and do not meet this specification.

B. Construction:

1. Transfer switch shall be a programmed delayed transition switch with center "off" position operation, double-throw construction. Switch shall be positively electrically and mechanically interlocked by a mechanical beam to prevent simultaneous closing (for break before make operation), and mechanically held in both normal and emergency positions. The transfer switch shall move to a neutral position before transferring to the Normal or Emergency position.
   a. Transfer switch shall be quick-break, quick-make operation so that the speed of opening and closing is not controlled by an operator during manual operation. Transfer switch shall provide a center "Programmed Transition Off" position for manual switching.
   b. Transfer switch shall be approved for manual operation under full load by integral mounted, permanently attached, high dielectric, manual operating handles. Manual operating handles, which are normally stored and must be installed for manual operation, do not meet this specification.
   c. The electrical operating means shall be a direct-acting, constant force in both directions, bi-directional linear induction motor to provide minimum friction, straight-line switch action. Motor shall be attached directly to the switching mechanism without the use of gears, cams, or other complex mechanical linkage methods.
   d. Transfer switch shall not contain any integral overcurrent devices in the main power circuit, including molded case circuit breakers or fuses.
   e. The transfer switch electrical actuator shall have an independent disconnect means to disable the electrical operation during manual switching.
   f. Manual operating handles and controls (other than key- operated switches) shall be accessible to authorized personnel only by opening the key locking cabinet door. Transfer switches located on the outside of the cabinet do not meet this specification.

h. Maximum transfer time in either direction shall be six (6) cycles, except where the "Programmed Transition" feature is furnished.

i. All transfer switches shall have transparent protective covers to protect operating personnel during manual operation, and to allow an operator to visually determine that the main contacts are "Open" or "Closed".

j. The main switch contacts shall be of the no maintenance type and high pressure silver cadmium oxide to resist burning and pitting for long life operation. All switches shall have arc chutes of heat absorbing material and metal leaves for positive extinguishing of arcs quickly and effectively; arc chutes shall have insulating covers to prevent interphase flashover.

k. Transfer switch shall have one (1) S.P.D.T. (Single Pole Double Throw), 480 volts auxiliary switch on both the normal and emergency-sides, operated by the transfer switch. These auxiliary switches shall be factory wired to an easy access terminal block and may be used to monitor transfer switch position for controlling indicator lamps or other peripheral equipment.

l. Complete AL-CU (Aluminum-Copper) lugs, U.L. listed and CSA certified, shall be provided for both normal and emergency load positions. For 150A and larger transfer switches, top or bottom feed for load connections shall be provided for slimmer design, requiring less wall space. Load connections shall be field changeable either from top-to-bottom or bottom-to-top. Wiring space at normal, emergency, and load lugs inside the transfer switch cabinet shall comply with 2011 NEC Table 312.6(b). Full rated neutral bar with lugs for normal, emergency, and load neutral conductors shall be provided inside the cabinet.

m. Relay, with 2 N.O. and 2 N.C. contacts that is energized whenever the normal source is available regardless of switch position.

n. Relay with 2 N.O. and 2 N.C. contacts that is energized whenever the emergency source is available regardless of switch position.

C. Transfer Switch Control (Level II):

1. <u>CONTROL PANEL</u>

Each transfer switch shall be provided with a control panel to allow the operator to view the status and control operation of the transfer switch. The operator panel shall be a sealed membrane panel rated NEMA 3R / IP53 or better that is permanently labeled for switch and control functions. The operator panel shall be provided with the following features and capabilities:

a. High intensity LED lamps to indicate the source that the load is connected to (Source 1 or Source 2); and which source(s) are available. Source available LED indicators shall operate from the control microprocessor to indicate the true condition of the sources as sensed by the control.

b. High intensity LED lamps to indicate that the transfer switch is “not in auto” (due to control being disabled or due to bypass switch {when used} enabled or in operation) and “Test/Exercise Active” to indicate that the control system is testing or exercising the generator set.

c. "OVERRIDE" pushbutton to cause the transfer switch to bypass any active time delays for start, transfer, and retransfer and immediately proceed with its next logical operation.
d. "TEST" pushbutton to initiate a preprogrammed test sequence for the generator set and transfer switch. The transfer switch shall be programmable for test with load or test without load.
e. "RESET/LAMP TEST" pushbutton that will clear any faults present in the control, or simultaneously test all lamps on the panel by lighting them.
f. The control system shall continuously log information on the number of hours each source has been connected to the load, the number of times transferred, and the total number of times each source has failed. This information shall be available via a PC-based service tool or an operator display panel.
g. Security Key Switch to allow the user to inhibit adjustments, manual operation or testing of the transfer switch unless key is in place and operated.
h. Vacuum fluorescent alphanumeric display panel with pushbutton navigation switches. The display shall be clearly visible in both bright (sunlight) and no light conditions. It shall be visible over an angle of at least 120 degrees. The alphanumeric display panel shall be capable of providing the following functions and capabilities.

2. CONTROL PANEL DISPLAY REQUIREMENTS

The control panel shall be able to display the following:

a. Display source condition information, including AC voltage for each phase of normal and emergency source, and frequency of each source. Voltage for all three phases shall be displayed on a single screen for easy viewing of voltage balance.
b. Display source status, to indicate source is connected or not connected.
c. Display load data, including 3-phase AC voltage, frequency, kW, kVA, and power factor. Voltage data for all phases shall be displayed on a single screen.
d. The display panel shall allow the operator to view and make the following adjustments in the control system, after entering an access code:
   i. Set nominal voltage and frequency for the transfer switch.
   ii. Adjust voltage and frequency sensor operation set points.
   iii. Set up time clock functions.
   iv. Set up load sequence functions.
   v. Enable or disable control functions in the transfer switch, including program transition.
   vi. Set up exercise and load test operation conditions, as well as normal system time delays for transfer time, time delay start, stop, transfer, and retransfer.
e. Display Real Time Clock data, including date, and time in hours, minutes, and seconds. The real time clock shall incorporate provisions for automatic daylight savings time and leap year adjustments. The control shall also log total operating hours for the control system.

f. Display service history for the transfer switch. Display source- connected hours, to indicate the total number of hours connected to each source. Display number of times transferred, and total number of times each source has failed.
g. Display information for other transfer switches in the system, including transfer switch name, real time load in kW on the transfer switch, current source condition, and current operating mode.
h. Display fault history on the transfer switch, including condition, and date and time of fault. Faults to include controller checksum error, low controller DC voltage, ATS fail to close on transfer, ATS fail to close on retransfer, battery charger malfunction, network battery voltage low, network communications error.

3. INTERNAL CONTROL REQUIREMENTS:
   a. The transfer switch control system shall be configurable in the field for any operating voltage level up to 600VAC. Provide RMS voltage sensing and metering that is accurate to within plus or minus 1% of nominal voltage level. Frequency sensing shall be accurate to within ± 0.2%. Voltage sensing shall be monitored based on the normal voltage at the site. Systems that utilize voltage monitoring based on standard voltage conditions that are not field configurable are not acceptable.
   b. Transfer switch voltage sensors shall be close differential type, providing source availability information to the control system based on the following functions:
      i. Monitoring all phases of the normal service (Source 1) for under voltage conditions (adjustable for pickup in a range of 85 to 98% of the normal voltage level and dropout in a range of 75 to 98% of normal voltage level.
      ii. Monitoring all phases of the emergency service (Source 2) for under voltage conditions (adjustable for pickup in a range of 85 to 98% of the normal voltage level and dropout in a range of 75 to 98% of pickup voltage level.
      iii. Monitoring all phases of the normal service (Source 1) and emergency service (Source2) for voltage imbalance.
      iv. Monitoring all phases of the normal service (Source 1) and emergency service (Source 2) for loss of a single phase.
      v. Monitoring all phases of the normal service (Source 1) and emergency service (Source 2) for phase rotation.
      vi. Monitoring all phases of the normal service (Source 1) and emergency service (Source 2) for over voltage conditions (adjustable for dropout over a range of 105 to 135% of normal voltage, and pickup at 95-99% of dropout voltage level).
      vii. Monitoring all phases of the normal service (Source 1) and emergency service (Source 2) for over or under frequency conditions.
   c. All transfer switch sensing shall be configurable from a Windows PC-based service tool, to allow setting of levels, and enabling or disabling of features and functions. Selected functions including voltage sensing levels

and time delays shall be configurable using the operator panel. Designs utilizing DIP switches or other electromechanical devices are not acceptable. The transfer control shall incorporate a series of diagnostic LED lamps.

d. The transfer switch shall be configurable to control the operation time from source to source (program transition operation). The control system shall be capable of enabling or disabling this feature, and adjusting the time period to a specific value. A phase band monitor or similar device is not an acceptable alternate for this feature.

e. Controls:

   i. Controls shall signal the emergency power system to start upon signal from normal source voltage sensors. Solid-state adjustable time delay (0-90 sec) start shall avoid nuisance engine-generator set start-ups on momentary voltage dips or interruptions.

   ii. The transfer switch shall transfer the load to the emergency power system after the engine-generator set reaches proper voltage and frequency and has stabilized.

   iii. The transfer switch shall control the engine-generator set to allow the set to start and transfer the load within 10 seconds (adjustable from 2 to 120 sec) after a normal source power failure. It shall be the responsibility of the transfer switch supplier to meet this requirement.

   iv. The transfer switch shall retransfer the load to the normal source after normal source power is restored, allowing normal source to stabilize before retransfer and shall allow staggered retransfer of loads in multiple transfer switch systems. Retransfer time delay shall be adjustable from 0-30 min.

   v. The controls shall signal the engine-generator set(s) to stop after load retransfer to the normal source, but shall maintain the availability of the emergency source in the event that the normal source fails shortly after retransfer. The controls shall allow the engine-generator set(s) to run unloaded for a cool down period prior to shut down (adjustable from 0 to 10 min).

   vi. The controls shall provide an automatic retransfer of the load from the emergency source to the normal source if the emergency source fails when the normal source is available.

   vii. The transfer switch operating power for transfer and retransfer shall be obtained from the source to which the load is being transferred.

   viii. Controls shall provide built-in "Control Mode Status" indicators, mounted on the interior of the enclosure, consisting of L.E.D.s (Light Emitting Diodes) to indicate a sequence of functions such as the following:

      - Source 1 OK
      - 2-Wire Run
      - Source 2 Ok
      - Timing for Transfer
      - Transfer Command

- Timing for Retransfer
- Retransfer Command
- Timing for Stop

ix. The indicators shall allow the operator to determine that the controls are properly sequencing and shall assist in determining the sequence of any malfunctions that might occur.

f. The control system shall be designed and prototype tested for operation in ambient temperatures from –40C to +70C. It shall be designed and tested to comply with the requirements of the noted voltage and RFI/EMI standards.

g. The control shall have optically isolated logic inputs, high isolation transformers for AC inputs, and relays on all outputs, to provide optimum protection from line voltage surges, RFI and EMI.

4. CONTROL INTERFACE:

a. The transfer switch will provide an isolated relay contact for starting a generator set. The relay shall be normally held open, and close to start the generator set. Output contacts shall be form C, for compatibility with any generator set.

b. Provide one set Form C auxiliary contacts on both sides, operated by transfer switch position, rated 10 Amps, 250 VAC.

3.1 INSTALLATION

A. The Contractors shall install all equipment per the manufacturer's instructions, contract drawings and National Electrical Code

B. Ground all switchboards in accordance with the National Electric Code and as specified in section 16450.

C. Automatic transfer switches shall be mounted on 4" high concrete pads which shall extend 2" on exposed sides. Securely bolt each unit to its pad for proper horizontal and vertical alignment.

D. Install Safety Labels in compliance with NEMA 260.

E. All parameters for the transfer switch are required to be set up for proper operation when interfacing with the utility company and emergency power. Refer to document below for set up requirements. Set-up and configuration shall be submitted to the engineer with test data for record purposes.

3.2 TESTS

A. Refer to Sections 16950 for testing requirements.

STANDBY POWER SYSTEM
AUTOMATIC TRANSFER SWITCH SET-UP AND CONFIGURATION

Date: _____

Project: _____

_____

_____

Contractor: _____

_____

Equipment Manufacturer: _____

Automatic Transfer Switch Model: _____

PARAMETERS

Parameter Description	Recommended Setting	Actual Setting
Time delay to override momentary normal source outages	*5 Seconds	
Adjustable time delay on retransfer to normal from emergency	*5 Minutes	
Time delay to stop emergency power upon re-transfer to normal source (generator cool down)	5 Minutes	
Time delay on transfer to emergency	*5 Seconds	

* Field coordinate time setting to obtain proper operation of equipment

This certifies that the Automatic Transfer Switch has been set up and configured as required to operate with the existing on site generators.

_____ _____
(Authorized Representative of the Manufacturer) (Date)

END OF SECTION

SECTION 16445

MODIFICATIONS TO EXISTING MOTOR CONTROL CENTERS

PART 1 - GENERAL

1.1 DESCRIPTION

A. The work of this section includes the furnishing, installing, and testing of modifications to existing motor control centers as specified herein and as shown on the contract drawings as indicated on the "Single Line Diagrams".

1.2 QUALITY ASSURANCE

A. The equipment specified herein is based upon the first manufacturer named after the phrase "Acceptable Manufacturer's". Equipment types, device ratings, dimensions, etc. correspond to the nomenclature dictated by that manufacturer. Equipment of other acceptable manufacturer's shall be equivalent in every way to that of the equipment specified.

B. Suppliers deemed equivalent shall be responsible to support and supply equivalent equipment which shall meet the intended design. Any extensive modifications or rework of the design drawings in order to facilitate acceptability shall be the responsibility of this Contractor at no additional cost to the Owner.

C. All equipment shall be tested at the factory. Unless specified elsewhere, standard factory inspection and operational tests will be acceptable.

D. Motor Control Center(s) shall have been tested in a high power laboratory to prove adequate mechanical and electrical capabilities. All major components shall have been individually design tested and guaranteed by the manufacturer.

E. All equipment to be submitted such as low voltage switchboards, motor control centers, panelboards, dry-type transformers, motor starters, disconnect switches, etc. shall be furnished by the same single manufacturer unless otherwise noted. Substitutions of multiple manufacturers for this equipment shall be rejected.

1.3 SUBMITTALS TO THE ENGINEER

A. Submit Shop Drawings for all service and distribution equipment, in their entirety, specified herein including the following information:

1. Manufacturer and equipment type.
2. Standard catalog information sheet.
3. Detailed Shop Drawings indicating plan, elevation, end, and isometric views.
4. Single-line diagram.
5. Complete bill of materials.
6. Additional information necessary to verify equipment to be supplied has features specified.
7. The above shall be submitted in a single complete brochure which shall be in the form of a soft cover binder with index tabs.

B. Submit complete documentation for coordination, short circuit, and arc flash study and report immediately upon approval of equipment and prior to start-up and testing of any equipment. Selection of equipment in order to make any necessary changes based on the study's findings before the equipment is approved. No start-

up will be allowed without this study and report and without the final recommended system settings being implemented and tested in the field. If equipment needs to be ordered prior to receiving the study, all necessary changes will be the responsibility of the contractor at no additional costs.

C. Provide six (6) copies of all correspondence, including verbal communications, with the utility company to the Engineer. Correspondence shall verify approval of the utility company for the proposed service, as designed. This must be submitted as soon as possible based on the intended design indicated on the Contract Drawings and part of the approval process for this Section.

1.4 REFERENCE TO OTHER SECTIONS

A. Refer to Section 16010 for shop drawing formatting requirements.
B. Refer to Section 16010 for identification nameplates requirements.
C. Refer to Section 16010 for coordination, short circuit, and arc flash study requirements.

1.5 WARRANTY

A. Manufacturer shall warrant specified equipment free from defects in materials and workmanship for the lesser of one (1) year from the date of installation or eighteen (18) months from the date of purchase.
B. All major components shall have been individually design tested and guaranteed by the manufacturer.

1.6 MATERIALS

A. Modifications to Existing Motor Control Centers:
   1. The modifications to the existing motor control centers and the manufacturer are shown on the contract drawings.
   2. This Contractor shall visit the site to become thoroughly familiar with the work required and specified herein. All modifications shall be performed without jeopardizing the integrity of the existing equipment. All work to be performed shall be complete and shall meet with all standards and guidelines for installation to this equipment.
   3. The contract drawings indicate that specific compartment section(s) are to be modified. The modifications shall include new equipment and/or modifications to existing equipment installed. Each compartment is to be replaced and/or existing equipment modified in order to retrofit the compartment sections as required by the contract documents.
   4. The short-circuit ratings of all new and modified devices shall be equal to or greater than that of the existing equipment. This is to be verified by this Contractor and the information furnished and included in the shop drawing submittals for this equipment.
   5. The Contractor shall be allowed to replace the sections as required in their entirety. This shall be verified with the Contractor and brought to the attention of the Engineer prior to final cost submittal.
   6. Provide screwed on nameplates for all revised sections as required for all front compartment devices and as noted on contract drawings.

7. The requirements noted have been outlined for this section. If any information on existing equipment cannot be verified then this shall be brought to the attention of the Engineer and verified prior to submitting bid for this project.
8. Refer to Section 16900 for control device and equipment requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The Contractors shall install all equipment per the manufacturer's instructions, contract drawings and National Electrical Code.
B. Ground all motor control centers in accordance with the National Electric Code and as specified in section 16450.
C. Install Safety Labels in compliance with NEMA 260.

3.2 TESTS

A. Refer to Section 16950 for testing requirements.

END OF SECTION

SECTION 16450

GROUNDING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: Provide and install all grounding and appurtenances as shown on the Drawings, manufacturer's installation manuals and guidelines, and as specified herein.

B. The Contractor is responsible to provide a complete interconnected grounding system which provides for a common potential grounding system. All components shall be bonded to the same potential via the grounding system for the entire facility. Review all connections and drawings along with requirements of the latest edition of the National Electrical Code (NEC) for final grounding requirements. A complete and integrated grounding system shall be the responsibility of the Contractor to furnish, install, and integrate into the sequence of construction for this the facility. All work shall be in compliance with NEC requirements and as indicated on the drawings.

1.2 PRODUCT HANDLING

A. All materials shall be shipped, stored, handled and installed in such a manner as not to degrade quality, serviceability, or appearance.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Refer to Section 16050 - Basic Materials for material to be used under this section.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Grounding electrode conductors shall be run in rigid steel conduits. All metal conduit used for the installation of the grounding electrode conductor shall be bonded with the use of a bonding bushing at both ends.

B. Grounding conductors shall be run with feeders where shown on the drawings or hereinafter specified.

C. Conduits stubbed-up below a motor control center or switchboard shall be fitted with insulated grounding bushings and connected to the ground bus. Boxes mounted below motor control centers shall be bonded to the motor control center ground bus. The grounding wire shall be sized in accordance with article 250 of the National Electric Code.

D. Liquid tight flexible metal conduit in sizes 1 inch and larger shall have bonding jumpers. Bonding jumpers shall be external, run parallel (not spiraled) and fastened with plastic tie wraps. Tie wraps shall be installed 12 inches apart and not more than 6 inches from ends.

E. Connect the following equipment by separate wire or cable directly to the grounding system:
   1. Frame of each transformer
   2. Neutral of each transformer for a separately derived system as defined by NEC article 250.
   3. Service entrance line compartment
   4. Low voltage switchboard
   5. Cable tray system
   6. Separately Derived Generator Systems
   7. Boiler stacks and the like

F. Connect the following equipment by separate wire or cable to the ground bus in the distribution equipment servicing the equipment:
   1. Motor Control Centers and Switchboards
   2. Panelboards
   3. 480 Volt motors
   4. Control panels
   5. Bus Duct
   6. All feeders and branch circuit installed in non-metallic raceways
   7. Receptacle circuits

G. The following equipment shall be grounded through the metallic raceway systems with permanent and effective ground connections:
   1. All metal cases and support frames
   2. Lighting system
   3. All motors
   4. Radio Antennas

H. Bond the following N.E.C. approved electrodes together to form a ground system:
   1. Metallic water main
   2. Building steel frame
   3. Steel reinforcing rods
   4. Grounding rods and plates
   5. Buried bare copper conductors

I. Grounding electrodes shall be driven where shown on the drawings. Spacing between electrodes shall be equal to or greater than the length of the electrodes. Exposed grounding connections shall be made by means of approved bronze clamps. Exposed connections between different metals shall be sealed with No. Oxide Paint Grade A, or equal.

J. Make connections to equipment with mechanical connections shall be made by means of approved bronze clamps. Exposed connections between different metals shall be sealed with No-Oxide Paint Grade A, or equal.

K. Make connections for all service entrance ground connections and all ground rods with an exothermic welding process.

L. All buried connections shall be made by an exothermic welding process equal to Cadweld. Molds used for the welding process shall be new having no prior usage. Molds shall be the specific type for the connection to be made.

M. All buried conductors shall be laid slack in trenches. The earth surrounding the cables shall be void of sharp objects which may injure the cables. Backfill material shall be natural earth. Where cables are exposed to mechanical injury they shall be

protected by pipes or other substantial guards. If guards are iron pipe or other magnetic material, conductors shall be electrically connected to both ends of the guard. Connections shall be made as hereinbefore specified.

N. Do not allow water main connection to be painted. If the connections are painted, they shall be disassembled and remade with new fittings.

O. Bond and ground all conduit systems. Ground conduit system and neutral conductor of wiring system with a connection at the main electrical service switchboard.

P. Furnish and install all main service grounding systems, building grounding systems and supplemental grounding systems as required by NEC and as shown on the drawings for a complete grounded system for the entire facility.

Q. Equip and install all exposed "pigtails" or grounding electrode conductors with an armored sheath.

R. Group and bond ground wires to panel boxes, light fixtures, receptacles, etc., not to system neutral.

S. Ground shield of a twisted-pair cable at one end only, at the power source for the device or instrument.

T. Ground all lightning arresters and exterior conduit risers.

3.2 TESTING

A. Tests shall be performed before loaming and seeding or paving work has been performed. Refer to Section 16950 for testing requirements.

END OF SECTION

SECTION 16500

LIGHTING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide complete interior and exterior lighting systems, including fixtures, standards, poles, hangers, supports, fittings, lamps, wiring, connections and controls, as indicated in the Contract Documents.

B. The lighting layouts on the DRAWINGS are diagrammatic only. Lighting fixtures, in general, have been specified for the particular type of ceiling in which they are to be installed. Refer to Architectural "Reflected Ceiling Plans" for exact location of recessed interior fixtures. Verify the ceiling construction details and provide fixtures and mounting hardware suitable for the respective ceiling types.

C. Manufacturer's lighting fixture catalog numbers as indicated on the "Lighting Fixture Schedule" indicate quality, type, efficiency and style but may not cover special, required design details. Provide lighting fixtures having such special details as noted in the "Lighting Fixture Schedule" and as required for proper installation.

D. Verify the availability of all fixtures proposed to be used in the execution of the work prior to submitting same for the Engineer's review. The discontinuance of production of any fixture after such review shall not relieve the Contractor from furnishing an alternate fixture of equivalent quality and design without additional cost to the Owner.

1.2 QUALITY ASSURANCE

A. All fixtures shall be new and shall bear the U.L. label for the service and location intended.

B. Lighting fixtures shall be standard products of manufacturer regularly engaged in the manufacture of the specific type lighting fixture specified as one of their principal products and shall be the manufacturer's latest standard design that complies with the specification requirements.

C. Lighting fixtures shall be as specified in the "Lighting Fixture Schedule" as shown on the contract drawings. Although only one manufacturer has been named, the phrase "or equal" may be applied to each fixture listed, unless otherwise noted. The lighting design is intended to be of the highest electrical efficiency and fixtures have been selected to provide the best illumination, at the lowest life cycle cost. The Engineer reserves the right to disapprove any lamp or fixture type submitted which is, in the Engineer's opinion, not equal in quality, appearance, efficiency or performance to the fixture specified.

1.3 SUBMITTALS TO THE ENGINEER

A. Shop Drawings are required for all items provided under this section. Submittals shall be provided in accordance with Sections 01340, 16010 and as specified in this section.

B. All lighting fixture types shall be submitted in a single complete brochure which shall be in the form of a hard cover binder with each fixture separated by an identified index tab. Catalog cut sheets shall indicate fixture identification, i.e., type A, D, J, etc., and shall indicate where it will be used.
Information on each fixture shall include:

1. Manufacturer and Catalog Number
2. Dimensioned Construction Drawing(s)
3. Standard Catalog "Cut" Sheet modified to show any options/accessories to be provided
4. Photometrics of each fixture
5. Lens/Louver Type for each fixture
6. Power Requirements
7. Ballast Type, Quantity and Rating
8. Socket Type/Position
9. Lamp Type , Quantity and specifications
10. Mounting Type and details of mounting equipment

1.4 DELIVERY, STORAGE AND HANDLING

A. Refer to Specification 16010 "Electrical - General" for this requirement.

PART 2 - PRODUCT

2.1 MATERIALS

A. Fixtures shall be identical in construction features, options and appearance to the fixtures specified in the Lighting Fixture Schedule as shown on the contract drawings. All fixtures shall be able to be pendant mounted.

B. Lamps

1. Incandescent lamps shall be inside frosted, rated for l30 volt operation.
2. Fluorescent lamps shall be rapid start, F32T8/TL835, mid white (3500K, CRI 80+), unless otherwise noted.
3. Metal halide lamps shall be phosphor coated and suitable for the burning position dictated by the luminaire.
4. High pressure sodium lamps shall be phosphor coated and suitable for the burning position dictated by the luminaire.
5. Acceptable Lamp Manufacturers: General Electric, Osram/Sylvania, Phillips or approved equal.

C. Ballasts

1. Ballasts shall be designed for continuous operation within the fixture provided and utilizing the lamp(s) specified without overheating or any other detrimental affects.
2. Ballasts shall be quiet in operation and of the lowest noise level generally available. Fixtures shall suppress ballast noise. Ballasts considered by the Engineer to have objectionable hum or noise shall be replaced immediately at no additional cost.
3. Fluorescent Ballasts shall conform to U. L. and ANSI specifications and shall display symbols of approval by the U. L. and of certification by the C.B.M. as tested by the E.T.L.
4. The component parts of the ballast shall be designed, fabricated, and assembled in accordance with the latest NEMA requirements. Ballasts shall be marked "Class P" indicating approved integral ballast protection. Fluorescent ballasts not "P" rated shall be individually fused at the ballast; fuses shall be cartridge type, sized as recommended by the ballast manufacturer.
5. Ballasts shall be Electronic, high-power-factor, series-sequence type, with less than 20% THD.
6. Fixtures with two lamps or multiples of two lamps shall have two-lamp ballasts. Three-lamp ballasts shall not be used unless specified.
7. Ballasts for interior fixtures shall be rated for starting operation at ambient temperatures to 50°F.
8. Ballasts for exterior fixtures shall be rated for starting operation at ambient temperatures to minus 20°F. Acceptable ballast manufacturers: EBT, GE, Magnetek, Motorola, Osram/Sylvania, or approved equal.
9. High intensity discharge ballasts shall be constant wattage type; have power factor of not less than 90%; be approved by E.T.L. and C.B.M. and have a UL label. Starting current shall not exceed operating current. Ballast shall maintain lamp operation for voltage fluctuations of plus or minus l0% of rated voltage. Voltage rating shall correspond to voltage of circuit to which ballast will be connected. Ballasts for exterior fixtures shall be rated for operation at ambient temperatures to minus 20°F. Ballasts shall have single or double fusing per Lighting Fixture Schedule shown on Contract Drawings.
10. All ballasts shall have a minimum two (2) year material and labor guarantee.

D. Emergency Lighting System (12 VDC System)

1. Power Units/ Combination Exit Signs
   a. Dry locations:
      i. Each power unit shall be commercial grade, UL listed, completely self-contained and consist of twin lighting heads (where indicated on the Drawings) mounted on multi-directional swivels.
      ii. Shall be furnished with a sealed, maintenance-free, nickel cadmium battery.
      iii. Shall be furnished with a solid state fully automatic, voltage limited battery charger with solid state switching, brownout sensitivity, low voltage battery disconnect and overload/short circuit protection.

iv. Each battery shall be capable of supplying power to the unit lights, exit light, and all connected remote fixtures for a period of 90 minutes per NEC, to an end voltage of 87.5% of nominal battery voltage.
v. The unit shall contain an AC "ON" light, high charge pilot light, and test switch to check transfer to DC lamps.
vi. Unit shall mount on standard 4 inch octagonal or square outlet box.
vii. Each lamp shall be a glare-free 8 watt halogen type.
viii. Remote heads shall be flame and impact resistant thermoplastic lamp holders. Lamps shall be 12 volt, 8 watt halogen sealed beam.
i. Exit sign light fixtures shall be of the LED type, constructed of high impact polycarbonate material, and shall normally be powered by 120V AC.
ii. Fixtures shall have 6-inch high red lettering with aluminum stencil face and matte black housing.

E. Fixture Supports and Hangers
1. Provide all necessary mounting brackets and boxes, suitable for the area in which it is to be installed, as required for a complete functioning installation for all lighting for project.
2. Provide all necessary hangers and supports for proper fixture installation.
3. Fixture supports shall be capable of supporting a minimum of two and one-half times the load normally carried at point of support.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to the contract documents for fixture mounting heights.
B. Mount fixtures in true vertical and horizontal alignment.
C. Fixture locations shown on the drawings are diagrammatic only. They are shown for quantity and approximate locations only. Adjust the location of any lighting fixture as required to avoid interferences with existing conditions, equipment, and of the work of other trades.
D. Each fixture provided shall be a completely finished unit with all components, mounting and/or hanging devices necessary for the proper installation of the particular fixture.
E. Mount all emergency lighting, exit signs, and light fixtures as indicated on the contract drawings when possible.
F. Ground all lighting fixtures and lighting poles per the National Electric Code, Article 250, as shown on drawings, and specification 16450.
G. Hangers and supports shall be anchored to channels in the ceiling construction, to the structural slab or to structural members above the suspended ceiling.
H. Fixtures mounted in suspended "lay-in" ceilings shall be supported from inverted "tee-bars" using "Caddy" clips suitable for the fixture type installed.

I. All suspended fixtures shall be pendant mounted and be suspended from the ceiling using cast swivel type connectors and 3/4 inch rigid galvanized steel conduit minimum, unless otherwise specified by the fixture manufacturer.
J. Provide all necessary accessories for "end-to-end" mounting where continuous rows of fluorescent fixtures are indicated.
K. Coordinate all recessed fixtures with the ceiling grid system prior to installation of the ceiling grid system where applicable. Lighting fixtures and mounting shall be compatible with the ceiling grid system.
L. Where multiple switching of fluorescent fixtures is indicated, the outside two (2) lamps of each fixture in the controlled area shall be switched separately from the interior (center) lamp(s).

3.2 TESTING

A. Refer to Section 16950 for testing requirements.

END OF SECTION

SECTION 16721A

ADDRESSABLE FIRE ALARM SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

A. The fire alarm system shall comply with the requirements of NFPA 72 for protected premises signaling systems.

B. Fire Alarm system devices shall match the manufacturer of the existing system.

C. Provide fire alarm devices as indicated on the DRAWINGS and as specified herein.

D. Provide full integration and programming by Simplex of the new addressable and indicating devices with the existing Simplex Fire Alarm System

1.2 QUALITY ASSURANCE

A. The system shall be wired, connected, tested, and left in first class operating condition. The equipment and completed installation shall be in compliance with local and national codes, authorities having jurisdiction and in accordance with applicable sections of the latest edition of NFPA 72 for Auxiliary Fire Alarm Systems. All equipment shall be listed by Underwriters' Laboratories and shall meet with the approval of the Local Fire Department.

B. Fire alarm equipment shall be the standard product of one manufacturer and shall be equal, in every way, to the current system manufactured by Simplex 4100. Catalog and model numbers are intended to indicate type and quality of design and material, as well as operating features as required.

1.3 SUBMITTALS TO THE ENGINEER

A. The following equipment, materials, products, etc. shall be included in the "Subcontract and Material List Sheet" per SECTION 16010, paragraph 1.3, A:

1. Initiating devices
2. Signaling devices

B. Submit shop drawings per SECTION 16010, Paragraph 1.4.B. Submit complete shop drawings for each system and piece of equipment specified. Shop drawing submittals shall consist of manufacturer's data sheets on all pieces of equipment and auxiliary devices; description of systems operation; interconnecting wiring diagrams cross referenced with equipment designations and locations indicated in the Contract Documents.

C. Provide riser diagrams - cross referenced with equipment designations (applicable to the project) and equipment locations indicated in the Contract Documents.

D. Submit Shop Drawings per SECTION 01340, and 16010. Submit complete Shop Drawings for each system and piece of equipment specified. Shop Drawing submittals shall consist of manufacturer's data sheets on all pieces of equipment and auxiliary devices; description of systems operation; interconnecting wiring diagrams, riser diagrams - cross referenced with equipment designations

(applicable to the project) and equipment locations indicated in the Contract Documents.

E. Standard manufacturer's catalog cut sheets are acceptable; however, they shall be modified to indicate equipment and options to be provided for this project. Any listed equipment, options, or features which are not to be provided shall be properly indicated in the submittal. Failure to properly indicate project-specific equipment, options, and features will result in the submittal being returned without being reviewed.

F. Submit certification of all fire alarm equipment operating tests at the completion of the project.

G. Copies of all shop drawings shall be submitted to the local fire authority for review and approval.

PART 2 - PRODUCT

2.1 MATERIALS

A. Addressable Devices:

1. General:

a. Addressable devices shall provide an address-setting means using rotary decimal or dip switches.

b. Addressable devices shall use simple to install and maintain decade (numbered 0 to 9) type address switches.

c. Initiating devices shall be intelligent and addressable, and shall connect with two wires to the fire alarm control panel signaling line circuits (SLC).

d. The fire alarm control panel shall permit initiating devices sensitivity adjustment through field programming of the system. Sensitivity shall be automatically adjusted by the panel on a time-of-day basis.

e. Using software in the FACP, initiating devices shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The initiating devices shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72, Chapter 7.

f. Smoke and heat detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature.

g. All detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a magnetic switch) or initiated remotely on command from the control panel.

h. Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (ION, PHOTO, THERMAL, etc.).

2. Manual Fire Alarm Station:
   a. The manual fire alarm station shall be a UL listed, 24V DC, dual action. addressable device compatible with the control equipment with which it will be utilized.
   b. The manual station shall be non-coded, with a key operated reset lock for testing and resetting after station operation.
   c. Manual stations shall have clearly visible operating instructions printed on the cover and the word "fire" in one-inch minimum high lettering shall appear on the front cover.
   d. When activated, the handle shall latch in the down position and the word "activated" shall appear.
   e. Manual stations shall be Simplex,
   f. Manual stations shall connect with two wires to one of the control panel SLC loops. The Manual Station shall, on command from the control panel, send data to the panel representative of the state of the manual switch. Manual stations shall provide two digit address-setting by use of rotary decimal switches or DIP switches.
3. Smoke and Heat Detector Base:
   a. In unfinished areas, all detector bases, shall be a low profile, standard flanged base Simplex.
   b. In finished areas, all detector bases shall be recessed, utilizing Simplex recessed mounting kit.
4. Photoelectric Smoke Detectors:
   a. Provide a U.L. listed, 24V DC, addressable, photoelectric type smoke detector compatible with the control equipment with which it will be utilized.
   b. Photoelectric detector base shall be interchangeable with both ionization and thermal type detectors and contain a built-in tamper-resistant feature.
   c. Detector shall be addressable by device using integral communications and built-in device type identification.
   d. Detector shall be 2 wire loop connected allowing T-taps or branches suitable for Class "B" type circuits.
   e. Detector shall allow for a 360° field viewing angle of the visual alarm indicators. Visible LED's shall pulse every time the unit is addressed and illuminate steady on alarm.
   f. Testing of the detector shall be via a built-in test switch activated by an external magnet as well as a remote test feature at the fire alarm control panel.
   g. Detector shall be able to withstand air velocities up to 4,000 FPM without triggering a false alarm.
   h. Detector shall relay a "maintenance required" signal to the alarm panel, upon an excessive amount of dirt or dust build-up.
   i. Detector shall be Simplex.
5. Ionization Smoke Detector:

a. Provide a U.L. listed, 24V DC, addressable, ionization type smoke detector compatible with the control equipment with which it will be utilized.
b. Ionization detector base shall be interchangeable with both photoelectric and thermal type detectors and contain a built-in tamper-resistant feature.
c. Detector shall be addressable by device using integral communications and built-in device type identification.
d. Detector shall be 2 wire loop connected allowing T-taps or branches suitable for Class "B" type circuits.
e. Detector shall allow a 360° field viewing angle of the visual alarm indicators. Visible LED's shall pulse every time the unit is addressed and illuminate steady on alarm.
f. Testing of the detector shall be via a built-in test switch activated by an external magnet as well as a remote test feature at the fire alarm control panel.
g. Detector shall relay a "Maintenance Required" signal to the alarm panel upon an excessive amount of dirt or dust buildup.
h. The detector shall be able to withstand air velocities up to 1,500 FPM without triggering a false alarm.
i. Detector shall be Simplex.

6. Thermal Heat Detector:
   a. Provide a U.L. listed, 24V DC, addressable, fixed temperature/rate of rise type heat detector compatible with the control equipment with which it will be utilized.
   b. Heat detector base shall be interchangeable with both ionization and photoelectric type smoke detectors and contain a built-in tamper-resistant feature.
   c. Detector shall be addressable by device using integral communications and built-in device type identification.
   d. Detector shall be 2 wire loop connected allowing T-taps or branches suitable for Class "B" type circuits.
   e. Detector shall allow a 360° field viewing angle of the visual alarm indicators. Visible LED's shall pulse every time the unit is addressed and illuminate steady on alarm.
   f. Testing of the detector shall be via a built-in test switch activated by an external magnet as well as a remote test feature from the fire alarm control panel.
   g. The detector shall contain two thermistors. The fixed temperature shall be factory set at 135°F (58°C). Rate of rise sensitivity shall be set at 15°F (8.3°C) per minute.
   h. Detector shall be Simplex.
7. Audio/Visual Alarm Station:
   a. Provide an audio/visual alarm station comprised of the above referenced fire alarm mini-horn with the addition of a Xenon Flashtube with solid state circuitry and an associated lens/reflector system with the word "Fire" printed on it.

b. The horn/strobe unit shall be wired as a primary signaling notification appliance.
c. The horn/strobe unit shall be Simplex. in dry locations. For exterior or damp locations, unit shall be Simplex with #WBB weatherproof backbox.

8. Fire Alarm Wiring:
   a. Wiring shall be as specified in SECTION 16050, paragraph 2.1., "Fire Alarm Wiring".

PART 3 - EXECUTION

3.1 INSTALLATION

A. The Contractor shall provide, in accordance with manufacturer's instructions, all devices, wiring, conduit and outlet boxes required for the installation of complete system(s) as described herein. All wiring shall meet the requirements of the Contract Documents, as recommended by the manufacturer, and the National Electrical Code.

B. Provide full integration and programming by Simplex of the new addressable devices with the existing Simplex Fire Alarm System.

C. All devices constituting the Fire Alarm System shall be mounted on approved electrical back boxes, or as recommended by the manufacturer.

D. All alarm initiating circuits shall be 2 wire loop connected allowing T-taps or branches suitable for Class B type circuits to all the contacts of the alarm initiating devices. The fire alarm control panel shall continually monitor each addressable device for proper operation and maintenance condition.

E. All Alarm Signaling Circuits shall consist of two (2) conductors and shall:
   1. Be polarized.
   2. Connect alarm audible/visual units in a parallel, continuously supervised fashion, up to a maximum amount of devices per circuit allowed by the control panel design.
   3. The last signaling device on any given alarm signaling circuit shall have an end-of-line resistor installed, supplied by the manufacturer of the fire alarm equipment, for the purpose of completing supervision.

F. All fire alarm wiring shall be installed in conduit. All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas. Smoke detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage. Fire alarm wiring shall not be installed in any enclosure or raceway in common with higher voltage systems.

G. Fire alarm wiring installed between buildings either aerially or in underground duct banks shall be twisted shielded pair cable as specified in Section 16050. Shielded cables shall be run to the fire alarm control panel, and all cable shields drained at the panel. Exterior fire alarm wiring shall be equipped on both ends with Isolated Loop Circuit Protectors for transient suppression. Protectors shall be located as close as practicable to the point where the circuits leave or enter a building. The protector grounding conductor shall be a #12 AWG wire connected to the building grounding electrode system and installed as directed by the

protector manufacturer. Protectors shall be mounted in suitable enclosures in accessible locations.

3.2 TESTS AND GUARANTEE

A. The manufacturer's representative shall, upon completing the installation of the Fire Alarm System, conduct a complete test of the system in the presence of representatives of the Fire Alarm Equipment manufacturer, local Fire Code representative, the Owner and the Engineer. During the course of the test, each manual station shall be activated, each rate of rise heat detector shall be activated per manufacturer's recommendations, each fixed temperature heat detector shall be activated by way of removing the fixed temperature heat element, or shorting the terminal of the heat detector. Each smoke detector shall be individually tested utilizing a source of smoke per manufacturer's direction. Check the installation, supervision and operation of all intelligent detectors and initiation devices and that the audibility of the tone at all alarm notification devices meets all applicable codes and regulations. Each alarm condition that the system is required to detect shall be introduced on the system, verifying the proper receipt and processing of the signal at the fire alarm control panel and the correct activation of the control points. At the completion of the test, a notarized letter shall be submitted to the Engineer stipulating that the Fire Alarm System was installed according to the plans and specifications.

B. The system supplier shall furnish to the Owner, a one-year minimum contract, effective from the date of acceptance, for maintenance and inspection services of the manufacturer's equipment with a minimum of four inspections during that contract year. Written evidence of such inspections shall be left with the appropriate authorities, verifying that at the conclusion of each inspection, the Fire Alarm System has been tested and was functioning properly, or has been repaired.

C. The system supplier shall provide programming and coordination with the Owner's alarm monitoring service company as required.

3.3 INSTRUCTION

A. Provide instruction as required for operating the system. Hands-on demonstrations of the operation of all system components and the entire system including program changes and functions shall be provided.

B. The Contractor and/or the Systems Manufacturer's representatives shall provide a typewritten "Sequence of Operation."

END OF SECTION

SECTION 16900

CONTROLS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide and install all panel and enclosure components and appurtenances as shown on the Drawings as Local Control Stations as specified herein. All components shall meet NEMA ratings as indicated on drawing E-1 for the specific area where they are to be installed.

1.2 SUBMITTALS TO THE ENGINEER

A. Shop drawings are required for all items provided under this Section. Submittals shall be in accordance with Sections 01340 and 16010.

PART 2 - PRODUCT

2.1 MATERIALS

A. Control Station Enclosures:
   1. General:
      a. Control stations shall be heavy duty oil-tight/watertight type stainless steel enclosure and shall consist of operators with contact blocks and indicator lights as indicated on the contract drawings. Enclosures shall have sufficient depth to accommodate mounting four Class 9001 KA-1 contact blocks side-by-side and in tandem behind a single operator for a maximum of eight circuits, four normally open and four normally closed.
      b. Enclosures shall have the required number of holes for the number of operators pre-manufactured as shown on the contract drawings.
   2. NEMA 12 and NEMA 4X
      a. Enclosures shall be 16 gauge Type 304 stainless steel gasketed enclosures.
      b. Acceptable manufacturers are Allen Bradley, General Electric, Square D, or equivalent.
   3. Class I, Division I and Class 1, Division 2 Enclosures
      a. Enclosures and covers shall be shall be iron or aluminum and gasketed with pre manufactured devices installed by manufacturer.
      b. Acceptable manufactures are Cooper Cooper Crouse-Hinds Flex Station Control Stations, Allen-Bradley, Square D, or equivalent.

B. Operators:
   1. General:
      a. All operators used in control stations shall be Square D type K and shall be suitable for cover mounting in a 1-7/32 inch diameter notch type cover hole and shall be held in place by the locking thrust washer. All operators shall be heavy duty oil/water tight, be 30mm in size, and maintain the NEMA rating of the enclosure.

b. Push buttons shall have removable inserts in eight different colors for function color coding. Push-button inserts shall be removable from the front of the control station without disturbing the wiring or mounting of the control units.
c. Selector switches shall have removable knobs in eight different colors for function color coding. Selector switch knobs shall be removable from the front of the control station without disturbing the wiring or mounting of the control units. Operators for selector switches shall be bat wing type.
d. Emergency stop pushbutton operators shall be large operator head type, red **mushroom-head**, maintained type switch with push to open and pull to re-engage control circuit. Provide multiple output contact type as shown on the drawings.
e. Indicator lights shall be heavy duty, oiltight and have the following requirements:
   - Designed to operate at 120 volts, 60 Hz AC.
   - Provided with a chrome-plated metal or anodized-aluminum mounting rings, engraved as indicated on the Drawings.
   - Lens color shall be as indicated on drawings.
   - Shall be 30 mm LED lamp type, with “Push to Test” requirements.
f. Provide legend plates which describe function of each device on control station.

2. Contact blocks used in heavy duty oil-tight control stations shall be of Square D Type K single-pole, single-throw (SPST), single-pole, double-throw (SPDT). Contact blocks shall be suitable for mounting side by side and/or in tandem to the base of the operator with this following requirements:
   a. mounting screws shall be captive with a drilled and tapped head to permit easy tandem mounting of contact blocks.
   b. Terminals shall be pressure wire type with a self-lifting pressure clamp that will compensate for wire of different size ranging from #12-#18 solid or stranded.
   c. Contacts shall be double break, and silver plated.
3. Class 1 Division 2 operators shall meet all requirements of section 2.1.B.1 with the addition of devices being hermetically sealed by the factory.

C. Control Circuit Fuses
1. Fuses shall be 3AB ceramic body fuses rated for at least 125 volts at the current ratings shown on the Drawings. Fuse size shall be ¼” x 1¼”.
2. Blow time shall be:
   - 110%, 4 hours minimum;
   - 135%, 1 hour maximum;
   - 200%, 15 seconds maximum for 1/8-12 amp fuses
   - 200%, 60 seconds maximum for 15-30 amp fuses.
3. Fuses shall be Littlefuse, Bussmann, or approved equal.

D. Relays
1. Industrial Control Relays - Industrial control relays shall be utilized where specifically called for on the Drawings or within the Specifications. Industrial control relays with 10 ampere contact rating shall be Square D, Class 8501

Type X, Allen-Bradley or approved equal. Relays with 30 ampere contact rating shall be Square D, Class 8501, Type C or equal.

2. Pilot Duty Relays - Unless specifically noted otherwise, relays shall be general purpose relays. General purpose relays shall be IDEC RH Series, 10A contact rating, 4 Form "C" contacts, Allen-Bradley or approved equal, provided with internal indicating light. Pilot duty control isolating relays for PLC inputs and outputs shall be suitable for the application, and shall be submitted for approval by Engineer.
3. Relays shall be electrically held, electrically operated with 120 volt coils except as noted otherwise on the Drawings. Contacts shall be rated 600 volt, 10 ampere and shall be convertible from Normally Open to Normally Closed. Where relays are used to control single-phase, fractional horsepower motors, contacts shall be rated in accordance with the N.E.C. for the motor to be controlled. Where relays are not installed within system control panels, provide a suitable enclosure as specified in Section 16160, with NEMA ratings as indicated on the Drawings.
4. Dry contacts used for instrumentation and SCADA inputs or other low current inputs, shall be bifurcated cross bar gold overlay silver and rated dry circuit. These contacts will be provided through dedicated interposing relays as shown on the schematic diagrams of the Drawings or as specified herein. Relays shall be provided with plug-in type sockets with screw terminal wiring connections to facilitate relay change out and wiring. Relays shall be Potter and Brumfield type KHAU-17A16 - 120 or 12V, IDEC, or approved equal as shown on Drawing.

E. On-Delay & Off-Delay Timing Relays

1. Solid State - Unless specifically noted otherwise, time delay relays shall be general purpose time delay relays. General purpose time delay relays shall be IDEC RTE, Potter-Brumfield, or approved equal.
2. Delay timing relays shall be solid state type rated for use at 120 volts. Contacts shall be normally open (NO) or normally closed (NC) as detailed shown on the Drawings or within the Specifications, and shall be rated 5 amperes (minimum). Minimum time range shall be adjustable from 1 second to 1 minute. Other ranges as required by function and as indicated on the Drawings or within the Specifications. Where mounted external to control panels, delay timing relays shall be provided with enclosures as specified in Section 16160, with NEMA ratings as indicated on the Drawings.

F. Miscellaneous Indicating Lights

1. Indicator lights shall be heavy duty, oiltight and designed to operate at 120 volts, 60 Hz AC. Indicator lights shall be provided with a chrome-plated metal or anodized-aluminum mounting rings, engraved as indicated on the Drawings. Lens color shall be as indicated. Indicator lights shall be 30 mm LED lamp type, with "Push to Test" requirements to allow easy testing of bulb integrity. Lights shall maintain NEMA rating of panel/enclosure.

G. Fuse Blocks

1. Fuse blocks shall be rated for at least 30 amps and 300 volts. The clips shall be high tensile spring brass, electro-tin plated. The base shall be polyester, glass reinforced with a UL-94VO flammability rating.

2. At least four spare sets of clips shall be provided on each fuse block and shall be labeled “SPARE”.
3. Fuse block switches shall be din rail mounted.
4. Fuse blocks shall be Littlefuse Omni-block, Bussmann, or considered equal.

H. Terminal Strips
1. Terminal strips with box type connectors shall be supplied to make all power and control connections. All terminals shall be clearly marked for easy identification. A ground terminal strip shall also be provided. At least 20 percent of terminals supplied shall be spare. All wiring shall be terminated on field terminal blocks.

I. Control Power Transformers
1. Supply all control power transformers necessary to make panel functional. All transformers shall have both primary legs and all "hot" secondary legs fused. One secondary leg shall be grounded. Fuse sizing shall be as recommended by the equipment manufacturer for the particular installation.
2. Final sizing of the control power transformer shall be based on the application and control equipment to be operated on this equipment. The supplier/contractor shall review all system schematics and provide the appropriate size CPT for each application. Oversized CPT will be required where necessary for the installation.

J. Emergency Stop Pushbuttons (E-Stops)
1. Pushbutton control station shall be red, large **mushroom-head** maintained switch with pull-on and push-off type. Provide multiple output contact type as shown on the drawings. Device shall maintain the NEMA rating for area in which it is being installed.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All items incorporated into the work shall be installed in accordance with the Drawings and Specifications. Where detailed drawings or technical specifications are not provided, the items shall be installed in accordance with the manufacturer's preferred recommendations and confirming to the best practice of the trade involved.

B. All installations shall be in accordance with the applicable sections of Division 16 (where applicable).

3.2 TESTS

A. All items shall be factory tested.

B. Refer to section 16950 for additional testing requirements.

END OF SECTION

SECTION 16950

TESTING ELECTRICAL SYSTEMS AND START-UP

PART 1 - GENERAL

1.1 DESCRIPTION

A. Test and demonstrate, to the satisfaction of the Engineer, all electrical devices in accordance with the following requirements. All testing and checkout of equipment specified under this Section shall be performed by the electrical contractor.

B. During the checkout and startup period, the electrical contractor shall provide sufficient personnel to aid with the start-up of all electrical equipment, to remove any faults, and to make the necessary adjustments for the proper operation of electrical equipment and installation.

C. A 1000 volt "megger" insulation test shall be available at all times during the testing of power feeders and motor wiring and 2500 volt "megger" test for heat trace cable.

D. All electrical equipment, wiring, switches and insulators found to be defective or to have failed due to poor workmanship shall be replaced promptly at no additional cost to the Owner.

1.2 SUBMITTALS TO THE ENGINEER

A. All test data shall be officially submitted in the same manner outlined for submittal shop drawings specified in Division 16 related sections.

B. It should be the Contractors responsibility to provide all required forms/direction as to submittal procedures for this contract and to verify compliance prior to submitting to the Engineer for review.

C. A record of all insulation values shall be properly recorded as listed in worksheet attached to the back of the section. All time intervals shown shall be recorded for each conductor being tested.

D. Ground testing results shall be properly recorded, witnessed, and reported to the Engineer.

E. A complete binder and documentation of the results of all testing shall be submitted for a final record of all testing and settings for the entire system. Five (5) hard bound copies shall be submitted for final record. This shall be reviewed for final compliance to this section and shall be required to be updated for final acceptance.

1.3 TESTING REQUIREMENTS

A. Prior to the start of check out and testing, insure that all equipment is properly and permanently identified according to Section 16010.

B. Before energizing any electrical equipment or apparatus, thoroughly check all equipment for the following:

1. All equipment and materials shall be clean, dry and free of foreign materials.

2. Vacuum clean to make free from filings, foreign matter or other materials left inside equipment or enclosures. Particular attention shall be given to bus conductors, conductors, terminal blocks, and windings.
3. Check for tools inside equipment or enclosures. All screw, bolt, and terminal connections shall be checked for tightness as specified by the equipment manufacturer.
4. Check the bearings of all rotating electrical apparatus and, if required, have supplier fill with the grease or oil as recommended by the manufacturers.
5. All motors, contacts, relays, bus, insulators and other electrical apparatus shall be cleaned and dried out if required and/or needed. Drying out methods will be such that the insulation temperature of the apparatus does not exceed 90°C.

C. Prior to applying voltage to any apparatus or circuit, make insulation resistance tests and, if necessary, dry the apparatus until resistance values conform to the standards of IEEE.

D. In case of a low resistance circuit insulation, eliminate the problem before the circuit is energized.

E. Provide 1000 volt "Megger" insulation testing on all 600 volt feeder conductors and motor power conductors. **This shall include any and all of the existing electrical feeder cables that are spliced with new wire/cable for reconnection to the new switchboard.**

F. Provide 2500 volt "Megger" insulation testing for all heat trace cabling to be installed at all locations as shown on the Drawings.

G. "Megger" test all required service feeder cables and circuit wiring at the existing facility in their entirety and submit a complete test report. Test voltage shall be applied until readings reach a constant value, and until three (3) equal readings, each one (1) minute apart, are obtained. Minimum megger reading shall be 45 megohms for feeder conductors.

H. Three phase motors shall be checked for rotation and, if necessary, reverse the connections at the starter. Single phase and DC motors at motor connection box.

I. All main plant building loops and major equipment grounds shall be tested to remote earth or directly referenced to an extremely low resistance (approximately 1 ohm) reference ground bench mark. Tests shall be made with ground testing ohm meter or "megger" approved by the Engineer for the purpose.

J. The ground resistance of the individual networks shall be measured at two points with the cables at all the test points disconnected.

K. Test the grounding system to assure continuity and to assure that resistance to ground does not exceed specified limits or form any ground loops.

L. The entire grounding network resistance shall be meggered. Resistance shall not exceed 25 ohms. Drive additional ground rods if necessary.

M. The Contractor shall provide load readings for all equipment, switchgear, motor control centers and panelboards.

N. Set all coordination, short circuit and arc fault settings to study provided for this facility for final set up of the electrical system.

O. Demonstrate fire alarm system device operation in compliance with specification 16721.

P. Adjust all settings on protective equipment and verify, check and establish with the power company that the secondary voltage is within 2% of rated voltage.

Q. The contractor shall maintain a complete marked up drawing set and all written documentation of all changes at the job site. These documents shall be made available to the Engineer at all times.

1.4 DEMONSTRATION AND START UP

A. All equipment shall be properly identified as indicated in SECTION 16010.
B. When directed by the Engineer, demonstrate the total system operation and make final adjustments to the system. If any system or piece of equipment within a system fails to function properly, rectify such defects or inadequacies and make a final demonstration as directed by the Engineer.
C. Demonstrate a full functional test of the new Automatic Transfer Switch and operation of the existing generator units in compliance with specification 16415.
D. Demonstrate a functional test of the Generator SWBD Kirk Key breakers and cam lock connector system.
E. Provide the services of authorized manufacturers' representatives to instruct the Owner's representatives in the proper operation of each partial or complete system installed under this Contract.
F. Pay all charges or fees, including the cost of any special test equipment, factory engineers, etc. necessary for the proper performance of the specified tests, demonstrations, and instructions.
G. All demonstrations and instructions shall be scheduled at the convenience of the Engineer and the Owner and shall be scheduled with at least seventy-two (72) hours written notice.
H. Set all circuit breaker and overcurrent devices based on overall system coordination and short circuit study. Final acceptance will not be allowed until all settings and protective devices are set, checked, tested, and verified in the field in the presence of the Engineer.
I. All control circuits shall be functionally checked to see that their operation and sequence are correct. Any adjustable switches such as float switches, limit switches and timers shall be adjusted for proper operation.
J. Just prior to acceptance of the lighting facilities, clean all lighting fixtures and relamp where required at no additional cost to the Owner.
K. All local control stations and control panels for equipment specified in DIVISIONS 16 shall be demonstrated to function properly of all items under simulated operating conditions unless otherwise specified elsewhere.
L. Test and demonstrate operation of the added devices to the existing fire alarm system. Provide all test results.
M. Test and demonstrate operation of the added devices to the existing security system. Provide all test results.
N. Provide a copy of the lighting arrestor installation certification.

MEGGER TEST RESULTS

Project: _____ **Temperature:** _____
Date: _____ **Weather:** _____
Location: _____ **Test Equipment:** _____

Equipment/feeder Under Test: _____ **Start Time:** _____ **End Time:** _____
Test Equipment: Make : _____ **Serial No.:** _____ **Test Voltage:** _____

	0.5 min	1 min	2 min	3 min	4 min	5 min	6 min	7 min	8 min	9 min	10 min	P.I.
Phase A-Gnd.												
Phase B-Gnd.												
Phase C-Gnd.												
Phase A-PhaseB												
Phase A-PhaseC												
Phase B-PhaseC												

Equipment/feeder Under Test: _____ **Start Time:** _____ **End Time:** _____

	0.5 min	1 min	2 min	3 min	4 min	5 min	6 min	7 min	8 min	9 min	10 min	P.I.
Phase A-Gnd.												
Phase B-Gnd.												
Phase C-Gnd.												
Phase A-PhaseB												
Phase A-PhaseC												
Phase B-PhaseC												

Notes: Megger test only should record 5 minutes value…
Polarization Index (P.I.) is 10 min reading divided by 1 min reading
Note: If a neutral is provided, this will also need to be tested

END OF SECTION

APPENDIX A
Panel and Load Schedules

PROJECT: 12688G
MCC-UV Load List

ENGINEER: SAL
REVISION DATE: 2/24/2015

				CONNECTED LOAD See Note					DEMAND LOAD See Note			
Device Voltage	Device Phase	Load Description	Tag:	Stater Type	Motor HP	NEC Current	Column 1 KW	Column 2 KVA	Motor HP	NEC Current	Column 1 KW	Column 2 KVA
480	3	Main (1200 amp rating)		Main				0.0				0.0
480	3	Plant Water Pump #1		VFD	15			0.0				0.0
480	3	Plant Water Pump #2		VFD	15			0.0				0.0
480	3	60 KVA UPS/ 75KVA Trans./Panel PDC-1		Feeder				0.0				0.0
480	3	60 KVA UPS/ 75KVA Trans./Panel PDC-2		Feeder				0.0				0.0
480	3	Flood Pump #1		VFD	40			0.0				0.0
480	3	Flood Pump #2		VFD	40			0.0				0.0
480	3	Exh. Fan EF-1		FVNR	3			0.0				0.0
480	3	Supply Fan SF-1		FVNR	1.5			0.0				0.0
480	3	AHU-10		Feeder	10			0.0				0.0
480	3	Power Panel PP-UV		Feeder								
480	3	UPS Bypass		Feeder				0.0				0.0
480	3	Tie Breaker (1200 amp rating)		Tie				0.0				0.0
480	3	30 Kva T-UV/Lighting Panel LP-UV		Feeder				0.0				0.0
480	3	UPS Bypass		Feeder				0.0				0.0
480	3	UPS Bypass		Feeder				0.0				0.0
480	3	Plant Water Pump #3		VFD	25			0.0				0.0
480	3	Flood Pump #3		VFD	40			0.0				0.0
480	3	Flood Pump #4		VFD	40			0.0				0.0
480	3	Hoist/Monorail		FVNR	Combined 3			0.0				0.0
480	3	Supply Fan SF-2		FVNR	3			0.0				0.0
480	3	ACU-1		Feeder				0.0				0.0
480	3	Power Panel DP		Feeder								
480	3	Plant Water Pump #4		VFD	25							
480	3	60 KVA UPS/ 75KVA Trans./Panel PDC-3		Feeder				0.0				0.0
					Motor Amps	0.0			Motor Amps	0.0		

** 125% times FLA of largest motor plus 125% of cont. loads

	Total Loads:	0.0 KVA	Total Loads:	0.0 KVA
25%	For future loads	0.0 KVA	For future loads	0.0 KVA
		3 Phase		3 Phase
	Service Voltage:	480 Volts	Service Voltage:	480 Volts
	Actual Load Current:	0.0 Amps	Actual Load Current:	0.0 Amps
	** NEC Feeder Current	0.0 Amps	NEC Feeder Current	0.0 Amps
	Future Load Current	0.0 Amps	Future Load Current	0.0 Amps
	Minimum Feeder Current	Amps	Minimum Feeder Current	Amps
	Largest Motor Amps	0 Amps	Largest Motor Amps	0 Amps
	Continuos loads	0 KVA	Continuos loads	0 KVA

Notes: Use Column 1, for linear loads, Column 2 will automatically calculate motor loads if voltage and current are known

PROJECT: 12688G
MCC-BL Load List

ENGINEER: SAL
REVISION DATE: 2/24/2015

				CONNECTED LOAD See Note					DEMAND LOAD See Note			
Device Voltage	Device Phase	Load Description	Tag:	Stater Type	Motor HP	NEC Current	Column 1 KW	Column 2 KVA	Motor HP	NEC Current	Column 1 KW	Column 2 KVA
480	3	Main (1200 amp rating)		Main				0.0				0.0
480	3	Aeration Blower #2		VFD	100			0.0				0.0
480	3	Aeration Blower #4		VFD	150			0.0				0.0
480	3	Grit Blower #2		FVNR	7.5			0.0				0.0
480	3	Grit Blower #3		FVNR	7.5			0.0				0.0
480	3	Op. Building Drain Pump #2		FVNR	5			0.0				0.0
480	3	Polymer Feed Pump #2		VFD	2			0.0				0.0
480	3	Polymer Feed Pump #3		VFD	2			0.0				0.0
480	3	Tie Breaker (1200 amp rating)		Tie				0.0				0.0
480	3	Polymer Feed Pump #1		VFD	2			0.0				0.0
480	3	Aeration Blower #1		VFD	100			0.0				0.0
480	3	Aeration Blower #3		VFD	150			0.0				0.0
480	3	Grit Blower #1		FVNR	7.5			0.0				0.0
480	3	Power Panel TPH-3/T-3/Panel TPL-3		Feeder				0.0				0.0
480	3	Op. Building Drain Pump #1		FVNR	5			0.0				0.0

Motor Amps 0.0 Motor Amps 0.0

** 125% times FLA of largest motor plus 125% of cont. loads

	Total Loads:	0.0 KVA	Total Loads:	0.0 KVA
25%	For future loads	0.0 KVA	For future loads	0.0 KVA
		3 Phase		3 Phase
	Service Voltage:	480 Volts	Service Voltage:	480 Volts
	Actual Load Current:	0.0 Amps	Actual Load Current:	0.0 Amps
	** NEC Feeder Current	0.0 Amps	NEC Feeder Current	0.0 Amps
	Future Load Current	0.0 Amps	Future Load Current	0.0 Amps
	Minimum Feeder Current	Amps	Minimum Feeder Current	Amps
	Largest Motor Amps	0 Amps	Largest Motor Amps	0 Amps
	Continuos loads	0 KVA	Continuos loads	0 KVA

Notes: Use Column 1, for linear loads, Column 2 will automatically calculate motor loads if voltage and current are known

480 V MCC-TPA (ADMIN.BLDG) 0 06/11/09

NO.		DESCRIPTION	LOAD SIZE	LOAD UNIT	QUANTITY CONN	QUANTITY OPER	QUANTITY EMER	FEEDER SIZING FACTOR	DEM FAC	VOLT KV	CONN KVA	OPER DEMAND KVA	EMERG KVA	FEEDER SIZING CONN. KVA	FEEDER SIZING DEM. KVA
1		SF-1	7.5	HP	1	1	1	1	1	0.48	9.1	9.1	9.1	9.1	9.1
2		EF-1	3	HP	1	1	1	1	1	0.48	4.0	4.0	4.0	4.0	4.0
3		MONORAIL CENTRIFUGE NO.1	0.5	HP	1	0	1	1	1	0.48	0.9	0.0	0.9	0.9	0.0
4		MONORAIL CENTRIFUGE NO.2	0.5	HP	1	0	1	1	1	0.48	0.9	0.0	0.9	0.9	0.0
5		ROOF FAN NO.1	0.5	HP	1	1	1	1	1	0.48	0.9	0.9	0.9	0.9	0.9
6		GEN ROOM ROOF FAN NO.7	2	HP	1	1	1	1	1	0.48	2.8	2.8	2.8	2.8	2.8
7		ROOF FAN NO.3	2	HP	1	1	1	1	1	0.48	2.8	2.8	2.8	2.8	2.8
8		ROOF FAN NO.4 (PRESS NO.2)	1	HP	1	1	1	1	1	0.48	1.7	1.7	1.7	1.7	1.7
9		ROOF FAN NO. 5 (PRESS NO.1)	1	HP	1	1	1	1	1	0.48	1.7	1.7	1.7	1.7	1.7
10		ROOF FAN NO.8	2	HP	1	1	1	1	1	0.48	2.8	2.8	2.8	2.8	2.8
11		BLOWER NO.6	15	HP	1	0	1	1	1	0.48	17.5	0.0	17.5	17.5	0.0
12		BLOWER NO.8	7.5	HP	1	0	1	1	1	0.48	9.1	0.0	9.1	9.1	0.0
13		MCC-TPC FEEDER	56	KVA	1	1	1	1.25	0.75	0.48	56.0	42.0	56.0	70.0	52.5
14		CENTRIFUGE NO. 1 MCP	200	KVA	1	1	1	1.25	1	0.48	200.0	200.0	200.0	250.0	250.0
15		MONORAIL CENTRIFUGE ROOM	0.5	HP	1	0	1	1	1	0.48	0.9	0.0	0.9	0.9	0.0
16		INCLINED SCREW CONVEYOR NO. 1	5	HP	1	1	1	1	1	0.48	6.3	6.3	6.3	6.3	6.3
17		TF-1	1	HP	1	1	1	1	1	0.48	1.7	1.7	1.7	1.7	1.7
18		CHILLER	40	FLA	1	1	1	1.25	1	0.48	33.3	33.3	33.3	41.6	41.6
19		TRAINING CENTER FEEDER	75	KVA	1	1	1	1.25	0.6	0.48	75.0	45.0	75.0	93.8	56.3
20		HV-1	7.5	HP	1	1	1	1	1	0.48	9.1	9.1	9.1	9.1	9.1
21		RF-6	1.5	HP	1	1	1	1	1	0.48	2.5	2.5	2.5	2.5	2.5
22		SP-5	0.75	HP	1	1	1	1	1	0.48	1.3	1.3	1.3	1.3	1.3
23		ACC-1	2	HP	1	1	1	1	1	0.48	2.8	2.8	2.8	2.8	2.8
24		ACU-3	2	HP	1	1	1	1	1	0.48	2.8	2.8	2.8	2.8	2.8
25		SLUDGE BAY DOOR NO. 1	1	HP	1	1	1	1	1	0.48	1.7	1.7	1.7	1.7	1.7
26		SLUDGE BAY DOOR NO. 2	1	HP	1	1	1	1	1	0.48	1.7	1.7	1.7	1.7	1.7
27		ACU-1	27.5	KVA	1	0	1	1.25	1	0.48	27.5	0.0	27.5	34.4	0.0
28		SP-6	0.75	HP	1	1	1	1	1	0.48	1.3	1.3	1.3	1.3	1.3
29		SP-1	0.75	HP	1	1	1	1	1	0.48	1.3	1.3	1.3	1.3	1.3
30		EF-2	0.75	HP	1	1	1	1	1	0.48	1.3	1.3	1.3	1.3	1.3
31		TF-2	1.5	HP	1	1	1	1	1	0.48	2.5	2.5	2.5	2.5	2.5
32		RF-7	1.5	HP	1	1	1	1	1	0.48	2.5	2.5	2.5	2.5	2.5
33		CENTRATE PUMP 2	10	HP	1	1	1	1	1	0.48	11.6	11.6	11.6	11.6	11.6
34			0	HP	1	1	1	1	1	0.48	0.0	0.0	0.0	0.0	0.0
										0.48					
		SPARE CAPACITY	0	%							0.0	0.0	0.0	0.0	0.0
TOTAL		MCC-TPA (ADMIN.BLDG)								0.48	497.3	396.5	497.3	595.3	476.6

CONNECTED LOAD			STARTER	LARGEST MOTOR				MIN BREAKER TRIP =
LARGEST MOTOR CONNECTED	15	HP	FV	MAX BREAKER TRIP =		50	A	MIN FEEDER AMPS =
TOTAL MOTOR HP	80	HP		MAIN BREAKER	80 %		RATED	MAX BREAKER TRIP =
DEMAND LOAD			STARTER	LARGEST MOTOR				MIN BREAKER TRIP =
LARGEST MOTOR CONNECTED	10	HP	FV	MAX BREAKER TRIP =		35	A	MIN FEEDER AMPS =
TOTAL MOTOR HP	56	HP		MAIN BREAKER	80 %		RATED	MAX BREAKER TRIP =
EMERGENCY LOAD			STARTER	LARGEST MOTOR				MIN BREAKER TRIP =
LARGEST MOTOR CONNECTED	15	HP	FV	MAX BREAKER TRIP =		50	A	MIN FEEDER AMPS =
TOTAL MOTOR HP	80	HP		MAIN BREAKER	80 %		RATED	MAX BREAKER TRIP =

480 V MCC-TPB (ADMIN. BLDG)

06/11/09

NO.	DESCRIPTION	LOAD SIZE	LOAD UNIT	QUANTITY CONN	QUANTITY OPER	QUANTITY EMER	FEEDER SIZING FACTOR	DEM FAC	VOLT KV	CONN KVA	OPER DEMAND KVA	EMERG KVA	FEEDER SIZING CONN. KVA	FEEDER SIZING DEM. KVA
1	LAB PANEL	15	KVA	1	1	1	1.25	0.7	0	15.0	10.5	15.0	18.8	13.1
2	OPERATIONS PANEL	20	KVA	1	1	1	1.25	0.7	0	20.0	14.0	20.0	25.0	17.5
3	GARAGE PANEL	15	KVA	1	1	1	1.25	0.7	0	15.0	10.5	15.0	18.8	13.1
4	BOILER ROOM PANEL	30	KVA	1	1	1	1.25	0.7	0	30.0	21.0	30.0	37.5	26.3
									0					
	SPARE CAPACITY	0	%							0.0	0.0	0.0	0.0	0.0
TOTAL	MCC-TPB (ADMIN. BLDG)								0.48	80.0	56.0	80.0	100.1	70.0

	CONNECTED LOAD			STARTER	LARGEST MOTOR	MIN BREAKER TRIP =
	LARGEST MOTOR CONNECTED	0	HP	FV	MAX BREAKER TRIP = 0 A	MIN FEEDER AMPS =
	TOTAL MOTOR HP	0	HP		MAIN BREAKER 80 % RATED	MAX BREAKER TRIP =
	DEMAND LOAD			STARTER	LARGEST MOTOR	MIN BREAKER TRIP =
	LARGEST MOTOR CONNECTED	0	HP	FV	MAX BREAKER TRIP = 0 A	MIN FEEDER AMPS =
	TOTAL MOTOR HP	0	HP		MAIN BREAKER 80 % RATED	MAX BREAKER TRIP =
	EMERGENCY LOAD			STARTER	LARGEST MOTOR	MIN BREAKER TRIP =
	LARGEST MOTOR CONNECTED	0	HP	FV	MAX BREAKER TRIP = 0 A	MIN FEEDER AMPS =
	TOTAL MOTOR HP	0	HP		MAIN BREAKER 80 % RATED	MAX BREAKER TRIP =

480 V MCC-HW (HEADWORKS BLDG)

06/11/09

NO.	DESCRIPTION	LOAD SIZE	LOAD UNIT	QUANTITY CONN	QUANTITY OPER	QUANTITY EMER	FEEDER SIZING FACTOR	DEM FAC	VOLT KV	CONN KVA	OPER DEMAND KVA	EMERG KVA	FEEDER SIZING CONN. KVA	FEEDER SIZING DEM. KVA
1	ROOF FAN RF-12	0.75	HP	1	1	1	1	1	0.48	1.3	1.3	1.3	1.3	1.3
2	ROOF FAN RF-11	0.75	HP	1	1	1	1	1	0.48	1.3	1.3	1.3	1.3	1.3
3	EUH-1	12.5	KW	1	1	1	1.25	1	0.48	12.5	12.5	12.5	15.6	15.6
4	EUH-2	12.5	KW	1	1	1	1.25	1	0.48	12.5	12.5	12.5	15.6	15.6
5	EUH-3	12.5	KW	1	1	1	1.25	1	0.48	12.5	12.5	12.5	15.6	15.6
6	EUH-4	3	KW	1	1	1	1.25	1	0.48	3.0	3.0	3.0	3.8	3.8
7	GRIT PUMP NO 1	15	HP	1	1	1	1	1	0.48	17.5	17.5	17.5	17.5	17.5
8	GRIT PUMP NO.2	15	HP	1	0	1	1	1	0.48	17.5	0.0	17.5	17.5	0.0
9	SCREEN MOTOR NO.1	0.5	HP	1	1	1	1	1	0.48	0.9	0.9	0.9	0.9	0.9
10	SCREEN MOTOR NO.2	0.5	HP	1	1	1	1	1	0.48	0.9	0.9	0.9	0.9	0.9
11	SUMP PUMP	0.33	HP	1	1	1	1	1	0.48	0.9	0.9	0.9	0.9	0.9
12	SCREW DRIVE NO.1	0.33	HP	1	1	1	1	1	0.48	0.9	0.9	0.9	0.9	0.9
13	SCREW DRIVE NO.2	0.33	HP	1	1	1	1	1	0.48	0.9	0.9	0.9	0.9	0.9
14	LIGHTING PANEL- HB	20	KVA	1	1	1	1.25	0.5	0.48	20.0	10.0	20.0	25.0	12.5
									0.48					
	SPARE CAPACITY	0	%							0.0	0.0	0.0	0.0	0.0
TOTAL	MCC-HW (HEADWORKS BLDG)								0.48	102.6	75.1	102.6	117.7	87.7

	CONNECTED LOAD			STARTER	LARGEST MOTOR		MIN BREAKER TRIP =
	LARGEST MOTOR CONNECTED	15	HP	FV	MAX BREAKER TRIP =	50 A	MIN FEEDER AMPS =
	TOTAL MOTOR HP	33.49	HP		MAIN BREAKER	80 % RATED	MAX BREAKER TRIP =
	DEMAND LOAD			STARTER	LARGEST MOTOR		MIN BREAKER TRIP =
	LARGEST MOTOR CONNECTED	15	HP	FV	MAX BREAKER TRIP =	50 A	MIN FEEDER AMPS =
	TOTAL MOTOR HP	18.49	HP		MAIN BREAKER	80 % RATED	MAX BREAKER TRIP =
	EMERGENCY LOAD			STARTER	LARGEST MOTOR		MIN BREAKER TRIP =
	LARGEST MOTOR CONNECTED	15	HP	FV	MAX BREAKER TRIP =	50 A	MIN FEEDER AMPS =
	TOTAL MOTOR HP	33.49	HP		MAIN BREAKER	80 % RATED	MAX BREAKER TRIP =

480 V MCC-PS (PRIMARY SLUDGE)

06/11/09

NO.	DESCRIPTION	LOAD SIZE	LOAD UNIT	QUANTITY CONN	QUANTITY OPER	QUANTITY EMER	FEEDER SIZING FACTOR	DEM FAC	VOLT KV	CONN KVA	OPER DEMAND KVA	EMERG KVA	FEEDER SIZING CONN. KVA	FEEDER SIZING DEM. KVA
1	PRIMARY CLARIFIER NO.1	1	HP	1	1	1	1	1	0.48	1.7	1.7	1.7	1.7	1.7
2	PRIMARY CLARIFIER NO.2	1	HP	1	1	1	1	1	0.48	1.7	1.7	1.7	1.7	1.7
3	PRIMARY SLUDGE PUMP NO.1	5	HP	1	0	0	1	1	0.48	6.3	0.0	0.0	6.3	0.0
4	PRIMARY SLUDGE PUMP NO.2	15	HP	1	0	1	1	1	0.48	17.5	0.0	17.5	17.5	0.0
5	PRIMARY SLUDGE PUMP NO.3	15	HP	1	1	1	1	1	0.48	17.5	17.5	17.5	17.5	17.5
6	PRIMARY SLUDGE PUMP NO.4	5	HP	1	0	0	1	1	0.48	6.3	0.0	0.0	6.3	0.0
7	HVAC UNIT NO.1	3	HP	1	1	1	1	1	0.48	4.0	4.0	4.0	4.0	4.0
8	LIGHTING PANEL -PS	30	KVA	1	1	1	1.25	0.5	0.48	30.0	15.0	30.0	37.5	18.8
9	PRIMARY SLUDGE GRINDER NO.1	3	HP	1	1	1	1	1	0.48	4.0	4.0	4.0	4.0	4.0
10	PRIMARY SLUDGE GRINDER NO.2	3	HP	1	1	1	1	1	0.48	4.0	4.0	4.0	4.0	4.0
11	MIXER NO. 1	4	HP	1	1	1	1	1	0.48	6.3	6.3	6.3	6.3	6.3
12	MIXER NO. 2	4	HP	1	1	1	1	1	0.48	6.3	6.3	6.3	6.3	6.3
13	MIXER NO. 3	4	HP	1	1	1	1	1	0.48	6.3	6.3	6.3	6.3	6.3
14	MIXER NO. 4	4	HP	1	0	0	1	1	0.48	6.3	0.0	0.0	6.3	0.0
15			HP	1	1	1	1	1	0.48	0.0	0.0	0.0	0.0	0.0
16		0	HP	1	1	1	1	1	0.48	0.0	0.0	0.0	0.0	0.0
17		0	HP	1	1	1	1	1	0.48	0.0	0.0	0.0	0.0	0.0
18		0	HP	1	1	1	1	1	0.48	0.0	0.0	0.0	0.0	0.0
19		0	HP	1	1	1	1	1	0.48	0.0	0.0	0.0	0.0	0.0
									0.48					
	SPARE CAPACITY	0	%							0.0	0.0	0.0	0.0	0.0
TOTAL	MCC-PS (PRIMARY SLUDGE)								0.48	118.2	66.8	99.3	125.7	70.6

	CONNECTED LOAD			STARTER	LARGEST MOTOR			MIN BREAKER TRIP =
	LARGEST MOTOR CONNECTED	15	HP	FV	MAX BREAKER TRIP =	50	A	MIN FEEDER AMPS =
	TOTAL MOTOR HP	67	HP		MAIN BREAKER	80 %	RATED	MAX BREAKER TRIP =
	DEMAND LOAD			STARTER	LARGEST MOTOR			MIN BREAKER TRIP =
	LARGEST MOTOR CONNECTED	15	HP	FV	MAX BREAKER TRIP =	50	A	MIN FEEDER AMPS =
	TOTAL MOTOR HP	38	HP		MAIN BREAKER	80 %	RATED	MAX BREAKER TRIP =
	EMERGENCY LOAD			STARTER	LARGEST MOTOR			MIN BREAKER TRIP =
	LARGEST MOTOR CONNECTED	15	HP	FV	MAX BREAKER TRIP =	50	A	MIN FEEDER AMPS =
	TOTAL MOTOR HP	53	HP		MAIN BREAKER	80 %	RATED	MAX BREAKER TRIP =

480 V MCC-RS (RETURN SLUDGE)

06/11/09

NO.	DESCRIPTION	LOAD SIZE	LOAD UNIT	QUANTITY CONN	QUANTITY OPER	QUANTITY EMER	FEEDER SIZING FACTOR	DEM FAC	VOLT KV	CONN KVA	OPER DEMAND KVA	EMERG KVA	FEEDER SIZING CONN. KVA	FEEDER SIZING DEM. KVA
1	SECONDARY SETTLING TANK NO.1	1	HP	1	1	1	1	1	0.48	1.7	1.7	1.7	1.7	1.7
2	SECONDARY SETTLING TANK NO.2	1	HP	1	1	1	1	1	0.48	1.7	1.7	1.7	1.7	1.7
3	RAS PUMP NO.1	7.5	HP	1	1	1	1	1	0.48	9.1	9.1	9.1	9.1	9.1
4	RAS PUMP NO.2	7.5	HP	1	1	1	1	1	0.48	9.1	9.1	9.1	9.1	9.1
5	RAS PUMP NO.3	7.5	HP	1	0	1	1	1	0.48	9.1	0.0	9.1	9.1	0.0
6	RAS PUMP NO.4	7.5	HP	1	0	1	1	1	0.48	9.1	0.0	9.1	9.1	0.0
7	RAS PUMP NO.5	7.5	HP	1	0	0	1	1	0.48	9.1	0.0	0.0	9.1	0.0
8	WAS PUMP NO.1	10	HP	1	1	1	1	1	0.48	11.6	11.6	11.6	11.6	11.6
9	WAS PUMP NO.2	10	HP	1	1	1	1	1	0.48	11.6	11.6	11.6	11.6	11.6
10	WAS PUMP NO.3	2	HP	1	0	0	1	1	0.48	2.8	0.0	0.0	2.8	0.0
11	WAS PUMP NO.4	2	HP	1	0	0	1	1	0.48	2.8	0.0	0.0	2.8	0.0
12	HVAC UNIT NO.2	10	HP	1	1	1	1	1	0.48	11.6	11.6	11.6	11.6	11.6
13	DRAIN PUMP CONTROL PNL	5	HP	1	1	1	1	1	0.48	6.3	6.3	6.3	6.3	6.3
14	LIGHTING PANEL-RS	30	KVA	1	1	1	1.25	1	0.48	30.0	30.0	30.0	37.5	37.5
									0.48					
	SPARE CAPACITY	0	%							0.0	0.0	0.0	0.0	0.0
TOTAL	MCC-RS (RETURN SLUDGE)								0.48	125.6	92.7	110.9	133.1	100.2

	CONNECTED LOAD			STARTER	LARGEST MOTOR				MIN BREAKER TRIP =
	LARGEST MOTOR CONNECTED	10	HP	FV	MAX BREAKER TRIP =		35	A	MIN FEEDER AMPS =
	TOTAL MOTOR HP	78.5	HP		MAIN BREAKER	80 %		RATED	MAX BREAKER TRIP =
	DEMAND LOAD			STARTER	LARGEST MOTOR				MIN BREAKER TRIP =
	LARGEST MOTOR CONNECTED	10	HP	FV	MAX BREAKER TRIP =		35	A	MIN FEEDER AMPS =
	TOTAL MOTOR HP	52	HP		MAIN BREAKER	80 %		RATED	MAX BREAKER TRIP =
	EMERGENCY LOAD			STARTER	LARGEST MOTOR				MIN BREAKER TRIP =
	LARGEST MOTOR CONNECTED	10	HP	FV	MAX BREAKER TRIP =		35	A	MIN FEEDER AMPS =
	TOTAL MOTOR HP	67	HP		MAIN BREAKER	80 %		RATED	MAX BREAKER TRIP =

480 V MCC-TS (THICKENED SLUDGE)

06/11/09

NO.	DESCRIPTION	LOAD SIZE	LOAD UNIT	QUANTITY CONN	QUANTITY OPER	QUANTITY EMER	FEEDER SIZING FACTOR	DEM FAC	VOLT KV	CONN KVA	OPER DEMAND KVA	EMERG KVA	FEEDER SIZING CONN. KVA	FEEDER SIZING DEM. KVA
1	DEGRITTED SEPTAGE PUMP NO.1	5	HP	1	1	1	1	1	0.48	6.3	6.3	6.3	6.3	6.3
2	DEGRITTED SEPTAGE PUMP NO.2	5	HP	1	0	1	1	1	0.48	6.3	0.0	6.3	6.3	0.0
3	CLASSIFIER	0.5	HP	1	1	1	1	1	0.48	0.9	0.9	0.9	0.9	0.9
4	THICKENED SLUDGE PUMP NO.1	15	HP	1	1	1	1	1	0.48	17.5	17.5	17.5	17.5	17.5
5	THICKENED SLUDGE PUMP NO.2	15	HP	1	1	1	1	1	0.48	17.5	17.5	17.5	17.5	17.5
6	THICKENED SLUDGE PUMP NO.3	15	HP	1	0	0	1	1	0.48	17.5	0.0	0.0	17.5	0.0
7	THICKENED SLUDGE PUMP NO.4	15	HP	1	0	0	1	1	0.48	17.5	0.0	0.0	17.5	0.0
8	RAW SEPTAGE PUMP NO.1	10	HP	1	1	1	1	1	0.48	11.6	11.6	11.6	11.6	11.6
9	RAW SEPTAGE PUMP NO.2	10	HP	1	0	1	1	1	0.48	11.6	0.0	11.6	11.6	0.0
10	SLUDGE THICKENER NO.1	0.5	HP	1	1	1	1	1	0.48	0.9	0.9	0.9	0.9	0.9
11	SLUDGE THICKENER NO.2	0.5	HP	1	1	0	1	1	0.48	0.9	0.9	0.0	0.9	0.9
12	LIGHTING PANEL-TS	30	KVA	1	1	1	1.25	0.5	0.48	30.0	15.0	30.0	37.5	18.8
13	THICKENED SLUDGE GRINDER NO. 1	5	HP	1	1	1	1	1	0.48	6.3	6.3	6.3	6.3	6.3
14	THICKENED SLUDGE GRINDER NO. 2	5	HP	1	1	1	1	1	0.48	6.3	6.3	6.3	6.3	6.3
15	SEPTAGE GRINDER MUFFIN MONSTER	5	HP	1	1	1	1	1	0.48	6.3	6.3	6.3	6.3	6.3
16	DRAIN PUMP NO. 3	15	HP	1	0	1	1	1	0.48	17.5	0.0	17.5	17.5	0.0
17	BF-1	1	HP	1	1	1	1	1	0.48	1.7	1.7	1.7	1.7	1.7
18	MAU-1	7.5	HP	1	1	1	1	1	0.48	9.1	9.1	9.1	9.1	9.1
									0.48					
	SPARE CAPACITY	0	%							0.0	0.0	0.0	0.0	0.0
TOTAL	MCC-TS (THICKENED SLUDGE)								0.48	185.7	100.3	149.8	193.2	104.1

	CONNECTED LOAD			STARTER	LARGEST MOTOR			MIN BREAKER TRIP =
	LARGEST MOTOR CONNECTED	15	HP	FV	MAX BREAKER TRIP =		50 A	MIN FEEDER AMPS =
	TOTAL MOTOR HP	130	HP		MAIN BREAKER	80 %	RATED	MAX BREAKER TRIP =
	DEMAND LOAD			STARTER	LARGEST MOTOR			MIN BREAKER TRIP =
	LARGEST MOTOR CONNECTED	15	HP	FV	MAX BREAKER TRIP =		50 A	MIN FEEDER AMPS =
	TOTAL MOTOR HP	70	HP		MAIN BREAKER	80 %	RATED	MAX BREAKER TRIP =
	EMERGENCY LOAD			STARTER	LARGEST MOTOR			MIN BREAKER TRIP =
	LARGEST MOTOR CONNECTED	15	HP	FV	MAX BREAKER TRIP =		50 A	MIN FEEDER AMPS =
	TOTAL MOTOR HP	99.5	HP		MAIN BREAKER	80 %	RATED	MAX BREAKER TRIP =

480 V MCC-SD (SLUDGE DIGESTER)

06/11/09

NO.	DESCRIPTION	LOAD SIZE	LOAD UNIT	QUANTITY CONN	QUANTITY OPER	QUANTITY EMER	FEEDER SIZING FACTOR	DEM FAC	VOLT KV	CONN KVA	OPER DEMAND KVA	EMERG KVA	FEEDER SIZING CONN. KVA	FEEDER SIZING DEM. KVA
1	PRIMARY DIGESTER NO.1	15	HP	1	1	1	1	1	0.48	17.5	17.5	17.5	17.5	17.5
2	PRIMARY DIGESTER NO.2	15	HP	1	1	1	1	1	0.48	17.5	17.5	17.5	17.5	17.5
3	LIGHTING PANEL -SD	30	KVA	1	1	1	1.25	0.5	0.48	30.0	15.0	30.0	37.5	18.8
4	RECIRCULATED SLUDGE PUMP NO.1	7.5	HP	1	1	1	1	1	0.48	9.1	9.1	9.1	9.1	9.1
5	RECIRCULATED SLUDGE PUMP NO.2	7.5	HP	1	0	0	1	1	0.48	9.1	0.0	0.0	9.1	0.0
6	RECIRCULATED SLUDGE PUMP NO.3	7.5	HP	1	1	1	1	1	0.48	9.1	9.1	9.1	9.1	9.1
7	RECIRCULATED SLUDGE PUMP NO.4	7.5	HP	1	0	0	1	1	0.48	9.1	0.0	0.0	9.1	0.0
8	AIR COMPRESSOR	0.75	HP	1	1	1	1	1	0.48	1.3	1.3	1.3	1.3	1.3
9	DRAIN PUMP NO. 1	15	HP	1	0	1	1	1	0.48	17.5	0.0	17.5	17.5	0.0
10	DRAIN PUMP NO. 2	15	HP	1	0	1	1	1	0.48	17.5	0.0	17.5	17.5	0.0
11	OUTDOOR DISCONNECT	50	KVA	1	1	1	1.25	1	0.48	50.0	50.0	50.0	62.5	62.5
12	GRINDER PUMP	2	HP	1	1	1	1	1	0.48	2.8	2.8	2.8	2.8	2.8
13	PRIMARY DIGESTER MIXER MOTOR NO. 1	15	HP	1	1	1	1	1	0.48	17.5	17.5	17.5	17.5	17.5
14	PRIMARY DIGESTER MIXER MOTOR NO. 2	15	HP	1	1	1	1	1	0.48	17.5	17.5	17.5	17.5	17.5
15	SP-3	0.75	HP	1	1	1	1	1	0.48	1.3	1.3	1.3	1.3	1.3
16	TEF-1	0.75	HP	1	1	1	1	1	0.48	1.3	1.3	1.3	1.3	1.3
17	SP-4	0.75	HP	1	0	0	1	1	0.48	1.3	0.0	0.0	1.3	0.0
18	DIGESTED SLUDGE GRINDER NO. 1	5	HP	1	1	1	1	1	0.48	6.3	6.3	6.3	6.3	6.3
19	DIGESTED SLUDGE GRINDER NO. 2	5	HP	1	1	1	1	1	0.48	6.3	6.3	6.3	6.3	6.3
20	DIGESTED SLUDGE GRINDER NO. 3	5	HP	1	0	0	1	1	0.48	6.3	0.0	0.0	6.3	0.0
21	ELEC. HEAT GAS ROOM	12.5	KW	1	1	1	1.25	1	0.48	12.5	12.5	12.5	15.6	15.6
22	ELEC. HEAT GAS ROOM	12.5	KW	1	1	1	1.25	1	0.48	12.5	12.5	12.5	15.6	15.6
23	SUMP PUMP NO. 1	2	HP	1	0	1	1	1	0.48	2.8	0.0	2.8	2.8	0.0
24	SUMP PUMP NO. 2	2	HP	1	0	1	1	1	0.48	2.8	0.0	2.8	2.8	0.0
25	GAS ROOM EXHAUST FAN	3	HP	1	1	1	1	1	0.48	4.0	4.0	4.0	4.0	4.0
26	HEATER NO. 1	3.25	HP	1	1	1	1	1	0.48	6.3	6.3	6.3	6.3	6.3
27	HEATER NO. 2	3.25	HP	1	1	1	1	1	0.48	6.3	6.3	6.3	6.3	6.3
28	EXHAUST FAN NO. 3	2	HP	1	1	1	1	1	0.48	2.8	2.8	2.8	2.8	2.8
									0.48					
	SPARE CAPACITY	0	%							0.0	0.0	0.0	0.0	0.0
TOTAL	MCC-SD (SLUDGE DIGESTER)								0.48	298.3	216.9	272.5	324.5	239.4

	CONNECTED LOAD			STARTER	LARGEST MOTOR			MIN BREAKER TRIP =
	LARGEST MOTOR CONNECTED	15	HP	FV	MAX BREAKER TRIP =		50 A	MIN FEEDER AMPS =
	TOTAL MOTOR HP	155.5	HP		MAIN BREAKER	80 %	RATED	MAX BREAKER TRIP =
	DEMAND LOAD			STARTER	LARGEST MOTOR			MIN BREAKER TRIP =
	LARGEST MOTOR CONNECTED	15	HP	FV	MAX BREAKER TRIP =		50 A	MIN FEEDER AMPS =
	TOTAL MOTOR HP	100.75	HP		MAIN BREAKER	80 %	RATED	MAX BREAKER TRIP =
	EMERGENCY LOAD			STARTER	LARGEST MOTOR			MIN BREAKER TRIP =
	LARGEST MOTOR CONNECTED	15	HP	FV	MAX BREAKER TRIP =		50 A	MIN FEEDER AMPS =
	TOTAL MOTOR HP	134.75	HP		MAIN BREAKER	80 %	RATED	MAX BREAKER TRIP =

480 V MCC- FP (FILTER PRESS)

06/11/09

NO.	DESCRIPTION	LOAD SIZE	LOAD UNIT	QUANTITY CONN	QUANTITY OPER	QUANTITY EMER	FEEDER SIZING FACTOR	DEM FAC	VOLT KV	CONN KVA	OPER DEMAND KVA	EMERG KVA	FEEDER SIZING CONN. KVA	FEEDER SIZING DEM. KVA
1	COMPRESSOR NO. 1	25	HP	1	0	1	1	1	0.48	28.3	0.0	28.3	28.3	0.0
2	COMPRESSOR NO. 2	25	HP	1	0	1	1	1	0.48	28.3	0.0	28.3	28.3	0.0
3	INCLINED SCREW CONVEYOR NO. 2	5	HP	1	1	1	1	1	0.48	6.3	6.3	6.3	6.3	6.3
4	SOLIDS DISTR. SCREW CONVEYOR NO. 2	10	HP	1	1	1	1	1	0.48	11.6	11.6	11.6	11.6	11.6
5	SP-2	5	HP	1	1	1	1	1	0.48	6.3	6.3	6.3	6.3	6.3
6	LIME SLURRY PUMP NO. 1	1	HP	1	1	1	1	1	0.48	1.7	1.7	1.7	1.7	1.7
7	MONORAIL CENTRIFUGE NO. 2	2	HP	1	1	1	1	1	0.48	2.8	2.8	2.8	2.8	2.8
8	MONORAIL HOIST NO. 2	0.5	HP	1	0	1	1	1	0.48	0.9	0.0	0.9	0.9	0.0
9	CENTRATE PUMP 1	10	HP	1	1	1	1	1	0.48	11.6	11.6	11.6	11.6	11.6
10	CENTRATE PUMP 2	10	HP	1	1	1	1	1	0.48	11.6	11.6	11.6	11.6	11.6
11	CENTRATE PUMP 3	10	HP	1	0	1	1	1	0.48	11.6	0.0	11.6	11.6	0.0
12	CENTRIFUGE NO. 2 MCP	200	KVA	1	0	0	1.25	1	0.48	200.0	0.0	0.0	250.0	0.0
	SPARE CAPACITY	0	%							0.0	0.0	0.0	0.0	0.0
TOTAL	MCC- FP (FILTER PRESS)								0.48	321.0	51.9	121.0	371.0	51.9

	CONNECTED LOAD			STARTER	LARGEST MOTOR				MIN BREAKER TRIP =
	LARGEST MOTOR CONNECTED	25	HP	FV	MAX BREAKER TRIP =		80	A	MIN FEEDER AMPS =
	TOTAL MOTOR HP	103.5	HP		MAIN BREAKER	80 %		RATED	MAX BREAKER TRIP =
	DEMAND LOAD			STARTER	LARGEST MOTOR				MIN BREAKER TRIP =
	LARGEST MOTOR CONNECTED	10	HP	FV	MAX BREAKER TRIP =		35	A	MIN FEEDER AMPS =
	TOTAL MOTOR HP	43	HP		MAIN BREAKER	80 %		RATED	MAX BREAKER TRIP =
	EMERGENCY LOAD			STARTER	LARGEST MOTOR				MIN BREAKER TRIP =
	LARGEST MOTOR CONNECTED	25	HP	FV	MAX BREAKER TRIP =		80	A	MIN FEEDER AMPS =
	TOTAL MOTOR HP	103.5	HP		MAIN BREAKER	80 %		RATED	MAX BREAKER TRIP =

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